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PREDICTION OF METABOLIZABLE ENERGY OF FULL-FAT SUNFLOWER SEEDS BY COCKERELS

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ABSTRACT

A five-year research programme (1993-1997) has been led with the European label EUREKA. This collaborative linkage of French and Dutch partners, named EUROPROTEINS programme, was the continuation of a previous five-year collaboration (1988-1992) called IMPROFEED. The main purpose of EUROPROTEINS research program was to increase nutrients accessibility of rapeseed, sunflower and peas by poultry and ruminants through fitting technologies. In France, these studies were carried out in close collaboration with CETIOM (and PROLEA organisations) and feeding industry.

KEYWORDS : sunflower, seed, poultry, nutrients accessibility, technology, environment

INTRODUCTION

Increasing nutrients accessibility (protein, energy) by monogastric animals is a priority for feeding industry. Expected progress of a better knowledge of raw materials is a higher incorporation rate in feed, reduced feeding cost and less nitrogen and phosphorus wastes. Full-fat sunflower seeds have high fat content : 45 - 55%, but low protein content : about 10 - 18% (dry matter basis). However several factors prevent from an optimal use of wholeseeds in feed : particularly the variability of their chemical composition and the feed technology impact.
The aim of the study was to evaluate the extent of the nutritional value variability of full-fat sunflower seeds and to understand the origin from chemical and technological factors.

1 - FRENCH AND EUROPEAN CONSUMPTION OF FULL-FAT SUNSEED

Consumption of full-fat seeds in France and in the European Union increased significantly between 1990/91 and 1993/94, but has stabilized since 1993, and has been decreasing since 1996. This evolution is essentially due to new CAP's economic rules which give much less interest for 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
1997/98	224	167	15
1998/99*	220	100	10

Sources : SCEES, ONIDOL, SIDO

1000 MT			E.U
1992/93	2140	940	320
1996/97	1570	720	470
1997/98	nc	500	100
1998/99*	nc	400	100

Sources : Oil World
* forecast

2 - METABOLIZABLE ENERGY OF FULL-FAT SUNSEED : VARIABILITY

Chemical composition

Two sets of sunseed batches were collected in 1993 (11) and 1995-96 (16). Chemical compositions were determined. The main values are reported in Table 2. They show rather big variations in fat, protein, fiber and NDF : in 1995-96, fat contents ranged between 44.6 and 54.9 %, protein contents between 10.5 to 17.7%, fiber contents between 12.1 and 17.7%, and NDF contents between 18.1 and 32.1%.

Table 2 : Chemical composition of full-fat seeds (% DM)

		Average (st. dev.)	Min - max
DM	1993	92.6 (1.4)	91.4 - 94.9
	1995-96	93.9 (0.7)	92.5 - 95.0
Fat	1993	48.7 (4.9)	36.9 - 52.2
	1995-96	49.9 -2.9)	44.6 - 54.9
Protein	1993	16.4 (3.0)	13.4 - 23.2
	1995-96	14.6 (2.0)	10.5 - 17.7
Fiber	1993	16.0 (3.0)	11.4 - 19.2
	1995-96	15.1 (1.9)	12.1 - 17.7
NDF	1993	21.5 (3.5)	16.2 - 27.7
	1995-96	25.1 (4.6)	18.1 - 32.1

Metabolizable energy

The seeds were incorporated at a level of 30% in a feed made of wheat, maize and soybean meal. The feed was pelleted and given *ad libitum* to adult cockerels for metabolisable energy (ME) determinations. The ME values of the sunseeds were calculated by difference with the control diet. Regression analyses were performed on both sets, separately and together.

The ME values of the seeds ranged approximatively from 4100 to 5400 kcal/kg DM for the 1993 set, and from 4700 to 5500 kcal/kg DM for the 1995-96 set.

The difference between extreme values of AMEn was 1200 kcal/kg DM for seeds cropped in 1993 and 800 kcal/kg DM for seeds cropped in 1995-96. The AMEn values for the 1995-96 seeds were higher by nearly 300 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 1995-96 feeds.

Fat digestibility of the seeds varied between 93.9% and 96.2% for the 1993 set, and between 94.5% and 96.7% for the other.

