A multi-year survey on the chemical composition of rapeseed meal produced in France

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Abstract

Since 2003, chemical composition of rapeseed meal produced in the French crushing factories was monitored with a quality survey. Each month, one sample of rapeseed and sunflower meals, from each French crushing factory, was analyzed by CETIOM's Laboratory (Ardon, France). Dry matter content, oil content, protein content, crude fiber content, glucosinolates content, protein solubility in caustic soda were measured on each sample. Mean yearly results for rapeseed meal were : dry matter from 88.7% to 89.7% , oil content from 3.2% to 3.9% of dry matter, protein content from 37.2% to 38.5% of dry matter, crude fiber content from 14.1% to 15.7% of dry matter, glucosinolates content from 10.3 to 11.7 µmol/g dry matter, protein solubility in caustic soda from 46.4 to 51.9 %. The first four characteristics were relatively stable and close to references used by feeding industry, whereas glucosinolates content and protein solubility strongly fluctuated. Differences between factories were noticed on glucosinolates content and protein solubility, due to process conditions. Due to these findings, further experiments could be carried out in order to evaluate the potential benefit of different meal characteristics for animal feeding.

Keywords: rapeseed meal, survey, quality, chemical composition, glucosinolates, protein, oil, crude fiber, crushing factories

TOPIC: Feed quality and use of extraction meals

1. Introduction

Since 2003, the chemical composition of rapeseed meal produced in the French crushing factories is monitored in the frame of quality survey by the French Oil-producing Interprofessional Organization (ONIDOL) and the French Technical Institute for Oilseeds (CETIOM).In the context of bio-diesel production, rapeseed meal (RSM) availability in France considerably increased and rose above2 million tons in 2009. Rapeseed meal is mainly used for ruminants feeding. But, since few years, the market in monogastric feeding strongly increased due to the economic interest and higher availability of RSM.

The objective of the survey was to participate to the RSM value-enhancing in animal feeding, by improving knowledge on its chemical characteristics and variability and nutritional value.

2. Material and methods

Each month, one sample of rapeseed meal, from each French crushing factory, was analyzed by CETIOM's Laboratory (Ardon, France). The samples were prepared by operators in the crushing plants, with a defined sampling method (10 elementary samples collected during RSM outloading on a day long).

Dry matter content (in-house method), oil content (NF V 03-908 for oilseeds), protein content (ISO 5983), crude fiber content (NF V 03-040), glucosinolates content (NF ISO 10633-1), protein solubility in caustic soda (in-house method) were analyzed on each sample.

From 29 to 88 rapeseed meal samples were analyzed each year since 2003, with a current participation of nine crushing factories.

In one factory, seeds and expeller cake, coming from the same batch than the final rapeseed meal, were also sampled in order to follow glucosinolates content change during the process.

3. Results

As shown on figure 1, mean yearly results for rapeseed meal were :

- dry matter from 88.5% to 89.7% ,
- oil content from 2.9% to 3.9% of dry matter,
- protein content from 37.2% to 38.5% of dry matter,
- crude fiber content from 14.1% to 15.7% of dry matter,
- glucosinolates content from 9.5 to 11.7 µmol/g dry matter,
- protein solubility in caustic soda from 46.4 to 51.9 %.

