# Approche économique de la valorisation de farines d'insectes en alimentation animale (Economic evaluation of insect meal in animal feed)

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# PLAN

Preliminary approach : Insectinov 2014

Economic simulation with Tenebrio molitor insect meal  in feed of

       laying hens or salmon (see abtsract)

       shrimp

       gilt head bream

Conclusion

# Least cost feed formulation with linear programing

Dantzig, 1947



|  | $Ingr_1$ | $Ingr_2$ | $Ingr_j$ | $Ingr_n$ |
|---|---|---|---|---|
| $Nutr_1$ | $a_{11}$ | | $a_{1j}$ | $a_{1n}$ |
| $Nutr_2$ | $a_{21}$ | | $a_{2j}$ | $a_{2n}$ |
| $Nutr_i$ | $a_{i1}$ | | $a_{ij}$ | $a_{in}$ |
| $Nutr_p$ | $a_{p1}$ | | $a_{pj}$ | $a_{pn}$ |

Technical matrix

| Price | $c_1$ | $c_2$ | $c_j$ | $c_n$ |

| X |
|---|
| $X_1$ |
| $X_2$ |
| $X_j$ |
| $X_n$ |

% inclusion

$\geq = \leq$

| $b_i$ |
|---|
| $b_1$ |
| $b_2$ |
| $b_i$ |
| $b_p$ |

Constraint

$Ingr_j$: dietary ingredient/ $Nutr_i$ = Nutrient / $C_j$ = price / $X_j$ = % inclusion in feed / $b_i$ = constraints

$$\text{Minimise Price} = \sum c_j X_j$$

# Insectinov 2014

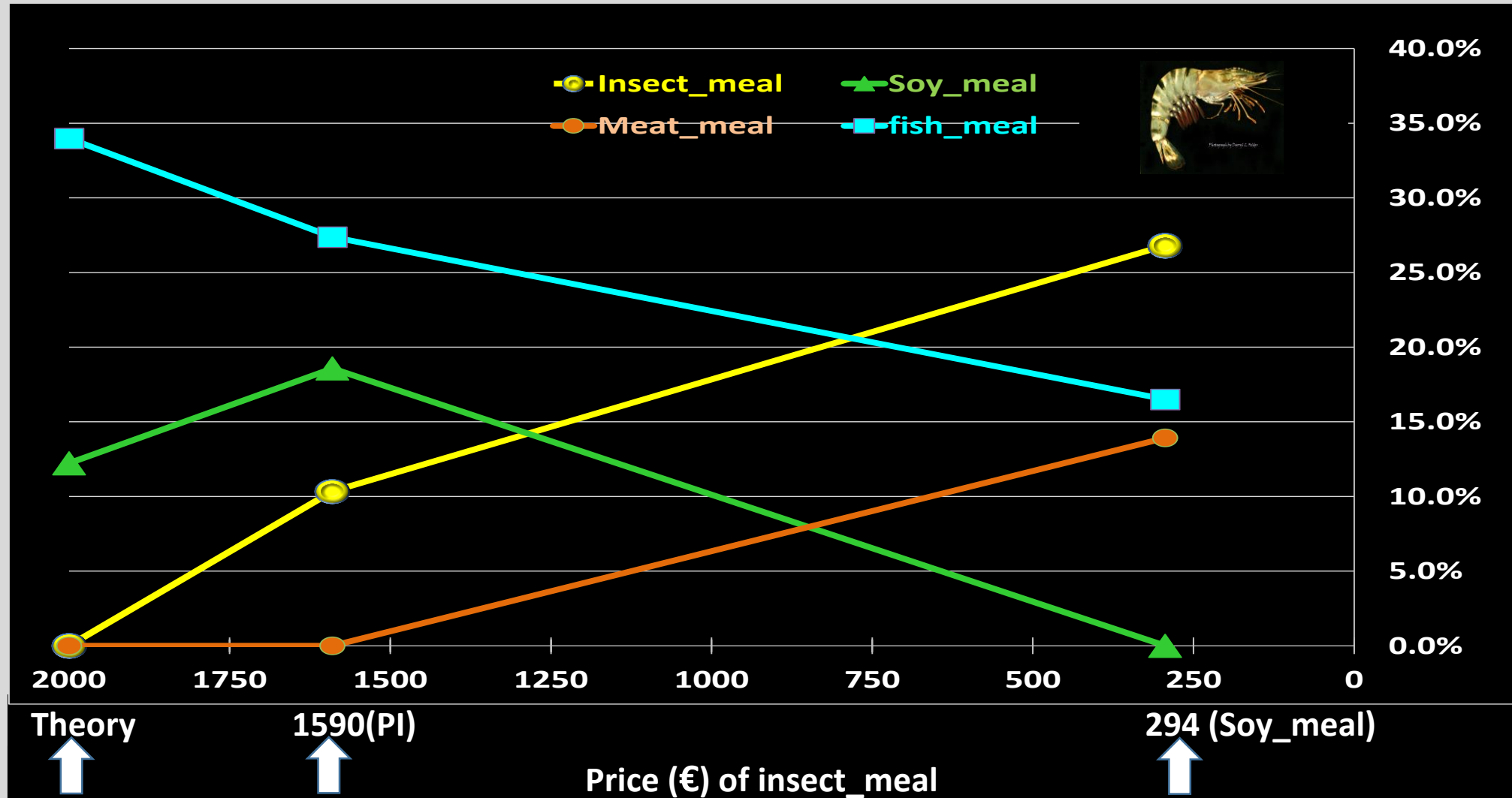| Insect | Formula | Price (€) | % Inclusion | Variation price |
|---|---|---|---|---|
| *Hermetia* **ill (l)** | | 3000- **600** -350 | 0 – **1** – 9 | **-7%** |
| *Musca* **dom (l)** | | 3000- **660** -350 | 0 – **1** – 12 | **-14%** |
| *Hermetia* **ill (l)** | | 3000- **660** -350 | 0 – **4** – 9 | **-10%** |
| *Musca* **dom (l)** | | 3000- **660** -350 | 0 – **6** – 19 | **-20%** |
| *Musca*. **dom (l)** | | 3000- **1320** -350 | 0 – **8** – 22 | **-22%** |
| *Musca*. **dom (l)** | | 3000- **800** -350 | 0 – **8** – 36 | **-20%** |

