PHYTASE, Xylanase, AND PROTEASE USE IN A WHEAT DDGS AND RAPESEED DIET FOR FINISHER PIGS

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67th Annual Meeting of the European Federation of Animal Science
Introduction

- **Phytase:** ↑ digestibility of phosphorous (P)
- **Carbohydrases:** ↑ digestibility of non-starch polysaccharides (NSP)
- **Protease:** ↑ digestibility of protein

**WHAT IS KNOWN IN PIGS:**
- Well known effect of phytase on P digestibility
- Inconsistent results with carbohydrases
- Protease not included regularly in finisher diets

Interactions between them?
Introduction

Hypothesis

✓ Supplementation of enzymes into by-product (RSM and wheat-DDGS) based diets can improve feed efficiency in finisher pigs

✓ Interactions between phytase, carbohydrase and protease can modify their individual supplementation effect

Objective:

✓ Establish the combination of feed enzymes that optimise feed efficiency in finisher pigs
Material and Methods

• 162 pigs, MaxGrow™ x (LWxLandrace; Hermitage Genetics)
• 81 same sex pen pairs into 9 treatments (n=9 pens/treatment)
• Age: 42 days pw (38.8 ± 2.90 kg)
• Duration: 76 days
• Recordings:
  • Body weight and feed intake 2-3 weeks
    • ADG (g/day), ADFI (g/day), FCR (g/g)
  • Slaughter:
    • Kill out %, carcass weight, fat depth, muscle depth and lean %,
Material and Methods

**DIETARY TREATMENTS:**

1) **Positive control (PC):** exceeds NRC (2012) requirements
2) **Negative control (NC):** basal diet with 5% reduction in energy and amino acid levels
3) **NC + Heat stable phytase**
4) **NC + Xylanase and β-glucanase complex (Xβ)**
5) **NC + protease**
6) **NC + phytase + protease**
7) **NC + phytase + Xβ**
8) **NC + Xβ + protease**
9) **NC + phytase + Xβ + protease**

Phytase (Phyzyme XP, DuPont), Xβ (Rovabio Spiky, Adisseo), Protease (Ronozyme ProAct, DSM)
Material and Methods

<table>
<thead>
<tr>
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<th>T1</th>
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<th>T9</th>
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</thead>
<tbody>
<tr>
<td><strong>Phytase, g/tone</strong></td>
<td>-</td>
<td>-</td>
<td>100</td>
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<td>-</td>
<td>100</td>
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<tr>
<td><strong>Carbohydrase, g/tone</strong></td>
<td>-</td>
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<tr>
<td><strong>Protease, g/tone</strong></td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>200</td>
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<tr>
<td><strong>Net Energy, MJ/kg</strong></td>
<td>9.9</td>
<td>9.4</td>
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<tr>
<td><strong>Av. Lysine, g/kg</strong></td>
<td>0.83</td>
<td>0.79</td>
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<tr>
<td><strong>P:Ca, g/g</strong></td>
<td>0.85</td>
<td>0.85</td>
<td>0.83</td>
<td>0.85</td>
<td>0.85</td>
<td>0.83</td>
<td>0.83</td>
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<tr>
<td><strong>Av. Phosphorus, g/kg</strong></td>
<td>0.30</td>
<td>0.30</td>
<td>0.22</td>
<td>0.30</td>
<td>0.30</td>
<td>0.22</td>
<td>0.30</td>
<td>0.22</td>
<td>0.30</td>
</tr>
<tr>
<td><em>Phytase sparing effect</em></td>
<td>+0.15</td>
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</tbody>
</table>

*Calculated composition

- Diets based on Rapeseed meal (9.6-10%), wheat (30-39%), barley (35-38%) and wheat DDGS (20%)
- Balanced amino acid profile
- Enzymes premixed with 10 kg of wheat
Results

