



Feeding Fats Safety



"Quality and safety of feeding fats obtained from co-products or by-products from the food chain"

<http://www.ub.edu/feedfat/>

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Feeding Fats Safety

MAIN POINTS OF THE PRESENTATION

- Overview of the FEEDING FATS SAFETY project
- Results for ANIMAL FATS characterisation
- ANIMAL TRIALS: design and preliminary results
- Preliminary remarks and conclusions



OVERVIEW OF THE PROJECT

"Feeding fats safety"

MAIN OBJECTIVES

- **Assessment of the adequacy of the use as feedingstuffs of some fatty co- and by-products from the food chain**
- **Assessment and quantification of the repercussions of their use in animal feeds on the corresponding meat lipid composition and quality.**
- **Assessment and quantification of the transfer rate of some undesirable products from these fats to the corresponding meat and other animal tissues and fluids.**
- **Check of the lack of deleterious effects on animal performance and health**

POTENTIAL IMPACT

- Improvement of the level of standardisation of fat materials in order to get safer production systems and to get more reliable quality control standards.
- Enhancement of the use of these fat co- and by-products in order to decrease environmental charges.
- Promotion of higher levels of quality and safety of meat production when these fat materials are used in animal feeding.
- Design of methodological proposals for the analytical control of feed fats.
- Dissemination of knowledge in the use and control of these type of feed fats among the producers.
- Increase the level of information and confidence of the consumers

1st STEP: CHARACTERISATION OF FATS

FAT MATERIALS

1. Acid oils from chemical refining **n=25**
2. Acid oils from physical refining **n=16**
3. Lecithins **n=9**
4. Recycled cooking oils **n=8**
5. Animal fats (beef tallow, lard, mixed origin) **n=36**
6. Oils extracted from exhausted bleaching earths **n=2**
7. Fish oils **n=9**
8. Hydrogenated fats from by/co-products **n=6**
9. Fatty acids calcium soaps **n=3**
10. Miscellaneous **n=10**



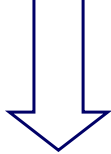
Moisture
Fatty acid composition
Total Cholesterol Content
Sterol composition
Tocopherols/Tocotrienols
Trans Fatty acids
Conjugated Fatty Acids
Acid Value
Mono- and diacylglycerols
FTIR spectra

Sterol oxidation products
Fatty acid oxidation products
Polymer content
Peroxide Value (volumetric)
Peroxides (XO colorimetric)
TBA value
p-anisidine value

Dioxines and PCBs
PAHs
PBDEs

2nd STEP: EFFECTS ON MEAT PRODUCTION

1-Selection of Fat Materials and Feed Preparation
2-Animal production (two species)



Productive parameters
Digestibility and mortality trials
Animal health parameters

Composition: fatty acid, tocopherol and sterol composition
Lipid oxidation levels: *oxidated sterols, index of FA oxidation (peroxides and TBA)*

Contents of *trans* and conjugated fatty acid isomers
Rate of transfer of contaminants from feed to meat, and to other tissues:
Dioxins and PCB, PAH and their metabolites, PBDE

- Tasks on "Feeding fats characterization and classification", constituted WORK PACKAGE 1
- Tasks on "Effects of fats on animals, meat and other tissues", constituted WORK PACKAGES 2, 3 AND 4

OTHER STUDIES: Activities starting at July 2007

- Proposal of analytical control programs for policy purposes
- Socio-economic impact of the application of fatty co- and by-products in commercial feeds
- Development of tools for dissemination and exploitation of results
- Consumer acceptance study



RESULTS for ANIMAL FATS

"Feeding fats safety"

CHARACTERIZATION

ANIMAL FATS n=36

Beef (n= 7)
Pork (n= 4)
Poultry (n= 10)
Duck (n= 1)
Bone, skin (n= 3)

mixed origin (n= 11)



Moisture
Fatty acid composition
Total Cholesterol Content
Sterol composition
Tocopherols/Tocotrienols
Trans Fatty acids
Conjugated Fatty Acids
Acid Value
Mono- and diacylglycerols
FTIR spectra

Sterol oxidation products
Fatty acid oxidation products
Polymer content
Peroxide Value (volumetric)
Peroxides (XO colorimetric)
TBA value
p-anisidine value

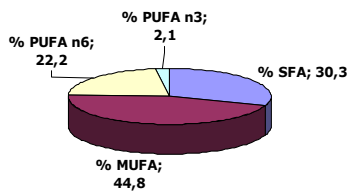
Dioxines and PCBs
PAHs
PBDEs

ANIMAL FATS

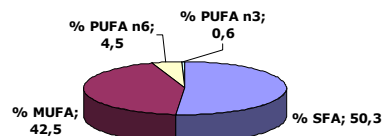
Composition and degradation

Animal fats - FA Composition

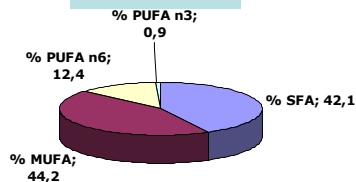
Poultry (n=10)



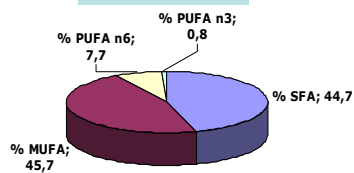
Beef (n=8)



Pork (n=3)



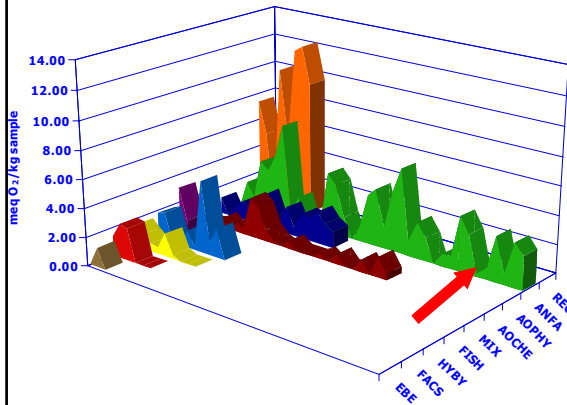
Mix (n= 11)



Beef and Mix very similar... Predominance of beef in mixes

Peroxide Value

Official ECC Method (Reg. 2568/91)