# Why new simulations in 2017 ?

- **No previous simulation with Tenebrio molitor meal**
- **New data on digestibility of insect meal in poultry and fish**
  - **Burel et al. in trout**
  - **Lesire et al. in poultry**
- **Changes in feed prices (Source: Cereopa)**



(Price 2017 / Price 2014) -1
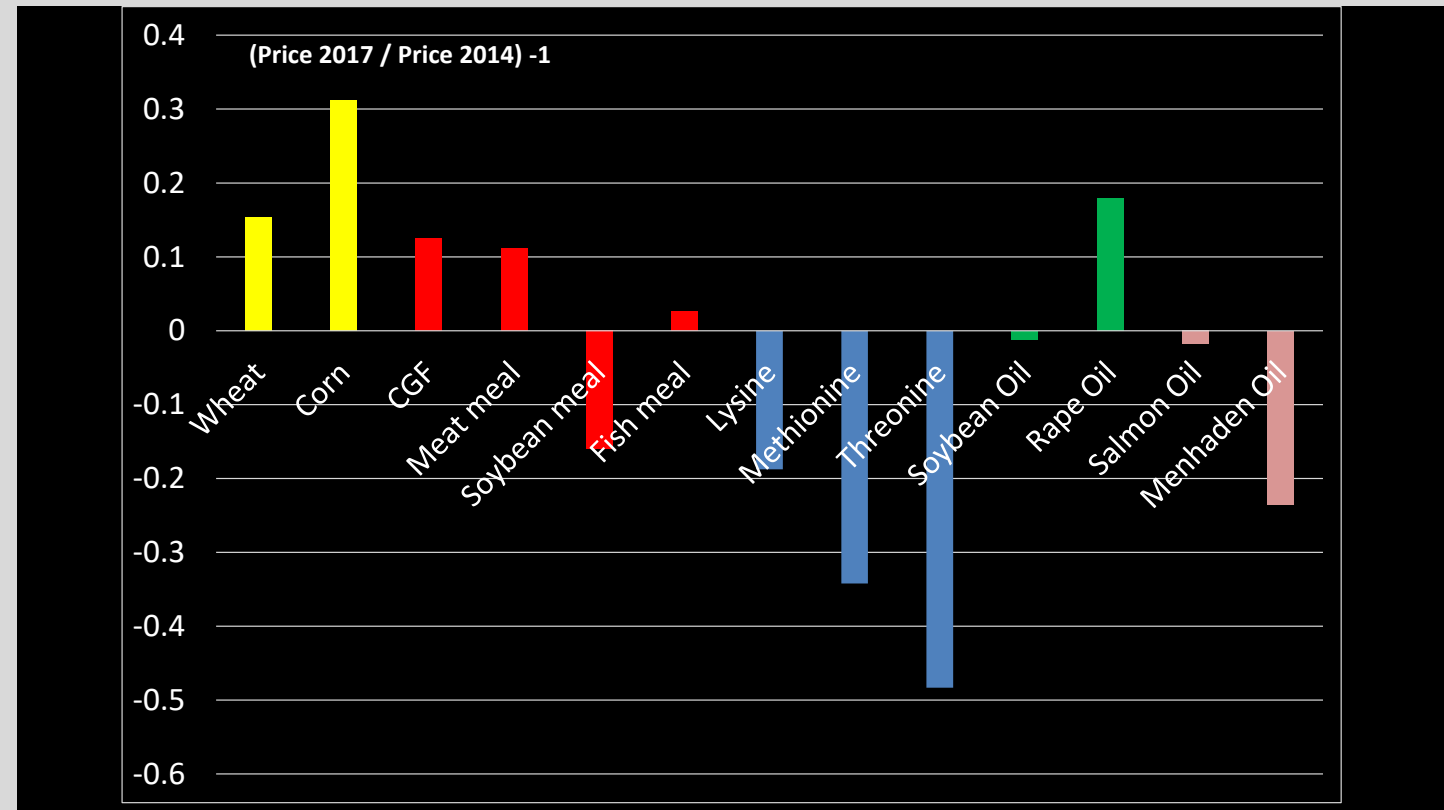
# Giant tiger prawn
# (Penaeus monodon)

