Main Results of the EUROPROTEINS Program

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A five-year research program (1993-1997) was led under the European label EUREKA. This collaborative study with French and Dutch partners, named EUROPROTEINS program, was the continuation of a previous five-year collaboration (1988-1992) called IMPROFEED. The main purpose of EUROPROTEINS research program was to increase nutrient accessibility of rapeseed, sunflower and peas for poultry and ruminants through well-adapted technologies.

In France, this work was carried out in close collaboration with CETIOM (and PROLEA organizations) and feeding industry.

Increasing nutrient accessibility (proteins, energy) for monogastric animals is a priority for feeding industry. Expected progress in a better knowledge of raw materials is a higher incorporation rate in feedstuffs, reduced feeding cost and less nitrogen and phosphorus wastes.

The main research areas concerning rapeseed were as follows :

- Variability of meal quality available on the market,
- Effects of crushing conditions on meal quality,
- Effects of different technologies on nutritional value of full-fat seeds by poultry.

1 - Nutritional value of full-fat rapeseed by poultry

a) French and European consumption of full-fat rapeseed

Consumption of full-fat seeds increased markedly between 1990/91 and 1993/94, but has been more stable since 1993. This evolution was essentially due to new CAP's economic rules which give much less interest to direct uses of seeds vs meals.

Table 1 : French and European consumption of full-fat seeds

1000 MT (France)

	Soya	Rapeseed	Sunflower
1988/89	154	30	5
1989/90	213	73	29
1990/91	200	120	43
1991/92	370	250	85
1992/93	320	500	120
1993/94	120	300	40
1994/95	340	200	50
1995/96	270	280	10
1996/97	270	240	70

Sources : SCEES, ONIDOL, SIDO

1000 MT (E.U)

1992/93	2 140	940	320
1996/97	1 570	720	470

Sources : Oil World

b) Metabolizable energy of full-fat rapeseed : variability

Two sets of rapeseed batches were collected in 1993 and 1995. Their chemical compositions were determined. The main values are given in Table 2 and show the quite big variations in fat, protein, fiber and glucosinolate contents.

Table 2 : Chemical composition of full-fat seeds

		Average (st. dev.)	*Min - max*
Fat (% DM)	*1993*	47.1 (1.1)	45 - 49%
	1995	47.4 (1.5)	44 - 45%
Protein (% DM)	*1993*	20.0 (1.0)	19 - 22%
	1995	19.2 (1.7)	17 - 22%
Fiber (% DM)	*1993*	7.8 (0.6)	6.7 - 9.0%
	1995	7.7 (0.7)	6.7 - 9.2%
GLS (µmol/g DM)	*1993*	13.3 (2.7)	9.3 - 17.5
	1995	15.2 (4.5)	6.7 - 22.3

Metabolizable energy values of both sets of rapeseed batches were measured on adult cockerels (*ad libitum* feeding). A regression analysis was performed on both sets (separately and together).

The difference between extreme values of AMEn was 400 kcal/kg DM for seeds cropped in 1993 and 480 kcal/kg DM for seeds cropped in 1995. The AMEn values for the 1995 seeds were higher by 200 kcal on average, as compared to the 1993 seeds values. This can be explained by the higher input of mechanical energy during pelleting of the 1995 feeds due to a lower moisture content compared to the 1993 feeds.

Correlations between AMEn (and AMEn/GE) and chemical values were determined (Table 3).

Concerning the 1993 rapeseeds, the results showed that 87 % of AMEn variations of the 1993 rapeseeds were explained by fat content (positive effect) and ADF content (negative effect). The AMEn/GE variations were explained at 85 % by fat content (positive effect) and ADF content (negative effect), or at 83 % by fat content (positive effect) and indolyl-glucosinolates (negative effect).

Concerning the 1995 rapeseeds, 79 % of AMEn variations were explained by fat content (positive effect) and total glucosinolate content (negative effect). The range of glucosinolates was broader for the 1995 set than for the 1993 set (6.7 to 22.3 mol/g DM vs 9.3 to 17.5 µmol/g DM).

The AMEn/GE variations were explained by indolyl-glucosinolates at 55 % (negative effect) and by alkenyl-glucosinolates at 31 % (negative effect).

For both sets taken together, 65 % of AMEn variations were explained by fat content (positive effect) and total glucosinolate content (negative effect).

Taking into account the Celsius degrees (temperature) brought during pelleting, we could explain the 14 extra percentage of the variation (positive effect).

The AMEn/GE variations were explained at 6 % by fat content (positive effect), indolylglucosinolates (negative effect) and temperature brought during pelleting (positive effect).

Table 3 : Factors explaining variations of metabolizable energy by poultry

	FAT(> 0)	ADF (< 0)	GLS (< 0)	IND (< 0)	ALK (< 0)	Pellet. Tp (> 0)
AMEn						
set 93	79 %	8 %				
set 95	69 %		10 %			
93 + 95	59 %		6 %			14 %
AMEn/GE						
set 93	75 %	10 %		or 8 %		
set 95				55 %	+ 31 %	
93 + 95	40 %			11 %		+ 16 %

c) Economic aspects

Economic simulations showed that increased metabolizable energy (vs normal full-fat rapeseed with 4200 kcal/kg DM) resulted in a higher interest price of seeds for feeding (Table 4).

Table 4 : Increased value of full-fat rapeseed through higher metabolizable energy

AM (kcal/kg DM)	Interest price (FF/MT)	Gain vs market price*
4 500	1 450 FF	+ 10 %
4 900	1600 FF	+ 19 %

* 1350 FF/MT

These increased values are much more profitable for feeding industry with a quite higher potential for using whole seeds.

2 - Effects of crushing conditions on meal quality

Protein degradability in ruminant feedstuffs is different according to raw materials : 71 % for rapeseed meal, 62 % for soybean meal and only 35 % for protected soybean meal.

A lot of work has been done, on the one hand in the oil-mill pilot plant of CETIOM, and on the other hand with industrial feeding plants.

The results (Table 5) showed that it is possible to reduce the protein degradability of rapeseed meal in rumen to nearly 36% without altering intestine digestibility of amino-acids.

Table 5 : Influence of crushing technology on nutritional value of rapemeal

	Rumen degradability of nitrogen		Digestibility of nitrogen		Digestible protein in intestine (g/kg DM)	
4 pilot meals		36 - 48 %		75 - 82 %		211 - 252
6 market meals	63 %	58 - 69 %	74 %	66 - 80 %	160	133 - 190
INRA	71 %		80 %		160	
Protected Sb meal	35 %					

Economic simulations (Table 6) showed that decreased rumen degradability of protein resulted in a gain of interest price for rapemeal.

Table 6 : Increased value of rapemeal by crushing technology

	Concentrate feed for production	Nitrogen complementation
Interest price (FF/MT)	1 390	1 230
Incorporation rate	14 %	20 %
Gain vs market price*	+ 24 %	+ 10 %

* 1 120 FF/MT

Conclusions

These results show the main role played by technologies for improvement of full-fat rapeseed and meal quality. Next year, we will draw particular attention to the glucosinolate content of rapeseed. Breeders' further efforts aiming at reaching very low glucosinolate contents should give rapeseed a better competitivity level vs soybean in animal feeding.