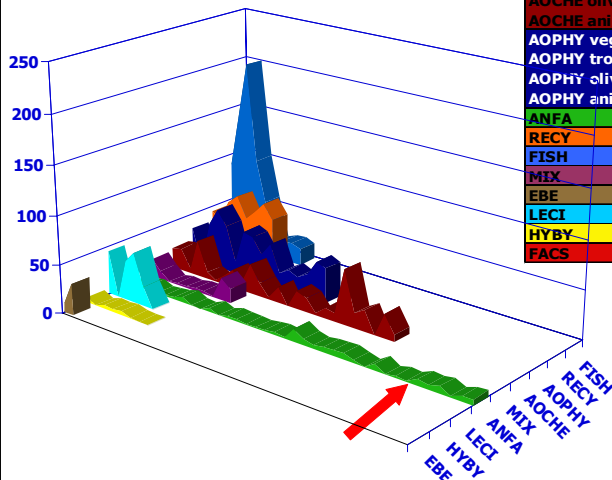


	N	AVERAGE	MIN	MAX
AOCHE veg	14	0,30	ND	1,46
AOCHE trop	3	0,40	0,18	0,62
AOCHE olive	6	1,14	ND	2,81
AOCHE anim	2	0,28	ND	0,55
AOPHY veg	4	0,88	ND	1,64
AOPHY trop	8	1,35	0,35	2,36
AOPHY olive	3	0,95	0,74	1,34
AOPHY anim	1	2,27		
ANFA	36	2,17	ND	6,81
RECY	8	7,64	ND	12,15
FISH	9	1,47	ND	5,10
MIX	10	1,33	ND	4,03
EBE	2	0,68	ND	1,36
LECI	8	ND		
HYBY	6	0,92	0,25	1,62
FACS	3	2,02	1,36	2,43

Very low values for ANIMAL FATS.
Similar to another fats.

p-Anisidine Value

(AOCS Official Method, Cd 18-90)

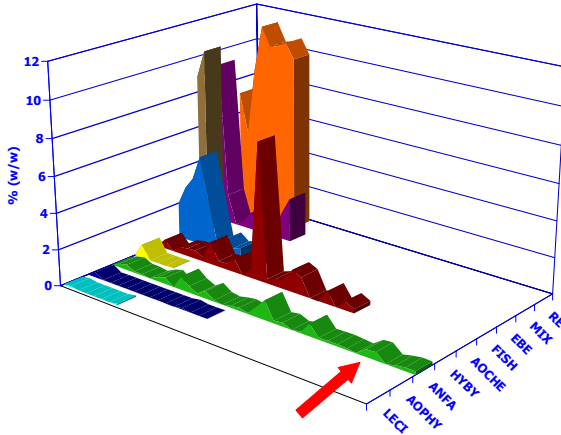


	N	AVERAGE	MIN	MAX
AOCHE veg	13	20.21	2.89	57.70
AOCHE trop	3	14.82	2.21	37.34
AOCHE olive	6	10.03	2.00	19.13
AOCHE anim	1	16.53		
AOPHY veg	3	32.69	17.62	44.15
AOPHY trop	8	33.17	13.40	48.00
AOPHY olive	3	45.87	29.88	62.61
AOPHY anim	1	24.50		
ANFA	33	3.82	0.06	13.38
RECY	8	55.02	36.94	68.97
FISH	9	73.48	15.97	200.47
MIX	10	7.38	0.13	23.04
EBE	2	20.80	9.77	31.82
LECI	5	42.82	19.28	57.28
HYBY	6	3.04	0.59	6.20
FACS	3	Not soluble		

The lowest values for ANIMAL FATS.

Polymers

(SE-HPLC)

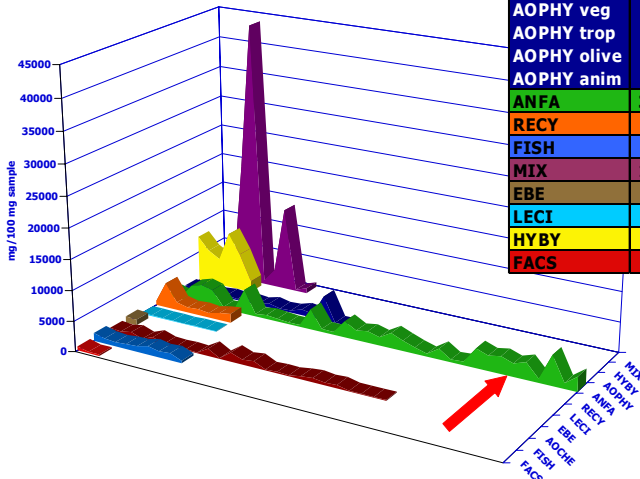


Very low values for ANIMAL FATS.

	N	AVERAGE	MIN	MAX
AOCHE veg	14	0.30	ND	0.76
AOCHE trop	3	0.32	ND	0.59
AOCHE olive	6	0.76	0.25	1.25
AOCHE anim	2	4.06	0.50	7.62
AOPHY veg	4	0.09	ND	0.27
AOPHY trop	8	ND		
AOPHY olive	3	ND		
AOPHY anim	1	ND		
ANFA	36	0.22	ND	1.08
RECY	8	9.15	4.98	11.27
FISH	9	2.06	0.36	5.06
MIX	10	1.72	ND	9.17
EBE	2	9.61	8.82	10.40
LECI	8	0.02	ND	0.08
HYBY	6	0.13	ND	0.75
FACS	3	Not soluble		

Wide range of values for ANIMAL FATS (according to species)

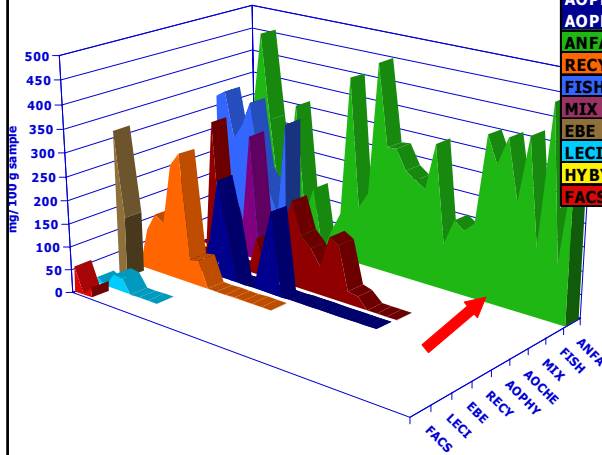
trans-FA (GC)



