Feed-a-Gene

Adapting the feed, the animal and the feeding techniques to improve the efficiency and sustainability of monogastric livestock production systems

Processing of partly defatted meals from European soybeans and nutritional value for broilers and piglets

E. Royer[1#], P. Carré[2], V. Halas[3], P. Sakkas[4§], P. Bikker[5], A. Quinsac[6], I. Kyriazakis[4], K. E. Bach Knudsen[7]

[1]Ifip-institut du porc, [2]Olead, [3]Kaposvár University, [4]Newcastle University, [5]Wageningen University & Research, [6]Terres Inovia, [7]Aarhus University, *Current addresses: [#]Institut de l'Elevage, [§]CCPA group*

ABSTRACT

The study determined the influence of different processes to produce good quality soy bean meal (SBM) with 46-52 % crude protein, 4-8 % residual oil and trypsin inhibitor content below 8 TIU/mg. Such extruded-expelled SBM produced in medium-sized crushing plants from local and GMO-free European soybean crops could have interesting nutritional values.

INTRODUCTION

- SBM = 46% of protein sources used in EU and 98 % imported in 2017/18
- European soybean surfaces are increasing and shifting north as new precocious cultivars are available
- Need for non-GM ≥ 10% of soybean equivalent imported into EU (3.4 Mt)
- Classical defatting process using hexane is highly regulated and requires huge investment and high energy consumption
- Partly defatting without hexane (expeller) may be adapted to local middle size crushing plants


OBJECTIVES

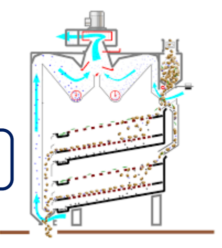
- Compare the impacts of the combination of dehulling and cooking (by extrusion or toasting) on nutritional values for partly de-oiled meals obtained from European soybeans

MATERIALS AND METHODS

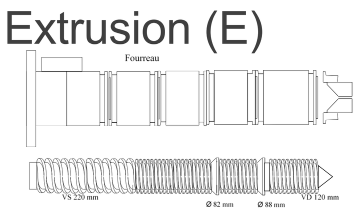
❑ One batch of soybeans (*var. Ecudor*)  → 2 x 2 factorial design

❖ Whole beans (W) or prepared with dehulling (D)

Denis D50 cleaner separator



❖ Extrusion (E) vs. Flaking + Cooking (FC)



France Extrusion single-screw extrudor

140°C
100 kg/h

Croix, contra-rotating smooth cylinders +

Olexa horizontal cooker

150°C 60 min
+155°C

❖ Pressing (P)

Olexa MBU 75 press → 4 products: EP-W, EP-D, FCP-W, FCP-D

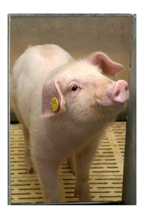
❑ Analyses : chemical composition, trypsin inhibitors, *in vitro* protein hydrolysis (pH-Stat), amino acids & reactive lysine contents, NIRs

	Dry Matter	Oil	Proteins		Protein solubility	Crude Fiber	Trypsin inhibitors
	% on crude weight basis			% de-oiled DM	% on crude		TIU / mg
Raw soybean	87	18	38	55.7	95	5	25
EP-whole beans	94	5	50	56.0	70	6	2.6
EP-dehulled	94	5	52	58.8	76	3	3.5
FCP-whole beans	91	8	47	55.8	82	5	3.6
FCP-dehulled	92	6	51	58.4	89	3	7.6

Extrusion ↘ residual oil content, whereas dehulling ↗ protein content.

A lower temperature at the dryer exit for the FCP-D batch (90 vs 97 °C) probably explained a higher trypsin inhibitor value for FCP-D SBM (confirmed by the pH-Stat results, not presented).

❑ Animal studies: broilers + piglets

❖ 288 male Ross 308 chicks in a 2x2 design.

- Starter (d0-14) and grower (d15-28) diets formulated to have same CP contents. SBM= 29-32 % in starter diets, 25-29 % in grower diets. Synthetic AAs added to cover AA requirements at the same level on a digestible AA basis in the 4 diets.
- Measurements: performance + DM and CP digestibility and digesta viscosity (3 birds /pen)

❖ 70 barrow DanBred piglets in a 4 weeks performance trial + 5 days metabolic study + post mortem digesta sampling