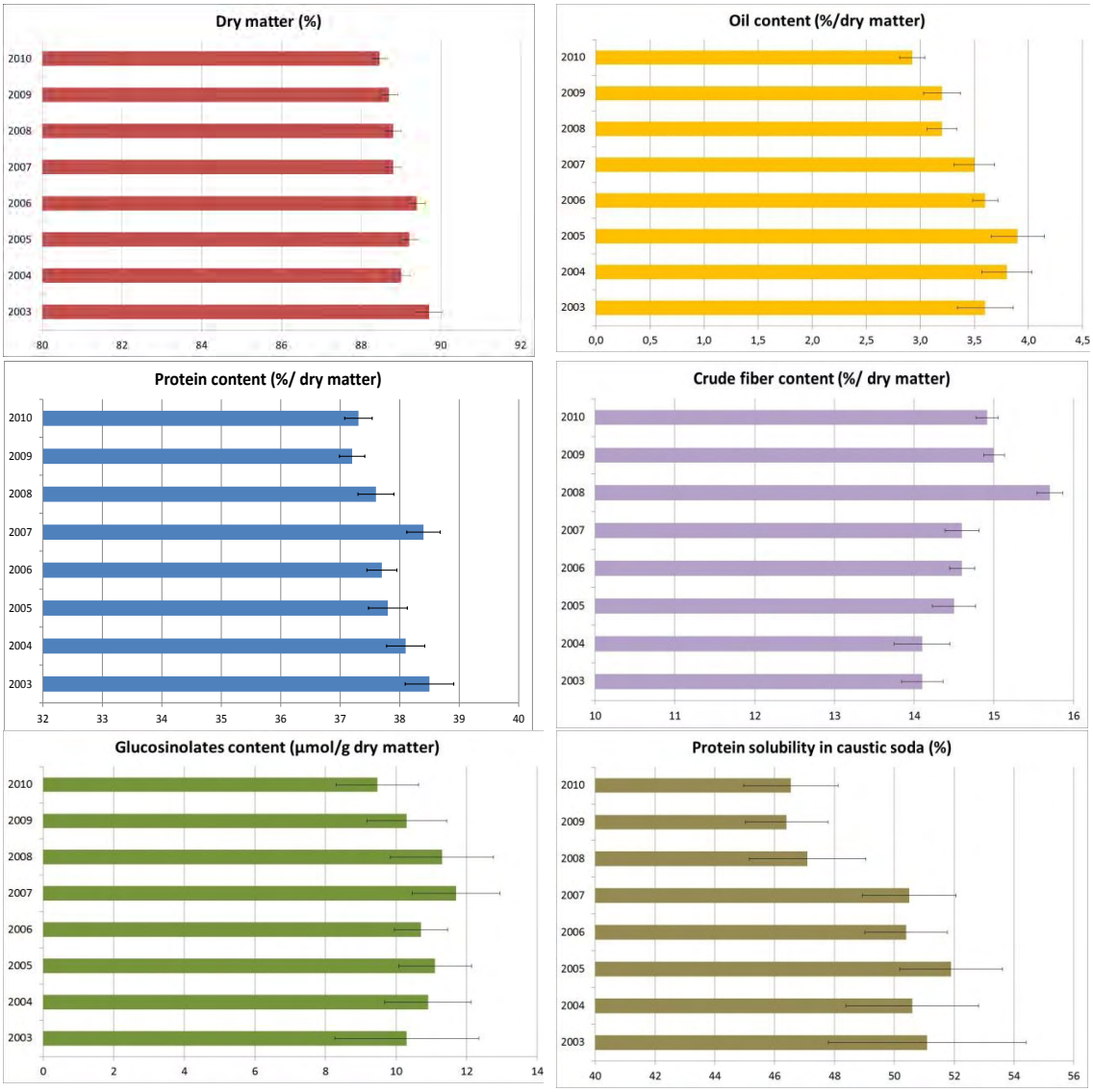

Figure 1: Mean results per year for dry matter, oil content, protein content, crude fiber content, glucosinolates content and protein solubility. Horizontal bars correspond to 95% confidence intervals.

In the plant from which seeds, expeller cakes and extraction meals were sampled and analyzed since 2005, glucosinolates content decreased during the process. Results were expressed in µmol/g on de-oiled dry matter (DDM). Glucosinolates contents were respectively34,4 µmol/g DDM in seeds (Standard deviation = 4,1), 31,9 µmol/g DDM in expeller cakes (Standard deviation = 4,1) and 10,1 µmol/g DDM in extraction meals (Standard deviation = 2,9). These results showed that only 7% of glucosinolates were lost during the preparation phase of the crushing process: conditioning, flaking, cooking and pressing while 68% were lost during the extraction and desolventisation steps.