	N	AVERAGE	MIN	MAX
AOCHE veg	14	484.82	115.32	1525.07
AOCHE trop	3	349.34	99.36	808.77
AOCHE olive	6	302.27	99.36	701.05
AOCHE anim	2	936.11	817.08	1055.14
AOPHY veg	4	386.38	ND	672.09
AOPHY trop	8	405.05	ND	955.45
AOPHY olive	3	397.68	231.11	697.61
AOPHY anim	1	4059.96	4059.96	4059.96
ANFA	36	1675.60	304.27	4956.28
RECY	8	1436.54	642.83	4199.56
FISH	9	950.34	374.92	1380.77
MIX	10	8276.56	105.64	43689.36
EBE	2	978.60	909.37	1047.83
LECI	8	104.42	36.54	162.03
HYBY	6	5900.60	1856.21	9378.43
FACS	3	380.74	224.84	666.18

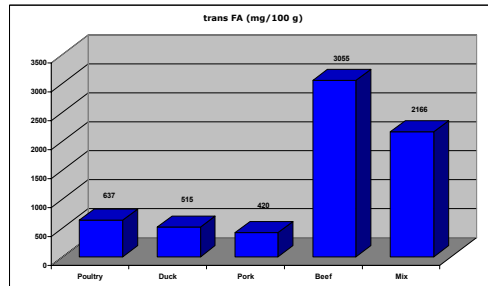
Highest values for ANIMAL FATS (high variability, according to species)

CLA (GC)

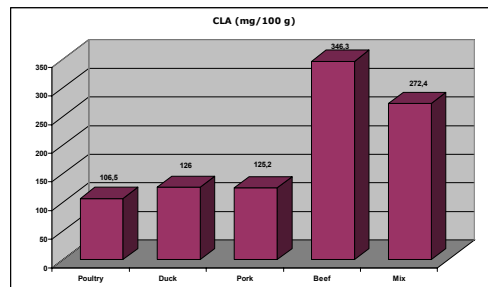


	N	AVERAGE	MIN	MAX
AOCHE veg	14	48.11	ND	309.79
AOCHE trop	3	20.66	ND	61.97
AOCHE olive	6	41.99	ND	132.07
AOCHE anim	2	156.35	126.37	186.33
AOPHY veg	4	71.29	ND	187.84
AOPHY trop	8	9.74	ND	77.90
AOPHY olive	3	108.59	ND	211.82
AOPHY anim	1	179.27	179.27	179.27
ANFA	36	220.42	ND	459.12
RECY	8	119.66	ND	275.96
FISH*	9	241.11	85.45	333.55
MIX	10	55.05	ND	273.39
EBE	2	223.59	131.78	315.40
LECl	8	8.93	ND	30.44
HYBY	6	ND		
FACS	3	25.50	ND	54.80

Trans FA contents in different ANIMAL FATS



CLA contents in different ANIMAL FATS



Very good markers for animal species !!!



Feeding Fats Safety

Conclusions about ANIMAL FATS: Composition and alteration

- Very low values of Acidity and MG+DG
- FA composition according to the animal species, or mixtures
- High variability in Cholesterol content, maybe dependent more on tissues used than on animal species
- Very low levels of tocopherols and tocotrienols, as compared to another fat categories analysed

- Very low values of peroxides; highest values found in mixed species samples and in skin and bone fats
- Very low levels of secondary oxidation (p-Anisidine value)
- Very low levels polymers of triacylglycerols

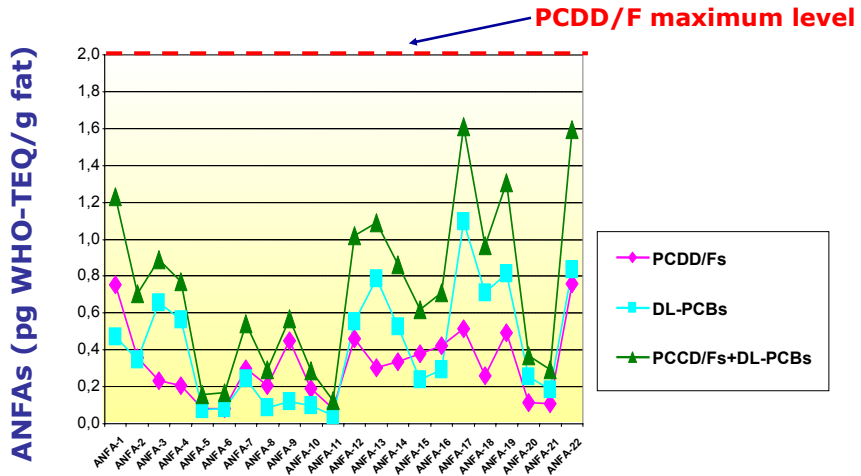
!!! MIXED fats ⇒ Particular attention. Difficult to "qualify"

ANIMAL FATS

Contaminants

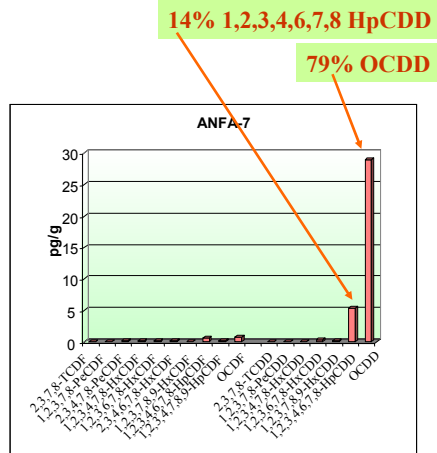
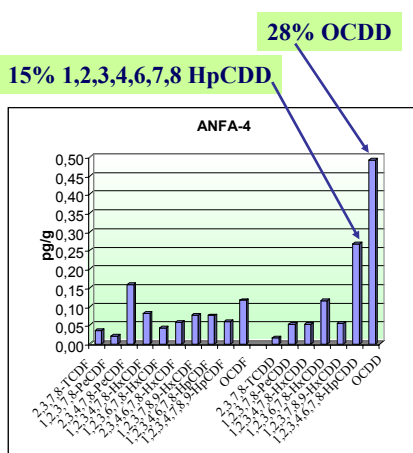
Dioxin and DL-PCB contents in ANIMAL FATS

The 22 ANFA samples selected showed levels of PCDD/Fs and DL-PCBs clearly below the maximum levels established by the EU for this type of matrices.

