Upgrading of Biomass to Animal Feed

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Training Course Biorefinery

International Biomass Valorisation Congress

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Background

Subsidiary Cehave Landbouwbelang u.a.

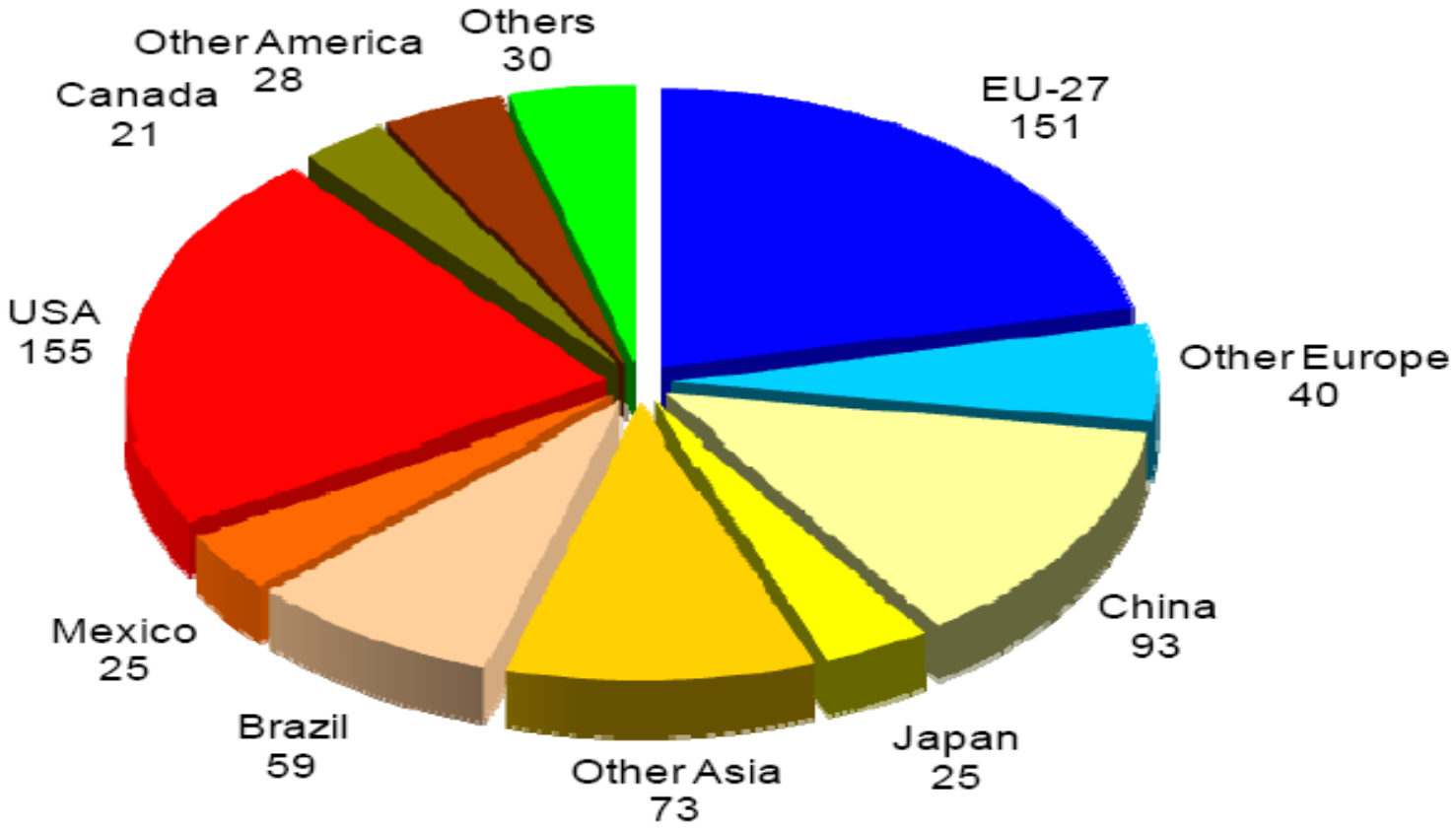
Core business: *production and marketing of high-quality feed for livestock animals and within the Netherlands marketing of agricultural products (seeds, fertilizers)*

CCL Research is dedicated to animal nutrition research and the development of novel feed concepts, products and technologies.