# Influence of insect meal price from Tenebrio *molitor* on its inclusion rate in a feed for Asian tiger shrimp
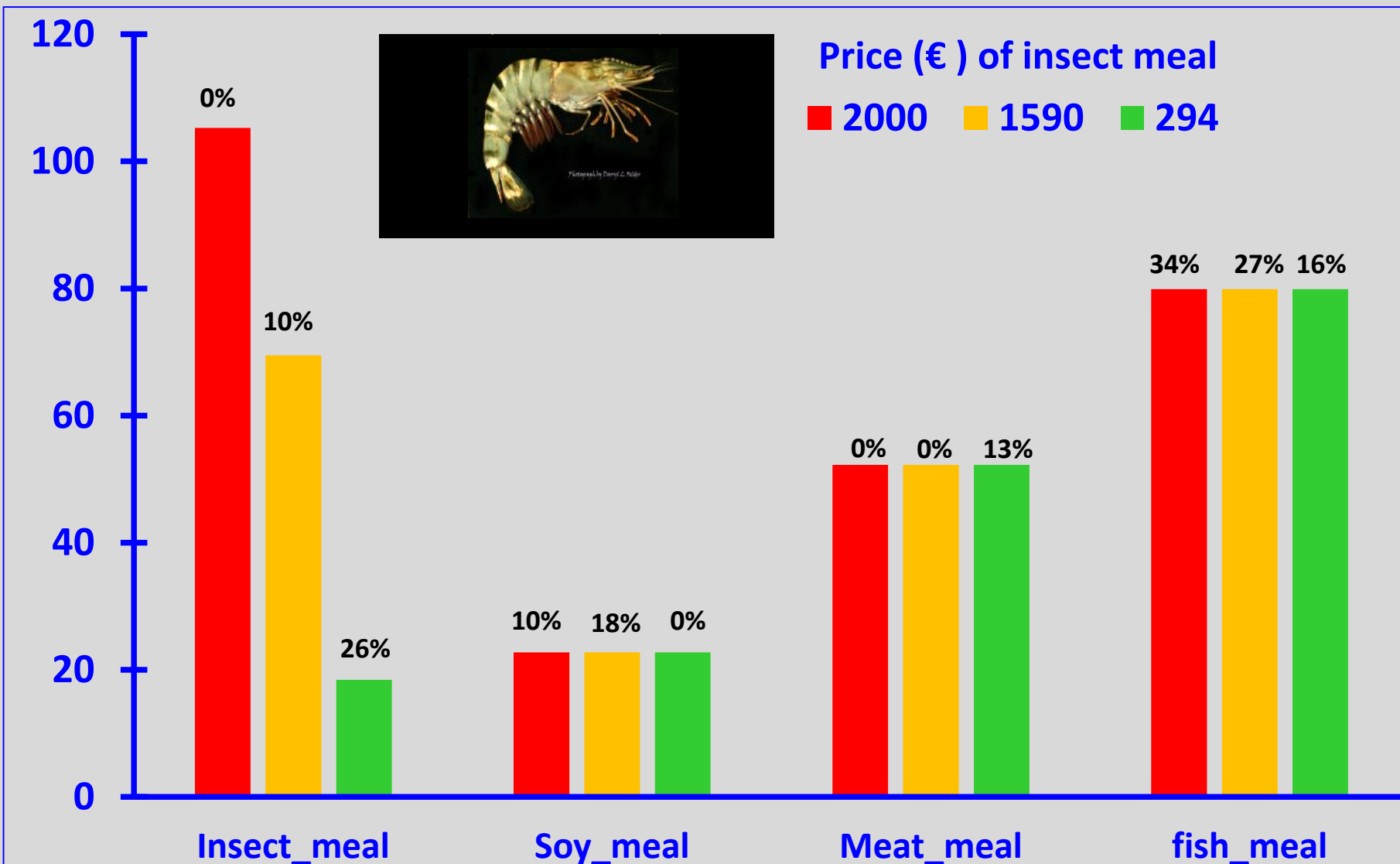