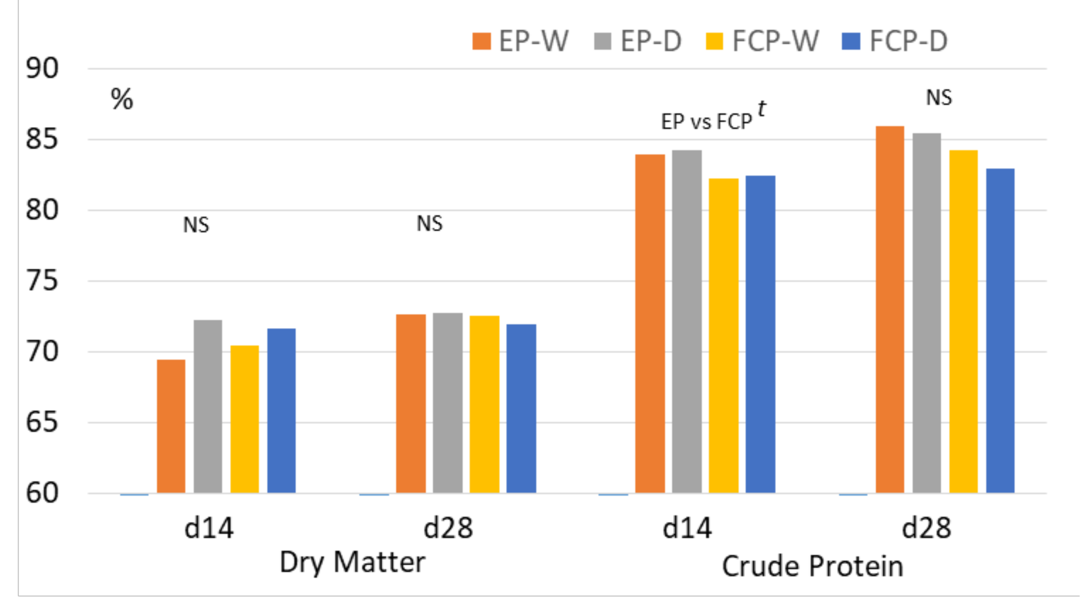
- 7 dietary treatments using commercial solvent extract SBM (CP=45%; Control), EP-W, EP-D, FCP-W, FCP-D, Casein diet, N-free diet, with SBM or casein as sole protein source. No synthetic AAs added except methionine (Met). Incorporation rates of SBM : 34-38 %.
- Measurements : body weight, feed intake, FCR + standardized ileal digestibility (SID) of amino acids.

RESULTS

- Effect of dietary treatments on performance of broilers for starter (d1-14) and growing (d15-28) periods

	EP-W	EP-D	FCP-W	FCP-D	SEM	P-value
ADFI d1-14, g/d	38.9[b]	36.7[a]	37.7[ab]	37.6[ab]	0.48	H*, HxP*
ADFI d15-28, g/d	111.4	110.3	114.1	112.2	1.39	NS
ADG d1-14, g/d	29.1[b]	27.5[a]	27.6[a]	28.8[ab]	0.43	NS
ADG d15-28, g/d	66.9	65.5	68.9	67.2	1.09	NS
FCR d1-14, g/d	1.33	1.33	1.37	1.30	0.019	H[t], HxP[t]
FCR d15-28, g/d	1.61	1.65	1.62	1.64	0.025	NS
Carcass yield (%)	65.3	68.9	66.7	68.9	1.12	H*

- Effect of dietary treatments on apparent ileal digestibility of broilers for dry matter (DM) and crude protein (CP) at the end of starter (d14) and growing (d28) periods