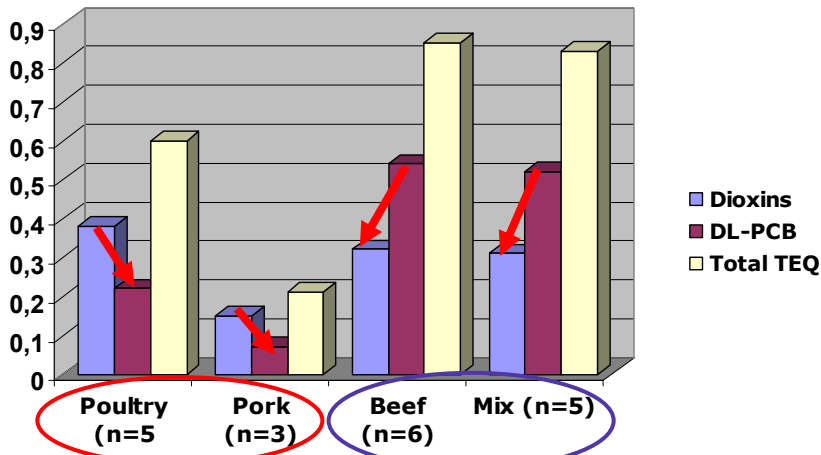


PCDD/F congener distribution in two representative ANFA samples

PCDD/F congener distribution profile was very similar in all the samples; being 1,2,3,4,6,7,8-HpCDD and, especially OCDD, the most relevant congeners in all cases



Dioxin/PCB contents in different ANFA types Beef, pork, poultry, mix



Polycyclic aromatic Hydrocarbons (PAHs)

Name	Abbreviation
Benzo(b)fluoranthene + Benzo(k)fluoranthene	BF
Benzo(e)pyrene	BeP
Benzo(a)pyrene	BaP
Perylene	Per
Indeno(123-cd)pyrene	IP
Dibenzo(ah)anthracene + Dibenzo(ac)anthracene	DA
Benzo(ghi)perylene	BP

Selected PAHs (high molecular weight compounds):

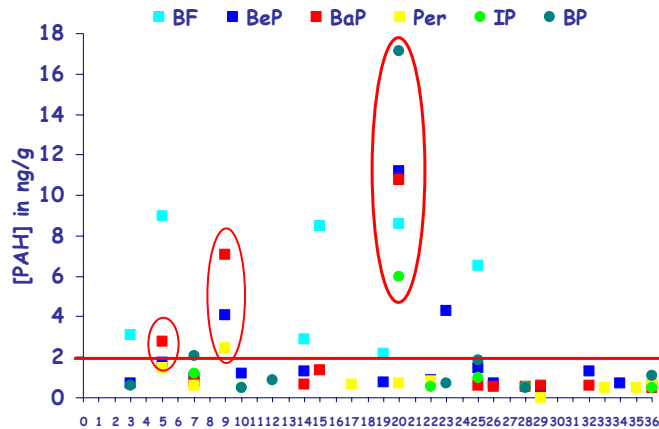
1. Toxicity
2. Reference endpoint for human consumption: BaP legal limit of 2 ng/g
3. Loss/degradation of lower molecular weight compounds during elaboration of feed

PAH determination :



ANFA (animal fats)

36 samples



Animal fats could be considered inside the lowest contaminated categories ... with some exceptions

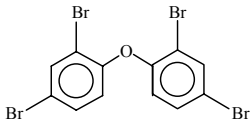
PAH contamination of feeding fats : The case of BaP [benzo(a)pyrene]

[BaP] ng/g	< 2	2 - 5	5 - 10	10 - 20	20 - 40	N > 2
ANFA	33	1	2			3/36
AOCHE	10	7	4	2	2	15/25
AOPHY	5	6	2	2	1	11/15
EBE		1	1			2/2
FACS	1	1	1			2/3
FISH	9					0/9
HYBY	5	1				1/6
LECI	8					0/8
MIX	9		1			1/10
RECY	4	1			1	1/6

➤ 3 levels of contamination :

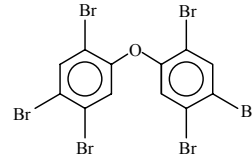
- very low (<0.5 – 2 ng/g) : FISH, HYBY, LECI
- very low but potentially at risk : ANFA, EBE, FACS, MIX, RECY
- low to very high : AOCHE, AOPHY

Polybromodiphenylethers (PBDEs)



BDE 47

Name	Abbreviation
2,2',4,4'-tetraBDE	BDE 47
2,2',4,4',5-pentaBDE	BDE 99
2,3',4,4',6-pentaBDE	BDE 119
2,2',4,4',5,5'-hexaBDE	BDE 153



BDE 153

PBDE contamination of feeding fats :

- PBDEs were only detected in fish oil category, as expected (BDE 47 and BDE 99 **<10 ng/g**)

PBDE determination :



Feeding Fats Safety

ANIMAL TRIALS Design and preliminary Results

"Feeding fats safety"



Feeding Fats Safety

WP2

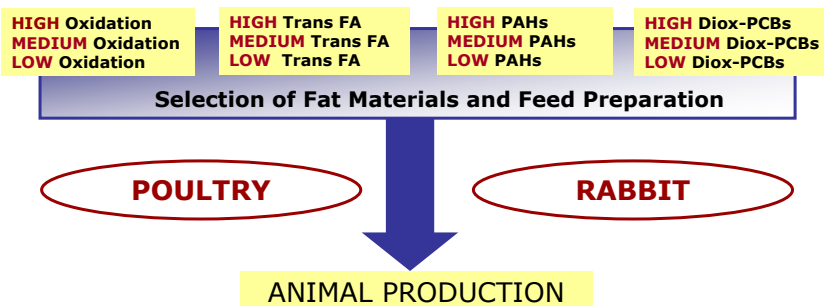
• Effects of feeding fat materials on animal performance and health

WP3

• Assessment of lipid composition and alteration in meats and other animal tissues

WP4

• Levels of contaminants in meat and other animal tissues. Rate of transfer from feed.



• Criteria for selection of experimental fats

1-Levels of the factor to be evaluated should be among those found in samples collected and characterised inside WP1.

2-The two fats selected for a trial should be as similar as possible in their FA composition (when it was possible).

3-The two fats selected should also be similar in other characteristics that could interfere with the assessment of effects.

4-The rest of feed ingredients were carefully selected (among most commonly used), and contaminant levels in particular were evaluated.