NRC (2011) recommandations

**Inclusion rate of insect meal of Tenebrio molitor according to its price in a feed for shrimp : contribution to <u>primary</u> saturating constraint 'Digestible Energy'**
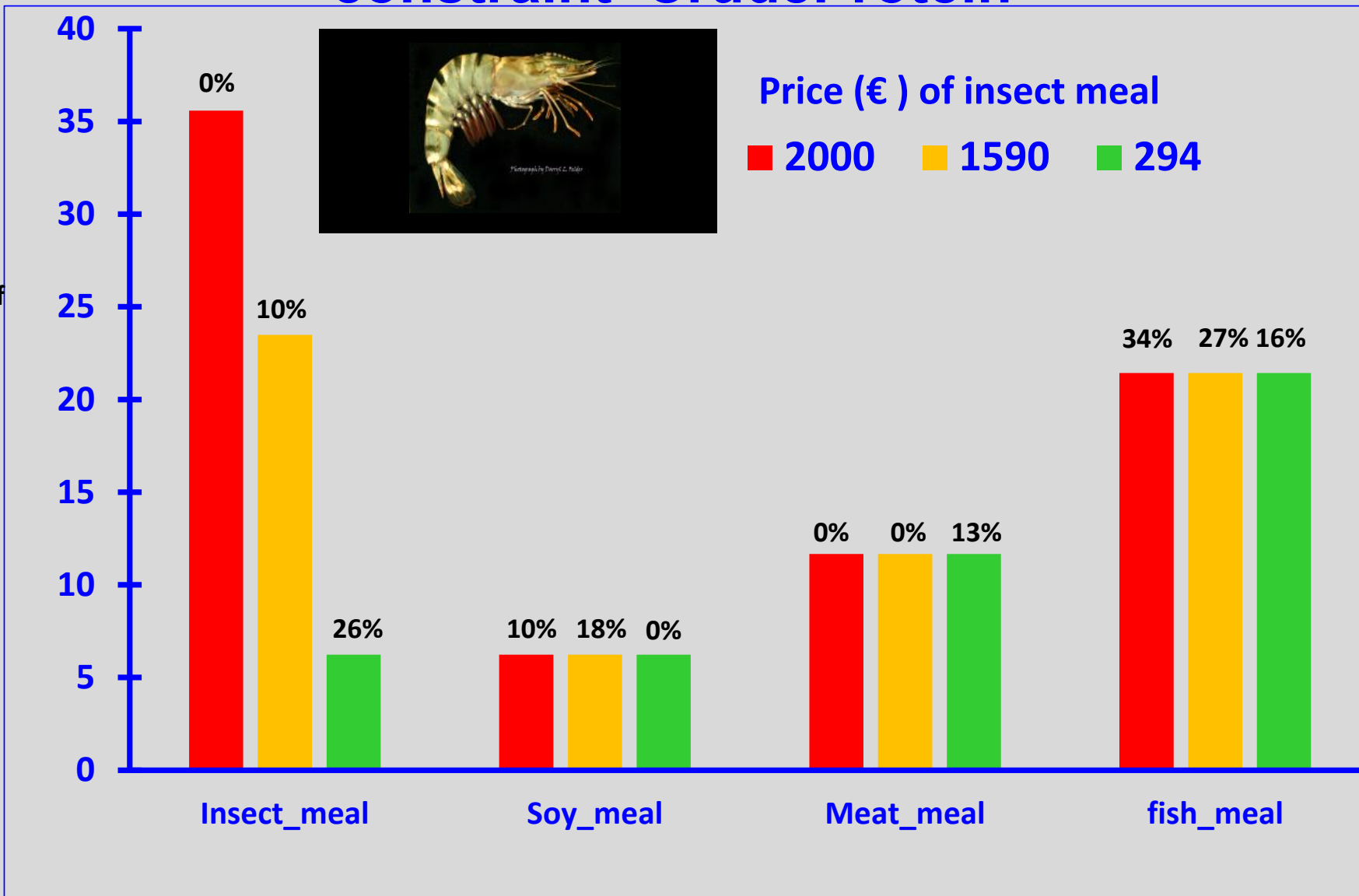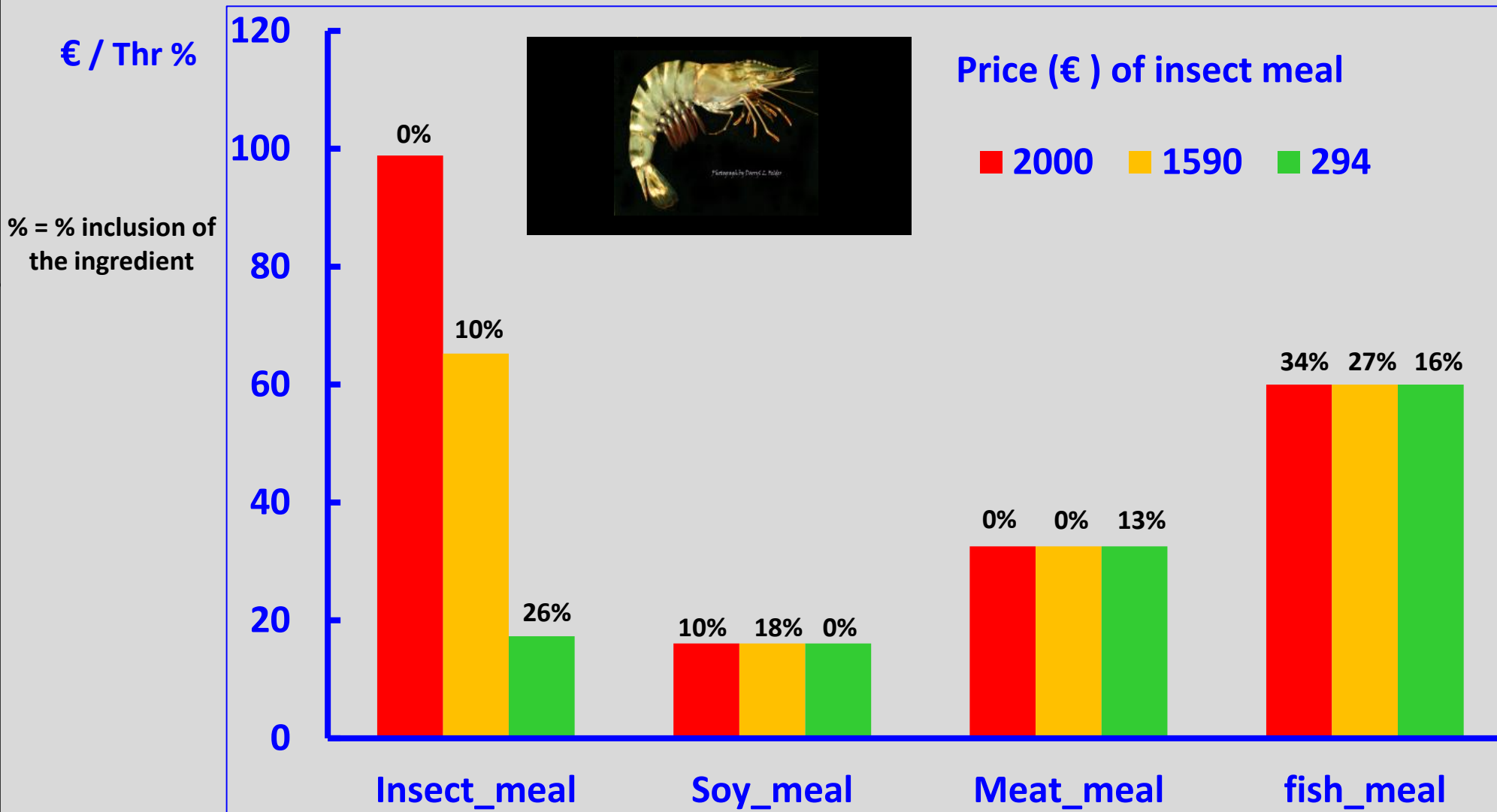
**Inclusion rate of insect meal of Tenebrio molitor according to its price in a feed for shrimp : contribution to secondary saturating constraint 'CrudeProtein'**