Table 3 : Metabolizable energy and fat digestibility (1993)

Samples	AMEn (kcal/kg DM)	Fat digestibility (%)
1	4833 (138)	95.0 (1.1)
2	**4142** (59)	**93.9** (0.7)
3	4692 (86)	95.8 (0.8)
4	5154 (152)	95.8 (1.6)
5	4667 (81)	95.4 (0.6)
6	**5351** (81)	**96.2** (0.5)
7	4995 (96)	95.9 (1.0)
8	4832 (73)	95.9 (0.6)
9	4888 (110)	96.1 (0.6)
10	4788 (67)	96.0 (0.6)
11	4741 (95)	95.9 (0.8)
Average (st. dev.)	4825 (306)	95.6 (0.6)

Table 3 : Metabolizable energy and fat digestibility (1995-96)

Samples	AMEn (kcal/kg DM)	Fat digestibility (%)
1	4845 (169)	95.3 (0.8)
2	4778 (75)	95.0 (1.0)
3	5116 (147)	9501 (1.0)
4	**4742** (131)	**94.5** (0.8)
5	5168 (79)	94.7 (0.8)
6	4907 (136)	95.9 (0.7)
7	5188 (174)	96.5 (0.8)
8	5299 (76)	96.4 (0.3)
9	5111 (135)	96.2 (1.1)
10	4961 (85)	96.0 (0.6)
11	5167 (149)	95.8 (0.5)
12	4965 (138)	96.3 (0.7)
13	5414 (124)	**96.7** (0.4)
14	5268 (114)	96.4 (0.3)
15	**5488** (137)	96.2 (0.5)
16	5303 (89)	96.6 (0.6)
Average (st. dev.)	5108 (222)	95.9 (0.7)

Linear regressions were carried out between AMEn and chemical values :

Concerning the 1993 sunseeds, the results showed that 89% of AMEn variations of the seeds were explained by fat content (positive effect). Taking into account the temperature (Celsius degrees) brought during pelleting (positive effect), 94% of the variation could be explained.

Concerning the 1995-96 sunseeds, 71% of AMEn variations were explained by fat contents (positive effect). Taking into account the walls (negative effect), 80% of the variations could be explained. The temperature brought during the pelleting had no effect.

For both sets taken together, 81% of AMEn variations were explained by fat content (positive effect). Taking into account the walls (negative effect), 85% of the variations were explained. Taking into account the temperature brought during pelleting (positive effect), 88% of the variations could be explained.

Table 3 : Factors explaining variations of metabolizable energy by poultry

AMEn	Fat (positive)	Walls (negative)	Pellet. Tp(positive)
set 93	89%	-	5%
set 95-96	71%	9%	-
set 93 + 95-96	81%	4%	3%

ECONOMIC ASPECTS

Different economic simulations have been applied to poultry feeding (Tables 4 & 5). The increased value of sunseeds (set 93) was evaluated in two economic situations (situation 1 : price of seeds = 1400 FF/MT and situation 2 : price of seeds = 1560 FF/MT).

Table 4 : Increased value of full-fat sunseed through higher metabolizable energy (situation 1)

Set 93	Fat (% DM)	AMEn (kcal/kg DM)	Interest price (FF/MT)	Gain vs market price*
2	36.9	4142	1420 FF	+ 1.4%
6	55.2	5351	1710 FF	+ 22%

* 1400 FF/MT

Table 5 : Increased value of full-fat sunseed through higher metabolizable energy (situation 2)

Set 93	Fat (% DM)	AMEn (kcal/kg DM)	Interest price (FF/MT)	Gain vs market price*
2	36.9	4142	1200 FF	- 30%
6	55.2	5351	1550 FF	0%

* 1560 FF/MT

The interest price of seeds was increased by a higher oil content : 1710 FF vs 1420 FF in the first situation and 1550 FF vs 1200 FF in the second situation. Nevertheless, the gain observed vs the market price (+ 22% in the first situation for the sample 6) disappeared in the second situation with a higher market price of sunseeds.

CONCLUSIONS

The utilization of sunflower seeds in animal feeding can be improved, but it mainly depends on three factors : the first one is a better control of the variability observed in seeds quality ; the second one is to optimize feed technology. The third factor is the most difficult to control : it concerns the feedstuffs market.

ACKNOWLEDGMENTS

This work has been carried out by EURETEC II (France), involving collaborative work with the feeding industry (Ets ARRIVE, CCPA, GUYOMARCH Nutrition Animale, SANDERS, UCANOR, UNICOPA) and PROLEA organizations (CETIOM, ITCF, ONIDOL, SOFIPROTEOL, UNIP), in the framework of the project EUREKA–EUROPROTEINS (EU623), with a financial support of the French Ministry of Research.