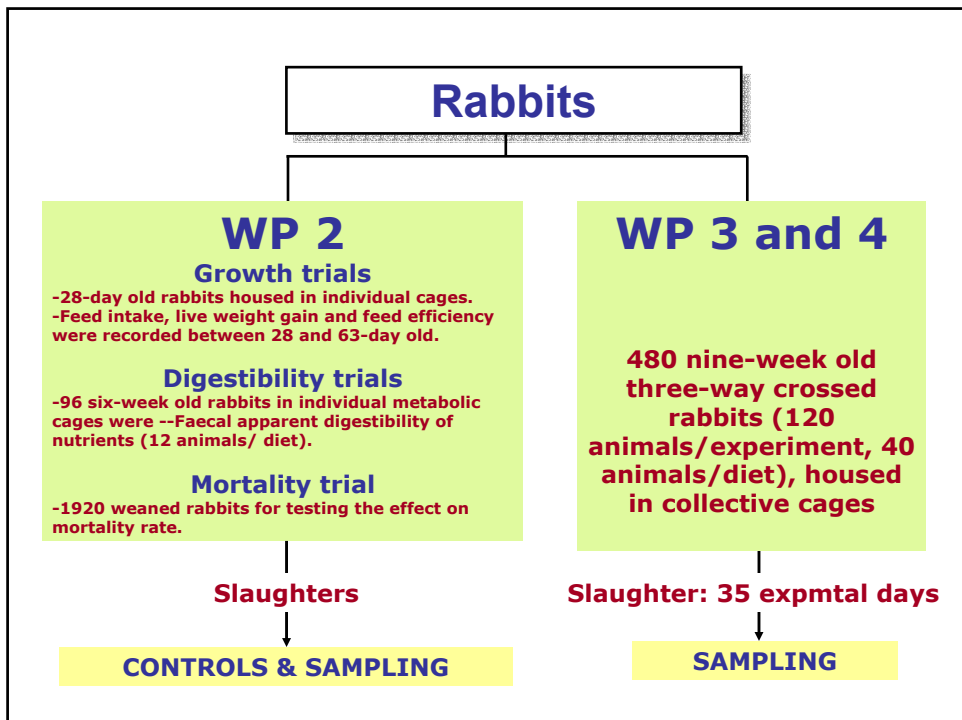
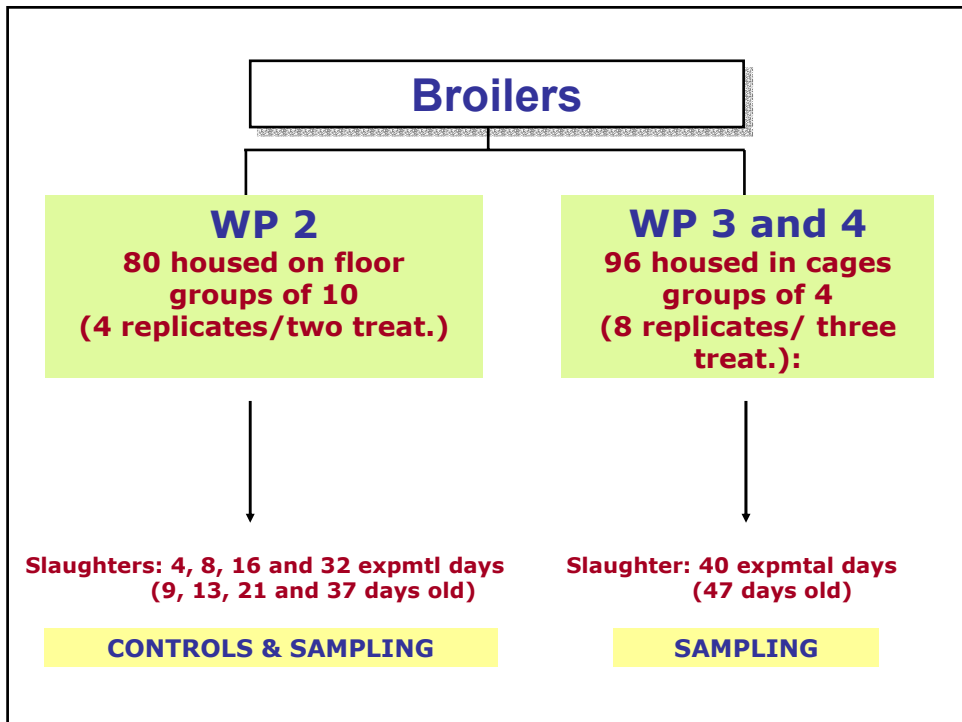
• **OXIDATION trial:** LOW, sunflower/olive oils (70:30 v/v)
HIGH, the same after frying chips

• **trans FA trial:** LOW, Palm FA distillate
HIGH, the same after hydrogenation

• **PAHs trial:** LOW, olive acid oil from CH. REF.
HIGH, pomace-olive acid oil CH. REF.

• **DIOXIN trial:** LOW, fish oil A
HIGH, fish oil B

WHY NOT ANIMAL FATS ?????



Meat composition

RABBIT & POULTRY

WP3-4 Results

Broilers

Rabbits

SAMPLING

- 1) Legs were hand-deboned and meat were ground & homogenised
- 2) Plasma samples were taken
- 3) Livers were also mixed in a pool
- 4) In PAH trial samples of bile and excreta were taken along the experiment

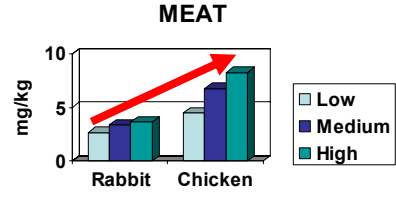
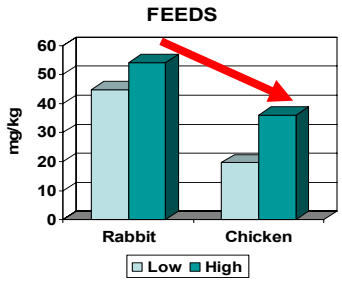
- 1) Legs were hand-deboned and meat were ground & homogenised
- 2) Plasma samples were taken at the slaughter
- 3) Livers were also mixed in a pool
- 4) In PAH trial samples of bile and urine were taken at the slaughter

WP 3-Assessment of lipid composition and alteration in meats and other animal tissues

