

**Nutritional evaluation of pig feeds: contribution of the EvaPig software**

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**EvaPig®**

**Energy, amino acids and phosphorus values for pigs**

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**Challenges in pig feeding**

- Many ingredients are available
- Ingredients have variable composition
- Feed accounts for > 50% of the cost of pig production
- The main component of feed cost is energy
- Feed impact technical and economic results
- Environmental concerns about the excretion of N, P etc.
- Animals, farm conditions and production targets are variable

**Feeding Tables**

Tables of composition and nutritional value of feed materials

<http://www.zootechnie.fr/tables/index.htm>

**Variability?????**

**Feeding Tables?**


Crude fiber, % as fed

Crude protein, % as fed

Tables give values for "typical" ingredients.


Soybean meal 48

- 1<sup>st</sup> objective of EvaPig® : How to take into account the effects of actual composition on nutritional value of ingredients?




### Objectives of EvaPig®

- EvaPig® is a **calculator** of energy, amino acids and phosphorus values of ingredients and diets for growing and adult pigs according to actual composition.
- EvaPig® includes the **chemical composition and nutritive values** for the pig of about 100 reference ingredients, mostly derived from the INRA-AFZ Tables.
- It creates **new ingredients** either by copying and modifying the reference ingredients, or by using your own data.
- It creates and calculates nutritive values of **complete diets** either by mixing ingredients or by providing a chemical composition.
- Specific and/or generic equations and coefficients** are used for calculating energy, amino acids and phosphorus values.




### EvaPig® and pig nutrient requirements

- EvaPig® generates diet nutritional values.
  - Diet specifications should be adapted to animal requirements
  - These requirements are highly variable according to bodyweight, stage of production, sex, genotype, etc.
  - EvaPig® proposes specific criteria in diet characteristics for adaptation to animal requirements.




### EvaPig® and pig nutrient requirements (examples)

- Optimal amino acid profile (ideal protein):
  - EvaPig® calculates the **amino acid profile** (digestible amino acid as % of digestible lysine) of the diet.
- The protein:energy ratio is highly variable between pigs according to physiological stage, body weight, etc.
  - EvaPig® provides the **ratio between digestible lysine and NE**, which is the best indicator of the protein:energy ratio.
- It is important to get an optimal ratio between Ca and digestible phosphorus (Pd):
  - EvaPig® calculates the **Ca:Pd ratio** of the diet



### Nutritional concepts in EvaPig® :

- Energy**
- Protein and amino acids**
- Minerals and phosphorus**



### Energy utilization

Diagram illustrating energy utilization:


**Gross Energy (GE)** →  $E_d$  → **Digestible Energy (DE)** →  $ME/DE$  → **Metabolizable Energy (ME)** →  $k = NE/ME$  → **Net Energy (NE)**

Losses from GE to DE: **Fecal energy**

Losses from DE to ME: **Urinary and gas energy**

Losses from ME to NE: **Heat increment**

k values (%)	
Starch	80
Protein	60
Fat	90



### Changes in Ed (%) according to stage of production

Ingredient	Growing	Adult	$\Delta, \%dEg$
Wheat	87.6	89.2	+1.8
Corn	87.9	91.4	+4.0
Soybean meal	85.2	90.4	+6.2
Wheat bran	56.7	62.7	+10.4
Corn gluten feed	65.6	76.4	+16.5
Soybean hulls	51.4	70.3	+36.8

**+ effects of technology?**

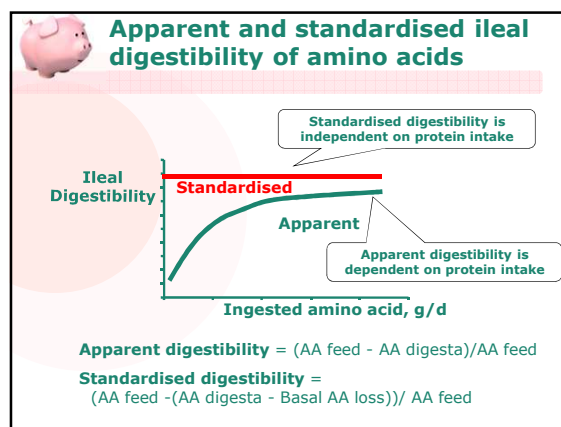
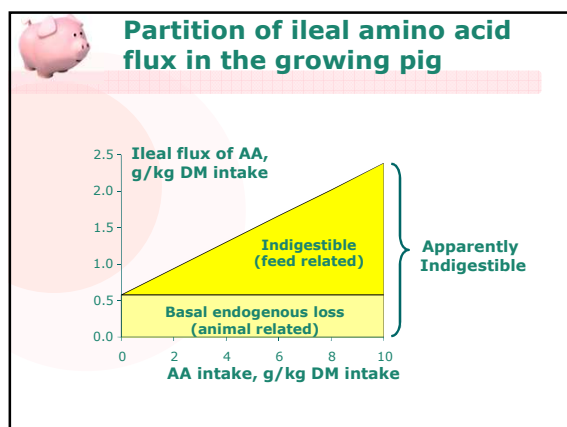
### Changes in ingredient ranking according to energy system

Ingredient	DE	NE
Corn	103	112
Wheat	101	106
Wheat bran	68	63
Soybean meal	107	82
Fat	243	300

Values expressed as % of the energy value of a "reference" compound feed

### Energy values in EvaPig®

- References = INRA & AFZ Feeding Tables
- DE, ME and NE
- 2 physiological stages: growing vs adult
- Effect of technologies (# bonus)
- NE is a better predictor of pigs performance
- NE = GE x dE x ME/DE x NE/ME (+ correction factors)
- Contributions of ingredients are additive.