4. Discussion

Dry matter, oil content, protein content and crude fiber content were relatively stable and close to references used by feeding industry, whereas glucosinolates content and protein solubility were much more variable : standard deviation for glucosinolates was in the range3,3 and6,3 µmol/g and standard deviation for protein solubility was in the range 6 and8,9%.

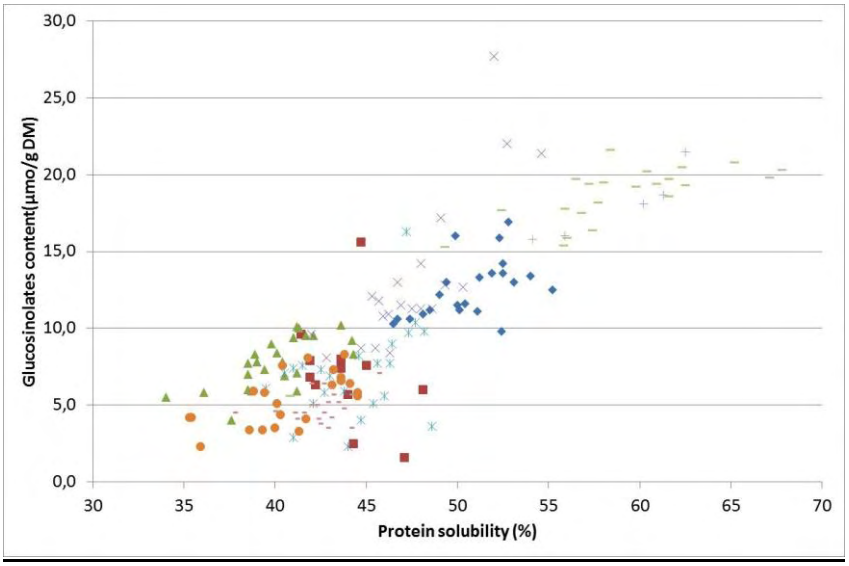

Figure 7: Relationship between glucosinolates content (µmol/g of dry matter) and protein solubility in caustic soda (%), in 9 crushing factories, during2009 and 2010.

Differences between factories were noticed on glucosinolates content and protein solubility, due to process conditions: in 2010, glucosinolates content was in the range 1.6 and27.7 µmol/g dry matter; while protein solubility was in the range 35.3% and67.8%. When higher hydro-thermal conditions were applied on meal during desolvantisation, glucosinolates were broken down and proteins became less soluble. That explains the relation between these two characteristics (figure 2). These findings are interesting for further experiments on interest of different meal characteristics for animal feeding.

5. Conclusion

The quality survey allowed the monitoring of the almost total RSM production in France since most of the crushing plants participated to the sampling and analysis programme. The numerous data collected in this survey showed that the proximate composition of regular rapeseed meal was found relatively stable and their average values were consistent with the reference data (INRA composition tables, Sauvant 2004).

The survey showed that GSL and protein solubility varied because of the effect of crushing process, particularly desolvantisation. So, it was verified that the process may differ in different crushing plants but was relatively stable in each one. As these results were merged and discussed with the stakeholders of the RSM production and using, (crushers, feed manufacturers) some adjustments were carried out on the industrial process to improve RSM quality or the mass balance of crushing operation (defatting). Results before and after 2008 showed that doubling the french crushing capacity (2.3 million tons of RSM used in feed in 2010, Peyronnet 2011) did not change significantly RSM quality.

The occurrence of various glucosinolates content and protein solubility values in regular RSM led to check its nutrional value on swine and poultry (Lessire 2009) because of the sensitivity of these animals (monogastrics). As a prospect, questions were opened on the effect on the process on RSM quality and some studies are in progress to understand the relation between process conditions, RSM composition and nutritional value.

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