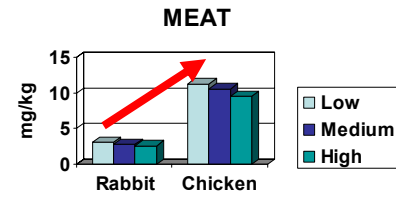
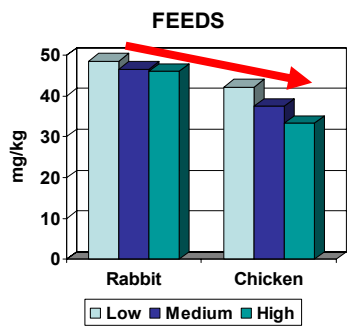
WP 4-Levels of contaminants in meat and other animal tissues. Rate of transfer from feed

- Determination of FA, sterol and tocopherol composition
- Determination of peroxides, TBA index, and SOPs
- Determination of trans FA and CLA
- Determination of PAH and their metabolites
- Determination of dioxins, PCB and PBDE

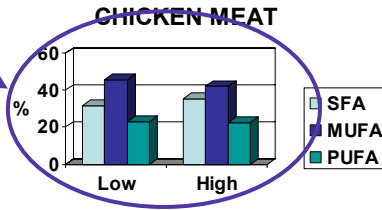
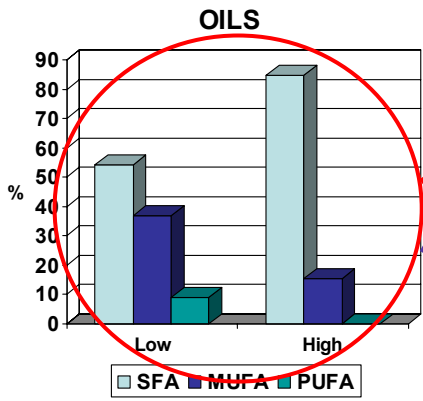
PAHs trial: alfa-tocopherol composition



Oxidation trial: alfa-tocopherol composition



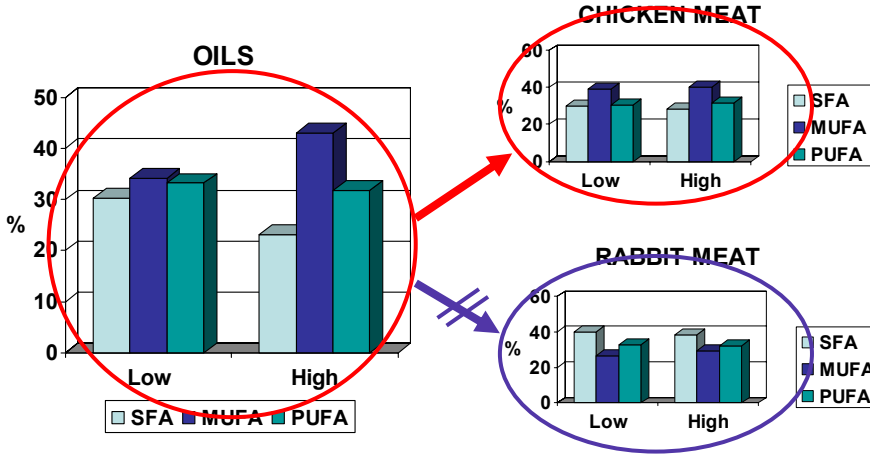
Trans trial: fatty acid composition PFAD
Hydrogenated PFAD



SAT Fats in feed: Only RABBIT shows similar FA profile

Dioxin trial: fatty acid composition

FISH OILS (A & B)



PUFA Fats in feed: Only POULTRY shows similar FA profile

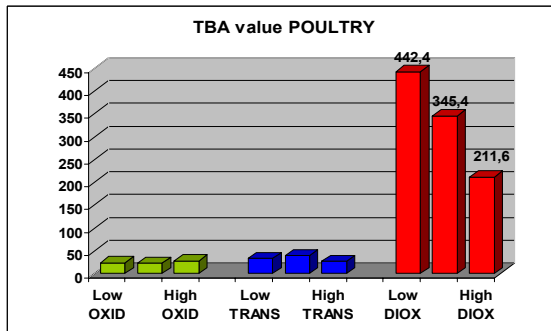
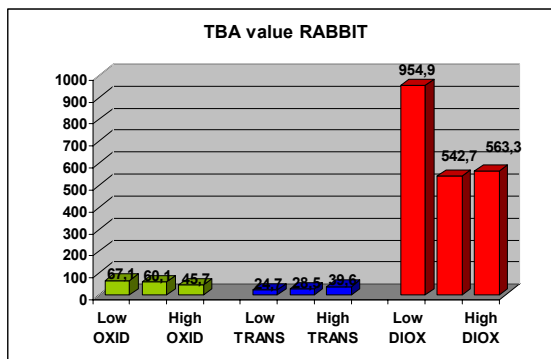
Comparison of TBA values in MEAT

Very low levels for all treatments

Except for fish oils, showing RABBITS higher values than POULTRIES



Maybe related to the lower levels of tocopherol in meat



• **FA composition in meat changes according to the corresponding composition of the oil and feed included.**

• **However, some differences are observed in the animal response according to the species and the type of fat:**

-Chicken meat reflect better the FA composition of the oils and feeds when they are more polyunsaturated (particularly for fish oils) compared to the rabbit meat.

-In contrast, rabbit tends to reflect better the FA composition of the oil when it is more saturated (i.e., PFAD and hydrogenated PFAD).

• **α -tocopherol content in meat is clearly influenced by the content of α -T in feeds.**

• **But there is different pattern of α -T deposition according to the animal species.**

-I.e., chicken meat clearly reflect the differences in α -T content of feeds, whereas rabbit samples do not reflect it

-Lower rate of transfer from feed to meat

Contaminants in Meat

RABBIT & POULTRY

Dioxin & PCBs transfer to MEAT

Levels in fish oils used

pg WHO-TEQ/g oil	Fish oil A	Fish oil B "spiked"
PCDD/Fs	1,95	9,78
DL-PCBs	7,69	19,02

Exceeding MAX values

Maximum levels for fish oil samples (COMMISSION DIRECTIVE 2006/13/EC 3 February 2006):
 6 pg WHO-TEQ/g oil PCDD/Fs
 24 pg WHO-TEQ/g oil PCDD/Fs + DL-PCBs

Broiler Feeds:

pg WHO-TEQ/g	Broiler Feed LC	Broiler Feed MC	Broiler Feed HC
PCDD/Fs	0,11 (0,12)	0,39 (0,35)	0,54 (0,53)
DL-PCBs	0,48 (0,46)	0,73 (0,80)	1,21 (1,14)