Role of biorefinery within CCL Research

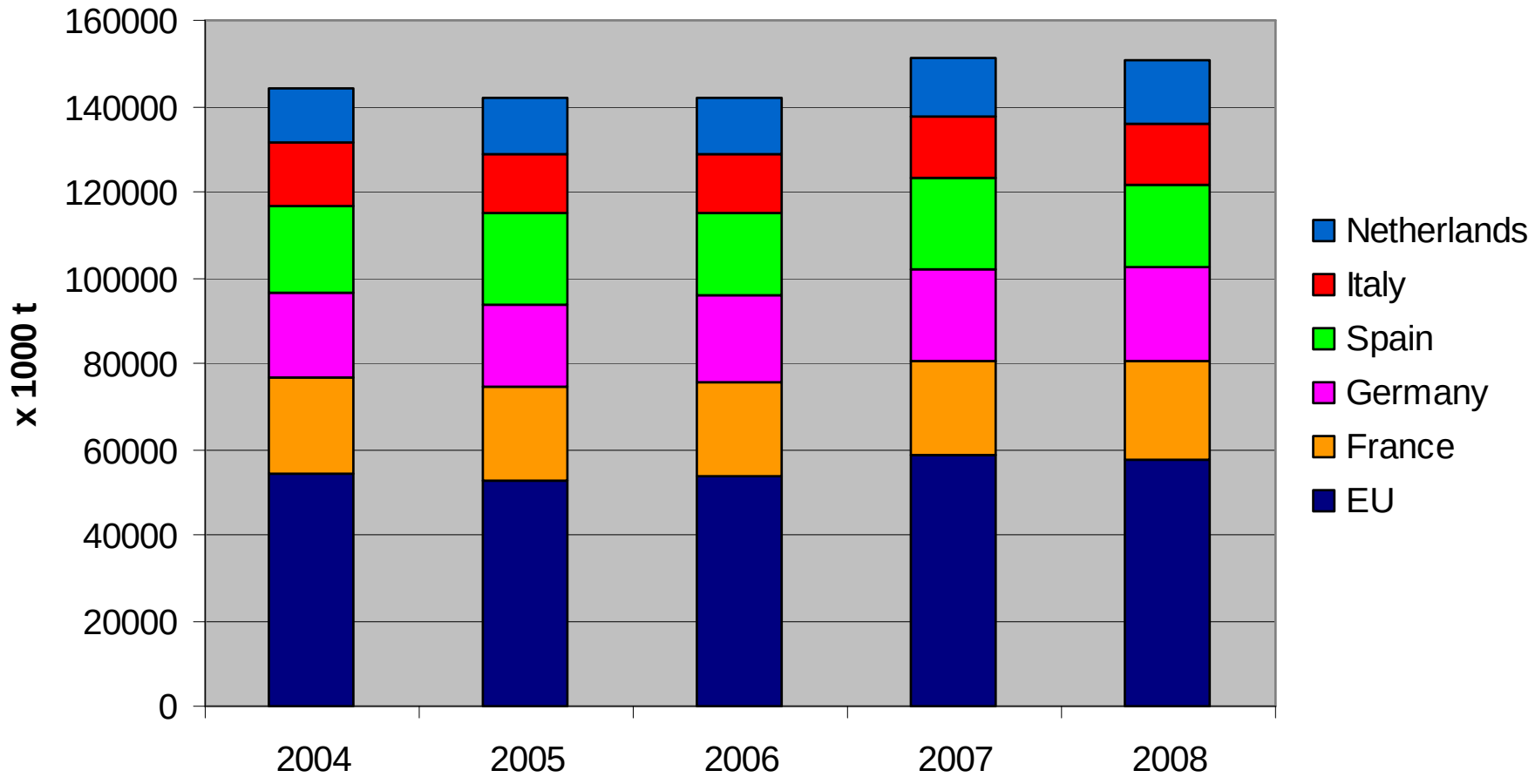
Upgrading the feeding value of vegetable biomass to create added value