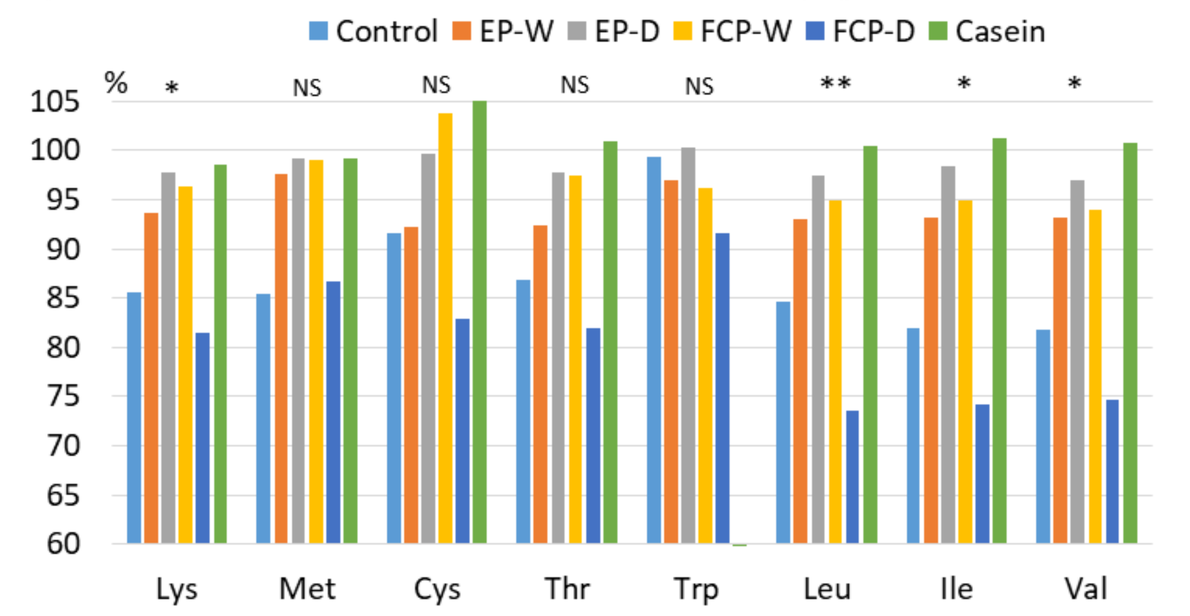


For broilers, the 4 experimental SBM resulted in similar performance parameters. Dehulling did not contribute to a significant advantage, except an increased carcass yield, possibly resulting from adaptive growth of gizzard and proventriculus (data not shown).

- Effect of dietary treatments on performance of piglets

	Control	EP-W	EP-D	FCP-W	FCP-D	RMSE	P-value
BW d1, kg	11,6	11,5	11,6	11,5	11,6	1,4	0,99
BW d28, kg	29,0[a]	28,5[a]	28,8[a]	27,5[a]	20,6[b]	2,5	< 0,01
ADFI, g/d	622[a]	608[a]	616[a]	572[a]	323[b]	58	< 0,01
ADG, g/d	1029[a]	979[a]	994[a]	950[a]	794[b]	74	< 0,01
FCR, kg/kg	1,66[a]	1,61[a]	1,62[a]	1,66[a]	2,56[b]	0,22	< 0,01
N digestibility, %	90,0[a]	91,5[a]	92,5[a]	91,0[a]	85,9[b]	2,0	< 0,01
N retention % of N intake	69,8	71,3	71,5	72,1	70,3	3,6	0,68

- Effect of dietary treatments on SID of amino acids for piglets



For piglets, three of the diets (EP-D, EP-W, and FCP-W) resulted in similar performance and higher apparent and standardized ileal digestibility of amino acids compared to control SBM.

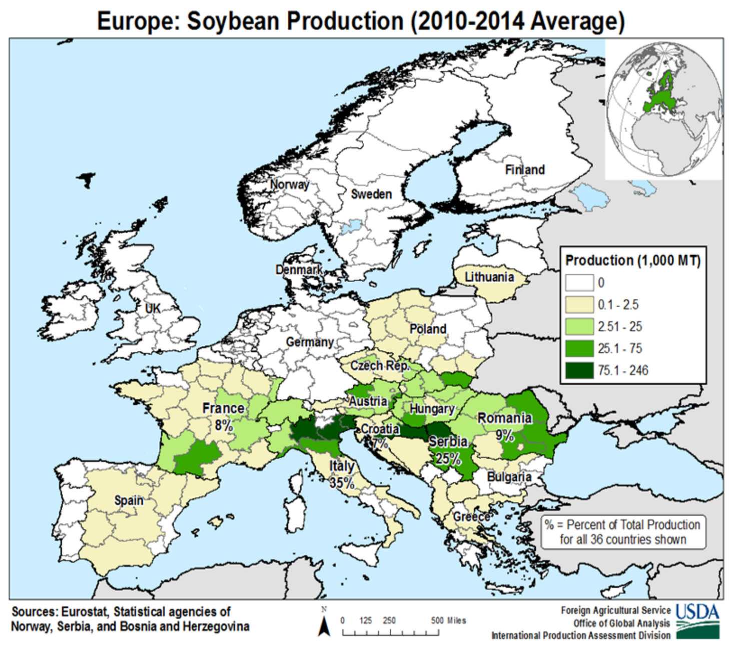
Lower performance and digestibility for the FCP-D diet highlight the importance of a low residual trypsin inhibitor activity in SBM, and the need for a setting adjustment.

CONCLUSIONS

- Soybean meals obtained from all four studied technologies involve similar performance and amino acid digestibility as solvent extracted high protein meals.
- Such meals produced in local and medium size crushing plants may improve the valorisation and competitiveness of non-GM European soybeans.

CONTACT: eric.royer@idele.fr

Europe: Soybean Production (2010-2014 Average)



Feed-a-Gene

Feed-a-Gene is a European H2020 project involving 23 partners which aims to adapt feeds, animals and feeding techniques to improve the efficiency and sustainability of pig, poultry and rabbit production systems. It is coordinated by INRA (France), started in March 2015 and will last 5 years. The project aims to reduce the environmental impact of monogastric livestock production by improving and diversifying animal diets and feed technologies and by integrating new selection criteria for these animals. The Feed-a-gene project further aims to develop new management systems for precision feeding and precision farming and to evaluate the overall sustainability of the different management solutions proposed in the project.

The Feed-a-Gene Project has received funding from the European Union's H2020 Programme under grant agreement no 633531.