ADG, g/day

ADFI, g/day

FCR, g/g

- T1, Positive control
- T2, Negative control
- T3, NC+Phytase
- T4, NC+Carbohydrase (Xβ)
- T5, NC+Protease
- T6, NC+Phytase+Protease
- T7, NC+Phytase+Xβ
- T8, NC+Xβ+Protease
- T9, NC+Phytase+Xβ+Protease
Results

Effect of diet density on growth performance

ADG, g/day

Positive Control: 1039
Negative Control: 1052
P<0.001

ADFI, g/day

Positive Control: 2650
Negative Control: 2858
P<0.001

FCR, g/g

Positive Control: 2.57
Negative Control: 2.76
P<0.01
Results

Sparing effect of phytase on growth performance

<table>
<thead>
<tr>
<th></th>
<th>Optimum P and Ca</th>
<th>Low P and Ca + Phytase</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADG, g/day</td>
<td>1046</td>
<td>1045</td>
</tr>
<tr>
<td>ADFI, g/day</td>
<td>2766</td>
<td>2742</td>
</tr>
<tr>
<td>FCR, g/g</td>
<td>2.67</td>
<td>2.66</td>
</tr>
</tbody>
</table>
Results

• Effect of Xβ on growth performance

- ADG, g/day
  - CONTROL: 1043
  - + Xβ: 1049

- ADFI, g/day
  - CONTROL: 2750
  - + Xβ: 2758

- FCR, g/g
  - CONTROL: 2.68
  - + Xβ: 2.66
Results

Effect of protease on growth performance

Interaction between protease effect and sex

<table>
<thead>
<tr>
<th></th>
<th>ADG, g/day</th>
<th>ADFI, g/day</th>
<th>FCR, g/g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1049</td>
<td>2757</td>
<td>2.67</td>
</tr>
<tr>
<td>+ Protease</td>
<td>1043</td>
<td>2751</td>
<td>2.66</td>
</tr>
</tbody>
</table>

Control | + Protease
Effect of protease on growth performance

- **ADG, g/day**
  - Control: 1001
  - + Protease: 994

- **ADFI, g/day**
  - Control: 2711
  - + Protease: 2770

- **FCR, g/g**
  - Control: 2.75
  - + Protease: 2.82

- **ADG, g/day**
  - Control: 1096
  - + Protease: 1092

- **ADFI, g/day**
  - Control: 2802
  - + Protease: 2732

- **FCR, g/g**
  - Control: 2.59
  - + Protease: 2.49

*1st September 2016 Belfast, 67th EAAP Meeting*
Results – Carcass parameters

- Fat, mm
- Muscle, mm
- Lean, %
- KO, %
- Cold weight, kg

N. S.

- T1, Positive control
- T2, Negative control
- T3, NC+Phytase
- T4, NC+Carbohydrase (Xβ)
- T5, NC+Protease
- T6, NC+Phytase +Protease
- T7, NC+Phytase+Xβ
- T8, NC+Xyl+Protease
- T9, NC+Phytase+Xβ+Protease

1st September 2016
Belfast, 67th EAAP Meeting
Conclusions

• ↓ 5% in energy and AA on a commercial Irish diet might not be sufficient to see the potential of feed enzymes

• **Phytase:** the sparing effect for P and Ca was effective

• **Xylanase and β-glucanase complex:** did not improve FCR

• **Protease:** has potential to improve feed efficiency in males

• Excellent performance without soya

  • Sister trial presented at Session 03 (M.M.E. Ball *et al.*)
Acknowledgements

• ECO-FCE project (7th FP-EU) & partners

• Teagasc Walsh fellowship programme

• Co-workers from the Teagasc pig department & IRTA & WIT

Thank you
EFFICIENT & ECOLOGICALLY-FRIENDLY PIG AND POULTRY PRODUCTION.

A WHOLE-SYSTEMS APPROACH TO OPTIMISING FEED EFFICIENCY AND REDUCING THE ECOLOGICAL FOOTPRINT OF MONOGASTRICS.

BASIC DATA

Funding:
EU-FP7
(€ 6 million)

Start date:
1 February 2013

Duration:
48 months
(2013 to 2017)