Global compound feed production in 2008 (mio. t)



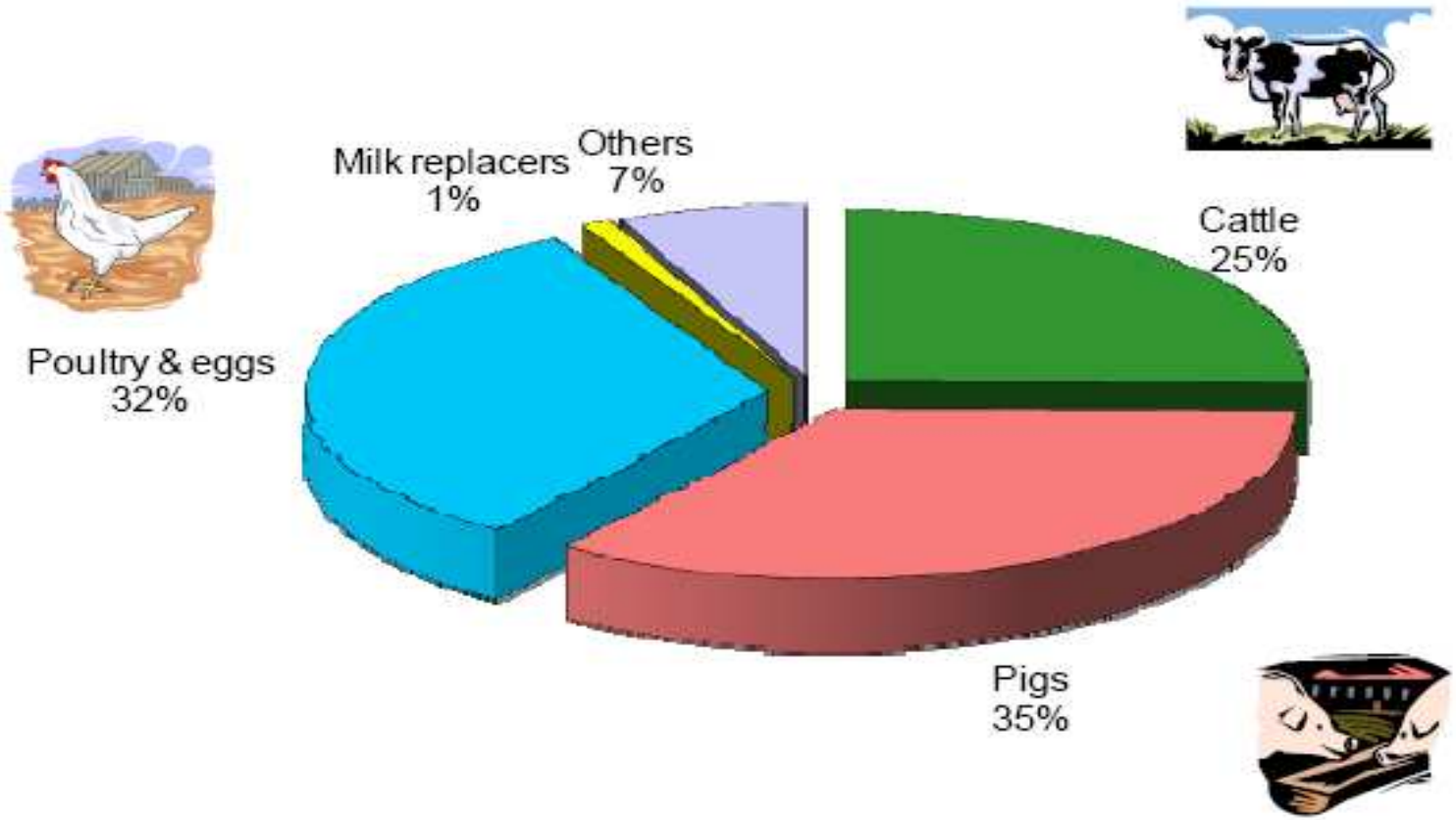
Source: Fefac, 2008

Industrial feed production EU



Source: Fefac, 2008

Industrial feed production per category in 2008 in the EU-27



Source: Fefac, 2008

Livestock feed composition

	Ruminants	Pigs	Poultry/piglets
Protein %	20-25	15-20	15-25
Fat %	5-10	5-10	5-12
Fiber	15-20	5-15	<7,5
Starch & sugars	20-30	25-45	35-45
Minerals & vitamins	10-15	10-15	10-15
Main raw materials	grain byproducts, pulp, palmkernel meal	oilseed meals, grain byproducts, grains	grains, oilseed meals, vegatable oils