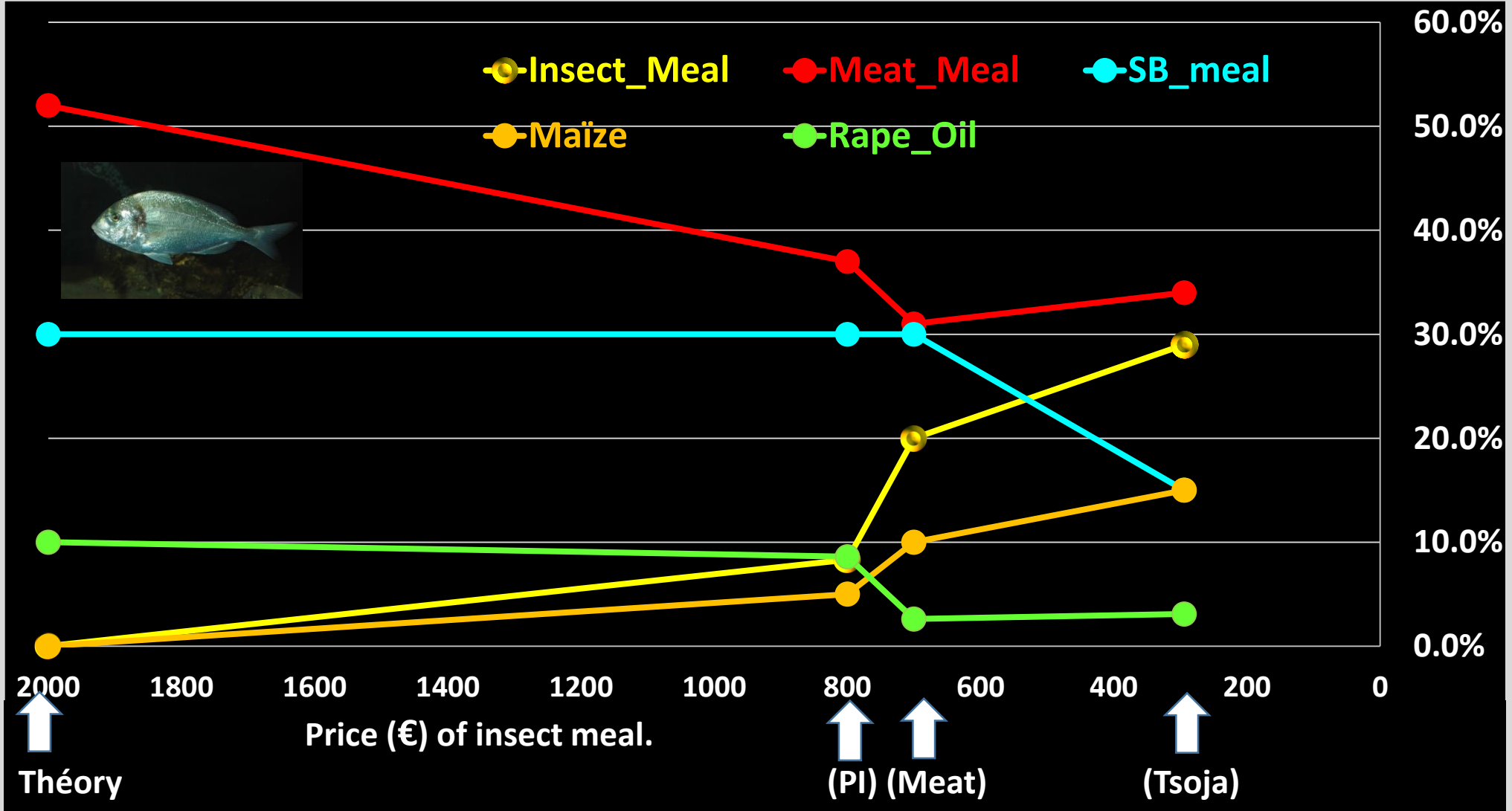Inclusion rate of insect meal of Tenebrio molitor according to its price in a feed for shrimp : contribution to third saturating constraint 'Threonine'