* Determined value (Theoretical value)

Rabbit Feeds:

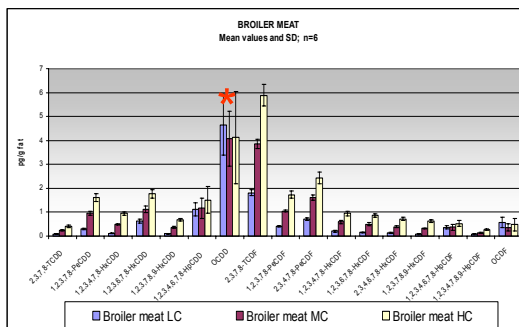
pg WHO-TEQ/g	Rabbit Feed LC	Rabbit Feed MC	Rabbit Feed HC
PCDD/Fs	0,10 (0,06)	0,15 (0,18)	0,27 (0,29)
DL-PCBs	0,23 (0,23)	0,38 (0,40)	0,69 (0,57)

* Determined value (Theoretical value)

Maximum levels for compound feedingstuffs (COMMISSION DIRECTIVE 2006/13/EC 3 February 2006):
 *0,75 pg WHO-TEQ/g PCDD/Fs
 *1,5 pg WHO-TEQ/g PCDD/Fs + DL-PCBs

ALL FEEDS under the MAX levels, except (Diox+PCB) value in POULTRY "High Diox"

Poultry Meat



Conc (pg/g fat)	MEAN	RSD(%)
HC		
n=6		
2,3,7,8-TCDD	0,407	12
1,2,3,7,8-PeCDD	1,617	10
1,2,3,4,7,8-HxCDD	0,945	7
1,2,3,6,7,8-HxCDD	1,765	10
1,2,3,7,8,9-HxCDD	0,690	8
1,2,3,4,6,7,8-HpCDD	1,510	37
OCDD	4,118	47
2,3,7,8-TCDF	5,892	8
1,2,3,7,8-PeCDF	1,733	9
2,3,4,7,8-PeCDF	2,436	10
1,2,3,4,7,8-HxCDF	0,948	9
1,2,3,6,7,8-HxCDF	0,863	7
2,3,4,6,7,8-HxCDF	0,719	9
1,2,3,7,8,9-HxCDF	0,628	8
1,2,3,4,6,7,8-HpCDF	0,530	23
1,2,3,4,7,8,9-HpCDF	0,285	9
OCDF	0,480	54

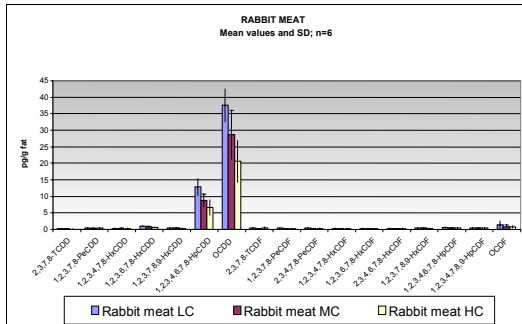
pg WHO-TEQ/g fat	Broiler LC	Broiler MC	Broiler HC
PCDD/Fs n=6	1,11 (RSD 6%)	2,85 (RSD 5%)	4,60 (RSD 8%)
DL-PCBs n=2	5,04	8,32	11,69
Total	6,15	11,17	16,29

Maximum levels for meat and meat products of poultry and farmed game (COMMISSION REGULATION (EC) N° 199/2006 3 February 2006):

- 2 pg WHO-TEQ/g fat PCDD/Fs
- 4 pg WHO-TEQ/g fat PCDD/Fs + DL-PCBs

Exceeding the MAXIMUM levels

Rabbit Meat



Conc (pg/g fat)	MEAN	RSD(%)
LC		
n=6		
2,3,7,8-TCDD	<u>0,115</u>	
1,2,3,7,8-PeCDD	<u>0,353</u>	
1,2,3,4,7,8-HxCDD	<u>0,287</u>	57
1,2,3,6,7,8-HxCDD	<u>0,969</u>	50
1,2,3,7,8,9-HxCDD	<u>0,388</u>	47
1,2,3,4,6,7,8-HpCDD	12,791	20
OCDD	37,501	59
2,3,7,8-TCDF	<u>0,381</u>	21
1,2,3,7,8-PeCDF	<u>0,296</u>	13
2,3,4,7,8-PeCDF	<u>0,357</u>	61
1,2,3,4,7,8-HxCDF	<u>0,269</u>	50
1,2,3,6,7,8-HxCDF	<u>0,264</u>	41
2,3,4,6,7,8-HxCDF	<u>0,291</u>	53
1,2,3,7,8,9-HxCDF	<u>0,369</u>	55
1,2,3,4,6,7,8-HpCDF	<u>0,510</u>	53
1,2,3,4,7,8,9-HpCDF	<u>0,425</u>	49
OCDF	1,277	51

Underlined values indicate 3 or more replicates below de LOD!!!

pg WHO-TEQ/g fat	Rabbit LC	Rabbit MC	Rabbit HC
PCDD/Fs n=6	1,12 (RSD 36%)	0,86 (RSD 15%)	0,75 (RSD 19%)
DL-PCBs n=2	1,48	1,49	2,37
Total	2,60	2,35	3,12

Maximum levels for meat and meat products of poultry and farmed game (COMMISSION REGULATION (EC) N° 199/2006 3 February 2006):

- 2 pg WHO-TEQ/g fat PCDD/Fs
- 4 pg WHO-TEQ/g fat PCDD/Fs + DL-PCBs

ALL MEATS show values under the MAXIMUM levels !!!

Main Conclusions on Dioxin/PCBs

✓ *The largest contribution to their presence in feeds was attributable to the fat, whereas the raw materials of vegetal origin had no detectable or relatively low levels*

✓ *The bioaccumulation behaviour of both types of animals, chickens and rabbits, was very different:*

-The congener distribution profile (contribution in % of each congener to the total concentration in pg/g) of chicken meat is very similar to the one observed in the corresponding feeds

-In addition, levels of the different PCDD/F and DL-PCB compounds increased when increasing the levels in the feed

-In contrast, the PCDD/F distribution profile in rabbit samples showed a predominance of two congeners, HpCDD and OCDD, which contributed with a 21-23% and 65-68%, respectively, to the total concentration.