Feeding value animal =

nutrient in raw material x digestible capacity =

price

→ Demand for energy

Changing market

Increasing demand for fuel and energy

↓ Availability of fossil oil and gas

↓ Availability of energy rich raw materials

→ competition food/fuel/feed

Demand for protein?

Raw material	examples	protein content
High value protein	blood proteins	~ 90%
	Fish meal	~55-75%
	Soy protein concentrate	55-65%
	Wheat gluten	~80%
High protein	Soybean meal	~42-49%
	Rapeseed meal	~30-34%
Mid protein	Palmkernel meal	~14-15%
	Wheat midlings	~15%

Source: CVB, 2005

Mission and Strategy
Cehave Landbouwbelang Cooperative

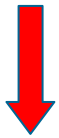
Create value for its members (farmers) in achieving an optimal return on their individual businesses.

By: focusing on producing and marketing high-quality animal feed and continuously working lowering the cost price of the end products in the farmyard (milk, meat and eggs)

Technological Upgrading of vegetable biomass

- Within strategy (lowering cost price)

- Change in price and sources of raw materials available



Need for Technological Upgrading of low quality (=low feeding value) of vegetable biomass

Types of technology within industrial feed production

Tool	Some examples
Physical	Extrusion, Expansion, UPC, Toasting, Particle size, Separation
Chemical	Acids, Alkaline hydrolysis, cross linking
Biological	Yeasts, enzymes

- Technology comprises a broad range of tools!
- Challenge is to select the right tools for a cost-effective process.

Role of biorefinery within industrial feed production

Creating more energy out of lignocellulose rich vegetable biomass

Why;

- Nowadays poorly digestible
- Party replace expensive energy delivering feedstuff (mainly grains) saves feeding costs.
- Sustainable

Which raw materials are interesting?

Remember; feeding value is depending on the digestibility of the raw material

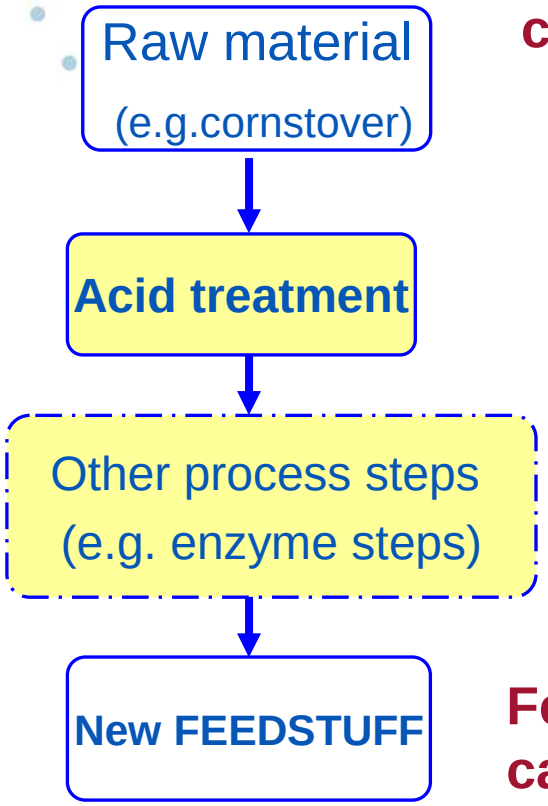
	carbohydrates %	% digestible	starch%	sugar%	% digestible*
Wheat	84	91	68	3	46
Rapeseed meal	51	67	1	10	58
Sugarbeet pulp	82	87	0	8	85
Corn stover	86	<20	-	-	<20
Wheat straw	84	<5	-	-	<5

* Of carbohydrates without starch and sugars

Source: CVB, 2005

Process

Developed by:
Peter de Bot (CCL) and
Wageningen University (FBR)



Native carbohydrates

Fermentable carbohydrates

Low energy value

High energy value

Simple one-way approach:
1 starting material-> 1 new Feedstuff

Goal of technological upgrading of vegetable biomass

Development of an *universal biorefinery process*

Which can handle a large diversity of lignocellulose rich vegetable biomass and focuses on the optimal relation between increased feeding value and cost price.