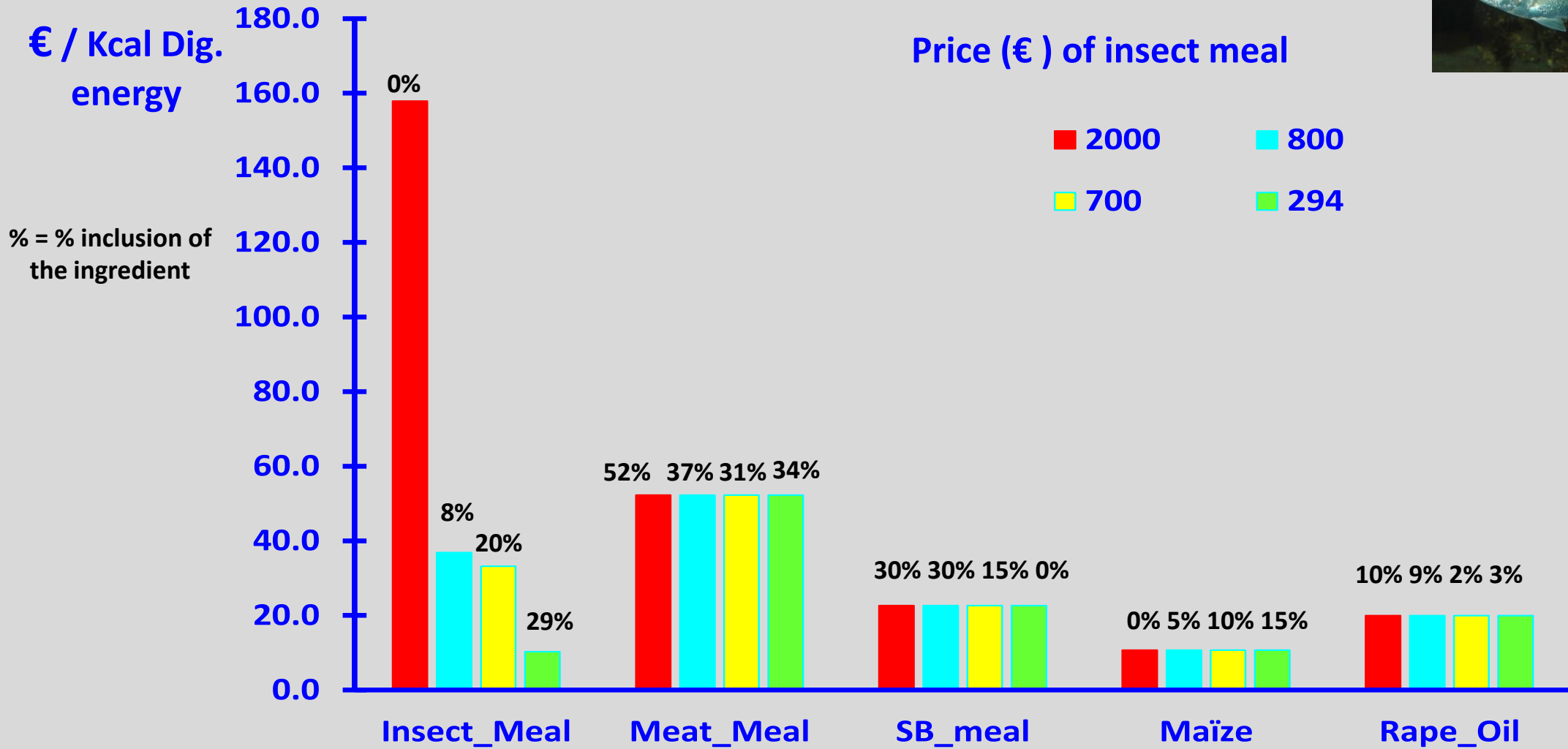# Gilt-head bream (*Sparus* aurata)

# Influence of insect meal from Tenebrio *molitor* on its inclusion rate in a feed for gilt head bream



NRC (2011) recommandations

Inclusion rate of insect meal of Tenebrio molitor according to its price in a feed for gilt head bream: contribution to **primary** saturating constraint 'Digestible Energy'

€ / Kcal Dig. energy

% = % inclusion of the ingredient

Price (€ ) of insect meal

■ 2000  ■ 800
□ 700  ■ 294

Insect_Meal: 0%, 8%, 20%, 29%
Meat_Meal: 52% 37% 31% 34%
SB_meal: 30% 30% 15% 0%
Maïze: 0% 5% 10% 15%
Rape_Oil: 10% 9% 2% 3%