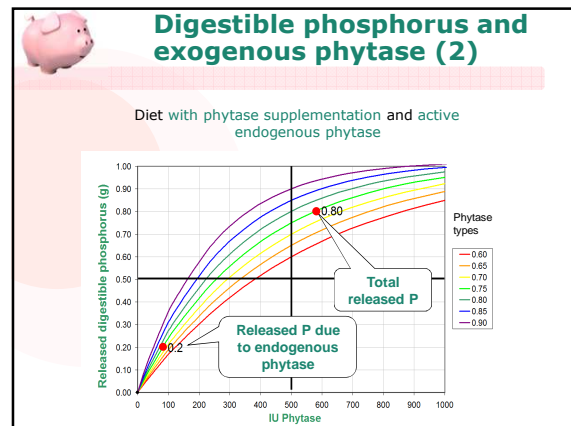
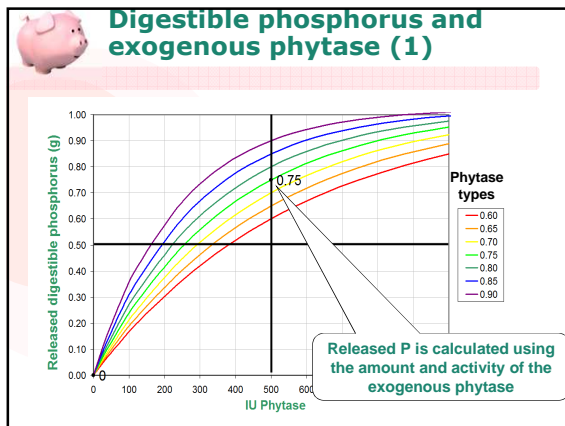


### Standardised digestible amino acids

- Standardised amino acid digestibilities are independent from the feed protein content
- The standardised digestible amino acid values of the ingredients are additive.
- Ileal amino acid digestibility coefficients are supposed to be identical at all stages of pig production; no effect of technology (?)
- Using standardised digestible amino acids is the best way to provide a balanced amino acid supply and predict the pigs performance.

### Digestible phosphorus

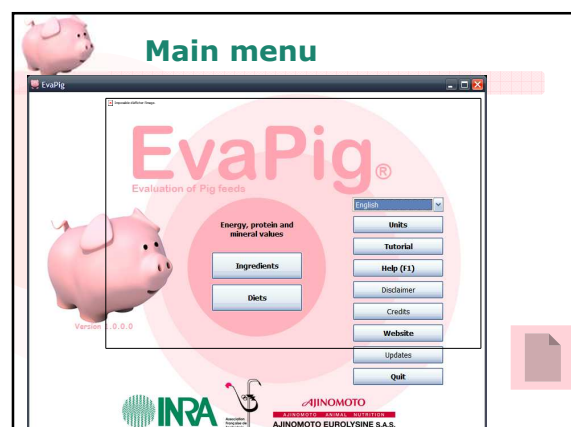
- Concept: apparent digestible phosphorus
- The calculation of digestible phosphorus in diets takes into account:
  - The presence of endogenous phytase
  - The addition of exogenous phytase
  - The physical form of the diet (pellet or mash)
- The amount of digestible phosphorus depends on the amount of phytase and on its biological activity



- ### EvaPig®
- Website
  - Calculator
    - Ingredients
    - Diets
    - Phytase
    - Bonus
    - Energy calculator



- ### www.evapig.com
- Free
  - Software download
  - Tutorial and Help
  - Manual
  - Equations
  - Documents (list of publications, etc.)
  - Updating of versions
  - Interactions with authors (contact, FAQ, etc.)



### Ingredients: reference database and user database

One tab per group of nutrients

Reference ingredients are shown in pink

User created ingredients are shown in blue

To sort the ingredients

To create an ingredient

### To create a new ingredient

- You can create your own ingredients by two methods:
  - Create an ingredient using a reference ingredient as a basis and correction factors x difference in chemical composition
  - Create an ingredient using only its chemical composition: Evapig® will use generic equations/coefficients
- A bonus can be applied
- Using reference ingredients is highly recommended

### To create a new ingredient

Click on this tab to create a new ingredient from the selected reference ingredient

Click on this tab to create a new ingredient from its chemical composition

### Steps of energy values calculation

- $GE = f(\text{protein, fat, ash})$
- $Ed = f(\text{fiber})$  (fiber = CF, ADF and/or NDF)
- $DE = GE \times Ed$
- $DE_{adult} = f(DE_g, Ed_g, \text{ash})$
- $ME/DE = f(\text{protein, DE})$
- $ME = DE \times ME/DE$
- $NE/ME = f(\text{protein, fat, starch, ME})$
- $NE = ME \times NE/ME$