Acid and enzyme treatment from lab .....to larger scale

Acid Treatment

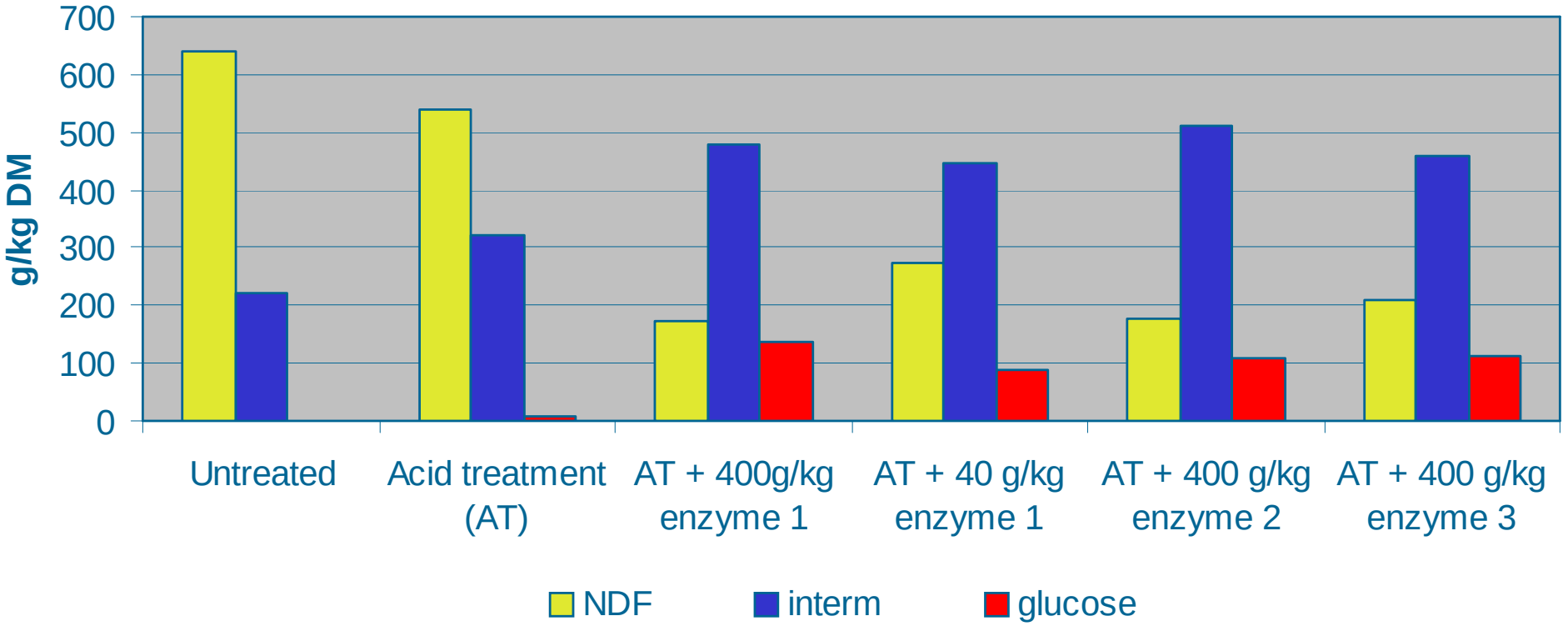
Enzymatic Treatment

Technical upgrading of vegetable biomass

What's in for the animal?