# Inclusion rate of insect meal of Tenebrio molitor according to its price in a feed for gilt head bream: contribution to <u>third</u> saturating constraint 'Met + Cyst'
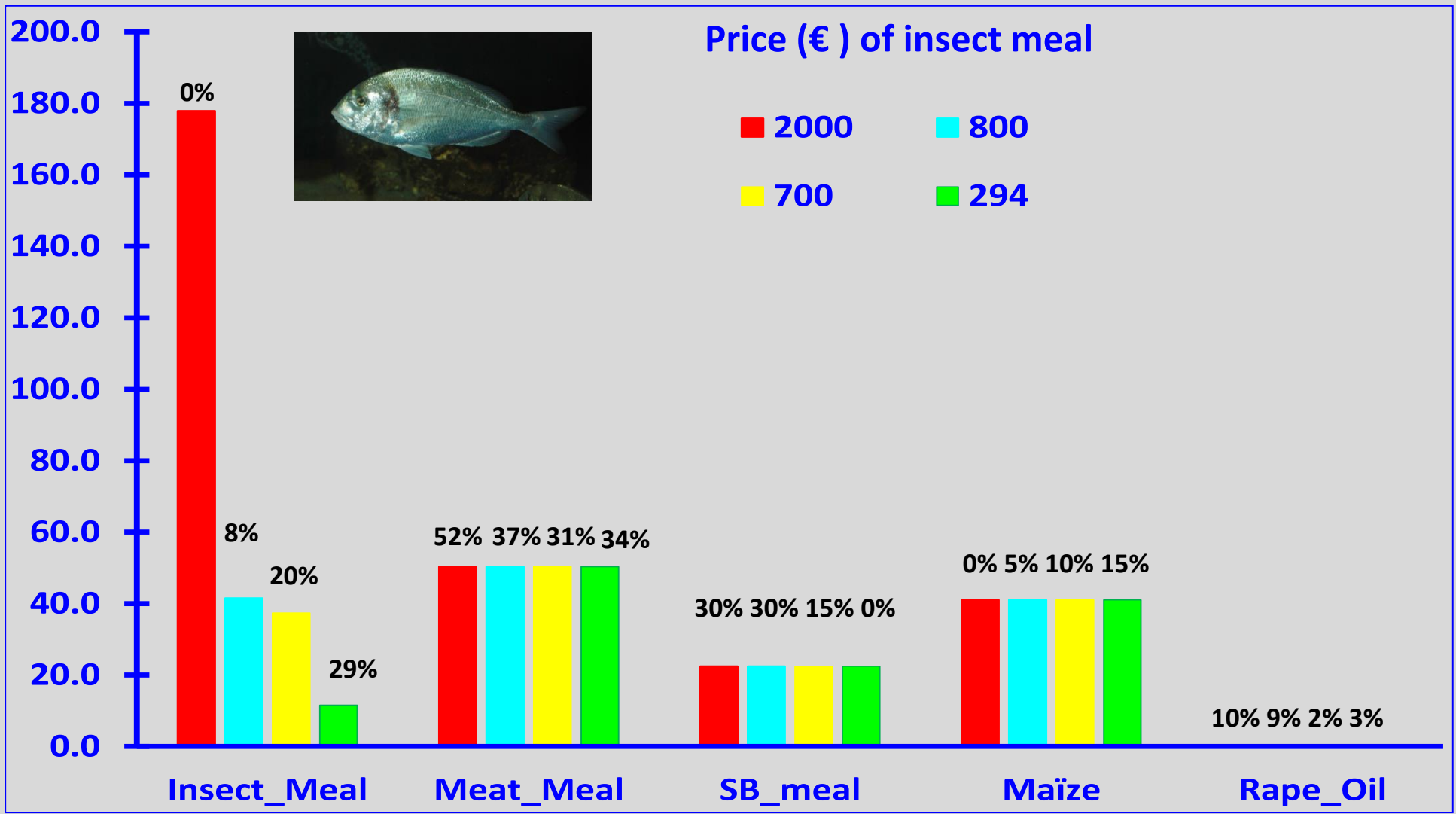
**€ /**
**% Met+Cyst**

**% = % inclusion of the ingredient**

**Price (€ ) of insect meal**

- 🟥 2000
- 🟦 800
- 🟨 700
- 🟩 294

**Insect_Meal:** 0% 8% 20% 29%

**Meat_Meal:** 52% 37% 31% 34%

**SB_meal:** 30% 30% 15% 0%

**Maïze:** 0% 5% 10% 15%

**Rape_Oil:** 10% 9% 2% 3%

# Conclusions on economic opportunity to use insect meal in animal feed

| Insect | Formula | Price (€) | % Inclusion | Variation price |
|--------|---------|-----------|-------------|-----------------|
| *T. Molitor* |  | 2000 / 800-700 / 294 | 0 / 8 – 20 / 29 | 0 / -16 -21 / -36 |
| *T. Molitor* |  | 2000 / 1590 / 294 | 0 / 10 / 27 | 0 / -6 / -27 |

CCL: * very large scale production is needed to decrease the price of insect meal to have a profitability in animal feed(cf. presentations of session 1 )

   * decrease in the price may be obtained by 'added value' to other insect based products (cf. afternoon presentations)

   * what would be the evolution of the european (world) market of feed ingredients (?)