Equations and coefficients on Evapig website

### Chemical composition and nutritional value of an ingredient

Proximate analysis

Energy values

Energy ratios and bonus

Mineral values

Total and digestible amino acids

Print, save, export

### Diets

- EvaPig® lets you formulate complete diets using the reference ingredients or the ingredients that you created.
- EvaPig® compares the contributions of each ingredient to the nutritional values of one or several diets
- EvaPig® compares the nutrients of several diets

## Create a diet

**Physical form**

**Diet ingredients**

**Inclusion levels**

**Phytase supplementation**

**Energy bonus**

**List of ingredients**

## Chemical and nutritional values of a diet

**Proximate analysis**

**Minerals**

**Amino acids**

**Energy values**

**Print, save, export**

**Animal requirements indicators**

## Phytase supplementation

Calculating the effect of phytase supplementation on diet phosphorus requires 3 values:

- Biological activity: g of digestible P released per 500 IU of phytase**
- Concentration: IU per g of phytase additive**
- Inclusion: IU per kg of feed**

Type:  0.70

Concentration: 500

Incorporation: 400

Calculated amount of phytase additive in % of the diet: 0.0800

## Diet energy calculator

**Energy calculator**

**Energy calculator**

## Steps of energy values calculation


- $GE = f(\text{protein, fat, ash, fiber, sugars, starch})$ 
  - GE value can also be provided and it will be used instead of GE calculated from chemical characteristics
  - EvaPig® uses several equations to predict gross energy. The equation used depends on the available chemical values.

Equations and coefficients on Evapig website


## Steps of energy values calculation

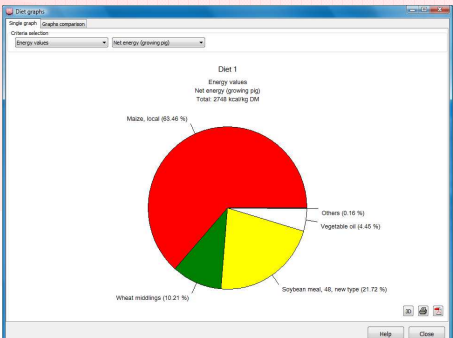
- $GE = f(\text{protein, fat, ash, fiber, sugars, starch})$
- $\text{Ingredient Ed} = f(\text{fiber})$
- $\text{Diet Ed} = f(\text{fiber, ash, in vitro digestible organic matter})$
- $DE = GE \times Ed$
- $DEa = f(DEg, Edg, \text{ash, protein})$
- Energy lost from urine =  $f(\text{protein})$
- Energy lost as methane =  $f(\text{ash, protein, fat, starch, sugars})$
- $ME = f(DE, \text{Energy urine, Energy methane})$
- $NE = f(DE, \text{protein, fat, starch, fiber})$

Equations and coefficients on Evapig website

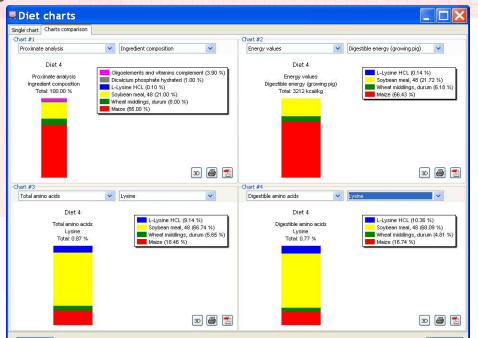
 **Energy bonus for ingredients and diets**


- Feeding Tables and EvaPig® generate energy values for mash feeds. The (>0) energy bonus can be used when a technological process is applied to an ingredient or a diet
- The bonus (>0 or <0) can be applied to ingredients for technology and "disagreement" effects

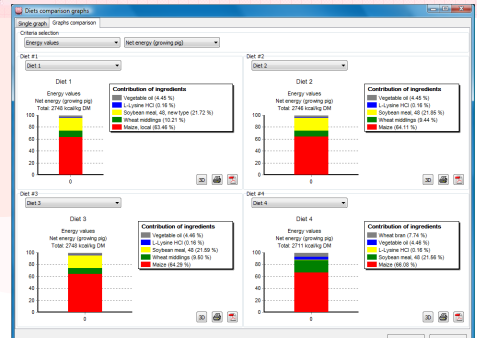
 **Diet chart**



 **Diet charts**



 **Diets charts**



 **www.evapig.com**

- Visit our website [www.evapig.com](http://www.evapig.com)
  - Software and database updates, tutorial, manual, etc
  - Documents (publications, presentations, equations, etc.)
  - Ask questions about EvaPig and its concepts
- New versions of EvaPig® will be available with new languages, new ingredients in the reference list, etc.... And corrections of errors!!!
- We thank in advance the people who will help to make EvaPig® better by providing us with nutritional values for new ingredients or more accurate and up to date information.

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- Others .....



## The end.....



# Thanks for your attention

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