Products from process	Fate product in animal
Glucose	Ready to absorp and digested (100%)
Free pentoses	- Fermented (~75% digestible)
	- but when absorbed; competes with glucose and can be toxic for the animal (=species dependent)
Partly hydrolysed carbohydrates	Fermented
Degraded pentose; furfural	Toxic
Degraded hexose; HMF	Loss of hexoses and might be toxic

Effect of treatment on the change of carbohydrate types in cornstover



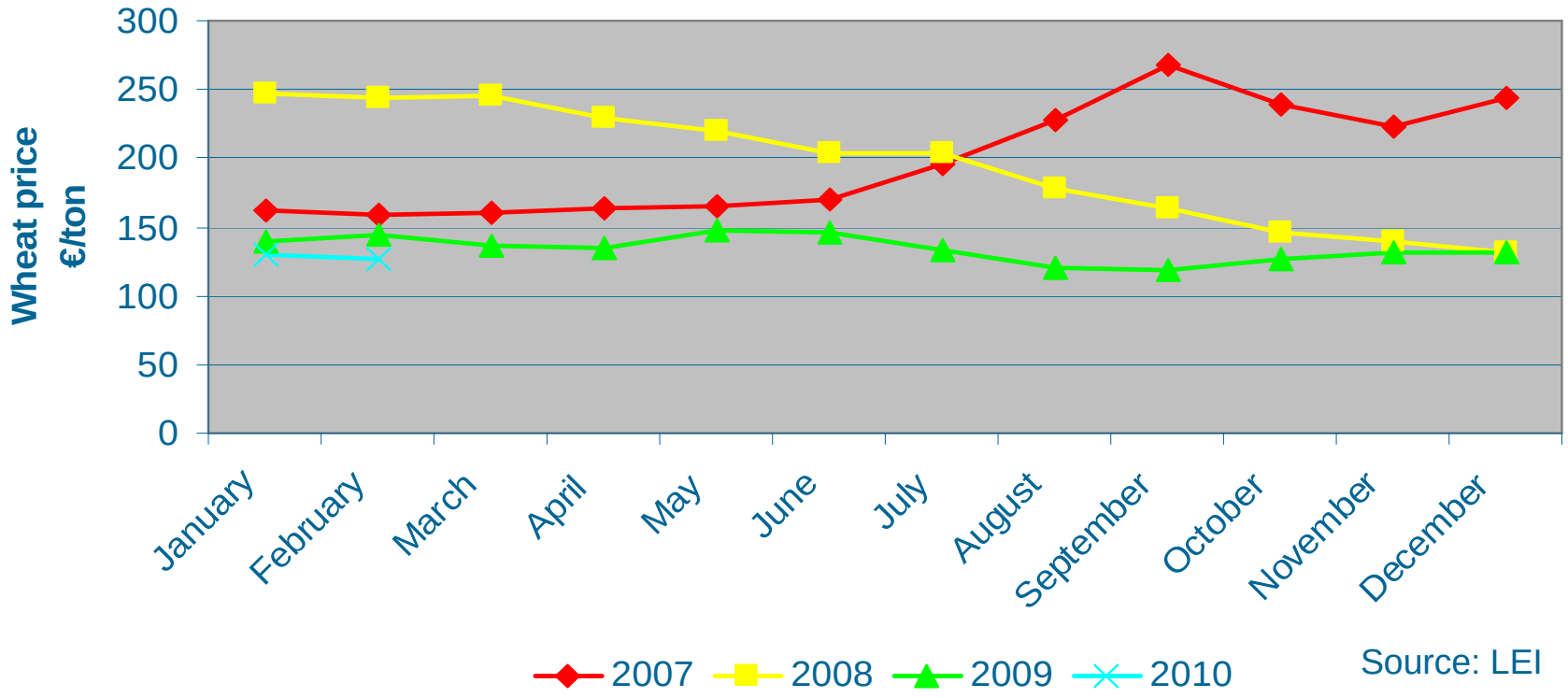
Source: Peter de Bot, CCL Research

Conclusions

Improvement of carbohydrate digestibility possible for cornstover

Higher feeding value was shown within an animal feeding trial

GO/NO GO challenges



Source: LEI

Selecting the optimal process which can handle different sources of vegetable biomass within a cost-effective process.

Thanks for your attention!

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