✓ Only the treatment "HD" corresponding to chicken experimental feeds showed a level of PCDD/Fs+DL-PCBs above the maximum established at the European Directive for this kind of matrices



✓ If the chicken meat samples from this study were commercialized and consumed with the skin they would be

- Above the maximum levels established at the European Regulation both for PCDD/Fs and PCDD/Fs+DL-PCBs, in the case of Treatments MD and HD.

-The treatment LOW Dioxin showed also values of the summatory of PCDD/Fs+DL-PCBs above the maximum levels established at the European Regulation

What about transfer of Dioxin/PCB to meat from **ANIMAL FATS** ????

-The feed corresponding to "LOW Dioxin" treatment showed the following values:

0,11 pg TEQ/g for Dioxins
0,48 pg TEQ/g for Dioxins+PCBs

-A feed prepared with the same conditions, using the Animal Fat that showed the highest Dioxin/PCB values, will give:

0,04 pg TEQ Dioxins/g feed
0,09 pg TEQ (Dioxins+PCBs)/g feed



Expected levels of Dioxins and PCB in MEAT coming from feeds containing those ANIMAL FATS should be much lower than max levels regulated by EC !!!!

Transfer of PBDE from feed to meat

DIOXIN TRIAL: PBDE contents

* Feed: for the 3 levels

* Animal tissues (meat & liver): 2 samples for the LL & HL experiments

Feed (rabbit & poultry)

[BDE] ng/g ww	BDE 47	BDE 99	BDE 119	BDE 153	TOTAL BDE
High	< 0,5	< 0,5	< 0,5	< 0,5	<2
Med	< 0,5	< 0,5	< 0,5	< 0,5	<2
Low	< 0,5	< 0,5	< 0,5	< 0,5	<2

Rabbit & poultry (meat & liver)

[BDE] ng/g dw	BDE 47	BDE 99	BDE 119	BDE 153	TOTAL BDE
Low (2 samples)	< 0,5	< 0,5	< 0,5	< 0,5	<2
High (2 samples)	< 0,5	< 0,5	< 0,5	< 0,5	<2

PBDEs negligible amounts !!!!!

Contents of PAHs in MEAT and LIVER

PAH TRIAL: PAH contents in meat and liver

[PAH] < 2 ng/g dw (Low & High levels, 2 samples)

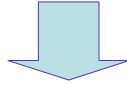
Transfer rate for the High level

[HAP] ng/g	OIL	FEED (rabbit)	FEED (chicken)	ANIMAL TISSUES
N	654	6,1	17,2	< 2
Acy	680	10,9	29,9	< 2
Ace	64	15,5	14,6	< 2
Fe	131	5,2	6,9	< 2
Phe	1612	45,6	77,6	< 2
A	164	4,0	7,4	< 2
Fluo	535	16,4	28,7	< 2
Pyr	552	17,6	29,3	< 2
BaA	135	4,2	7,2	< 2
Chrys	297	9,8	17,5	< 2
BbF+BkF	144	6,0	9,5	< 2
BeP	87	2,8	4,7	< 2
BaP	87	2,4	6,3	< 2
Per	16	2,1	2,7	< 2
IP	46	1,8	2,9	< 2
DaA+DaC	6	0,1	0,5	< 2
BP	81	2,7	4,6	< 2

Contents of PAHs in MEAT and LIVER

***All PAHs analysed in meat and liver samples from the PAH trial**

N, Acy, Ace, Fe, Phe, A, Fluo, Pyr, BaA, Trph+Chrys, BbF+BkF, BeP, BaP, Per, IP, DaA+DaC, BP



**Values ALWAYS <2 ng/g (upper limit),
both in POULTRY and RABBIT**

**Animal performance and
health**

RABBIT & POULTRY

RABBIT

TRANSFA
trial

High dietary content in trans fatty acid induced substantial impairment of fat digestibility having repercussion on energy digestibility

DIOXIN
trial

Fish oil quality more than its level of contamination affected growth performance

PAHs
trial

High dietary content in PAHs of acid oils induced a general impairment of digestibility

OXIDATION
trial

Oxidation level of a vegetable oil did not affected digestibility or growth performance

POULTRY

- **No differences were observed between treatments in none of the trials, for ADI, ADG and FE**
ADI: average daily intake; ADG: average daily gain; FE: feed efficiency
- **The best feed efficiency was observed in the PAHs experiment, probably because the higher level of energy in those diets**
- **No differences were observed for "Final body weight, "Abdominal fat (%carcass)" and "Carcass yield (%BW)"**
- **Very low "mortality rate" was observed in the 4 trials**
- **No lesions were observed in animals (*post-mortem*)**
- **Gut morphology tests performed showed no differences**



Preliminary remarks and conclusions

"Feeding fats safety"

From the results obtained during the first two years of Feeding Fats Safety (FFS) research project we can draw the following preliminary remarks:

- **All analytical tests carried out within the FFS project provided interesting and positive results in the chemical composition and for the presence of neo-formed products or contaminants;**
- **In terms of free fatty acids and oxidised products the category is not homogeneous: all type and origin samples were collected jointly and then analysed. We have checked that a combination of several methods can allow to discriminate between "good" and bad "samples";**
- **All collected data demonstrate that it should be possible to set a table containing minimum quality requirements for the introduction of animal fats in feeding formulations;**

The final results and conclusions of the FFS project can allow to demonstrate that animal fats, if properly produced and managed, may warranty a practical absence of environmental contaminants such as dioxines (in the larger definition), poly-aromatic hydrocarbons, poly-brominates hydrocarbons, and neo-formed compounds such as polymers.

From the results obtained during the first two years of Feeding Fats Safety (FFS) research project we can draw the following preliminary remarks:

- **Obviously there are some barriers related to:**
 - presence of saturated fatty acids**
 - presence of *trans* isomers**
 - presence of high levels of cholesterol**
 - difficulties for a good characterisation of mixed animal fats: need to improve control and "reputation"**

EFRA should play a key role promoting actions for the re-qualification of animal fats in feeding industry, by means of an action connected with some responsible and voluntary initiatives to promote information and clarity in this sector.

What is absolutely necessary, for the re-qualification of this material is a limp policy of information and some quality criteria allowing the segregation and the forbidden use for feeding purposes of :

- used fried oils;
- oxidised and generally damaged products;
- products contaminated by mineral oils, and/or containing poly-aromatics or poly-chlorinated hydrocarbons

This position will take benefit from an active and scientifically based information initiatives, such as the deliverables and reports coming from our FFS research project.