

# Feeding the Danish Pig Production

By Per Tybirk, SEGES Innovation

Teams meeting, Ministry of Foreign Affairs of  
Denmark, 18-03-2024

STØTTET AF

**Svine**afgiftsfonden

**SEGES**  
INNOVATION

# My Background

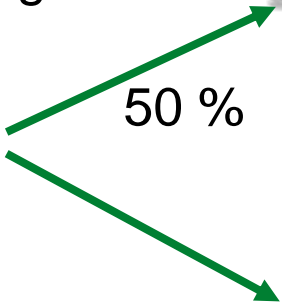
- At SEGES, Innovation more than 30 years (different names)
- Main responsibilities now:
  - Chairman Pig Nutrition Recommendation Board
  - Feed evaluation systems for pig feed in Denmark
  - Connection between feed and environment
    - Protein, phosphorus and environmental regulation
  - Danish Standards for nutrients in slurry – and equations for individual calculations – including finding data!
  - Ammonia emission calculation and regulation – ammonia agreement pig feed
  - Feed and climate impact

# Danish Pig Production, numbers, 2023

925.000 sows



30 million piglets 30 kg



Denmark  
115 kg



Germany.  
Polen etc

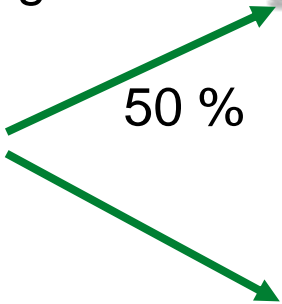


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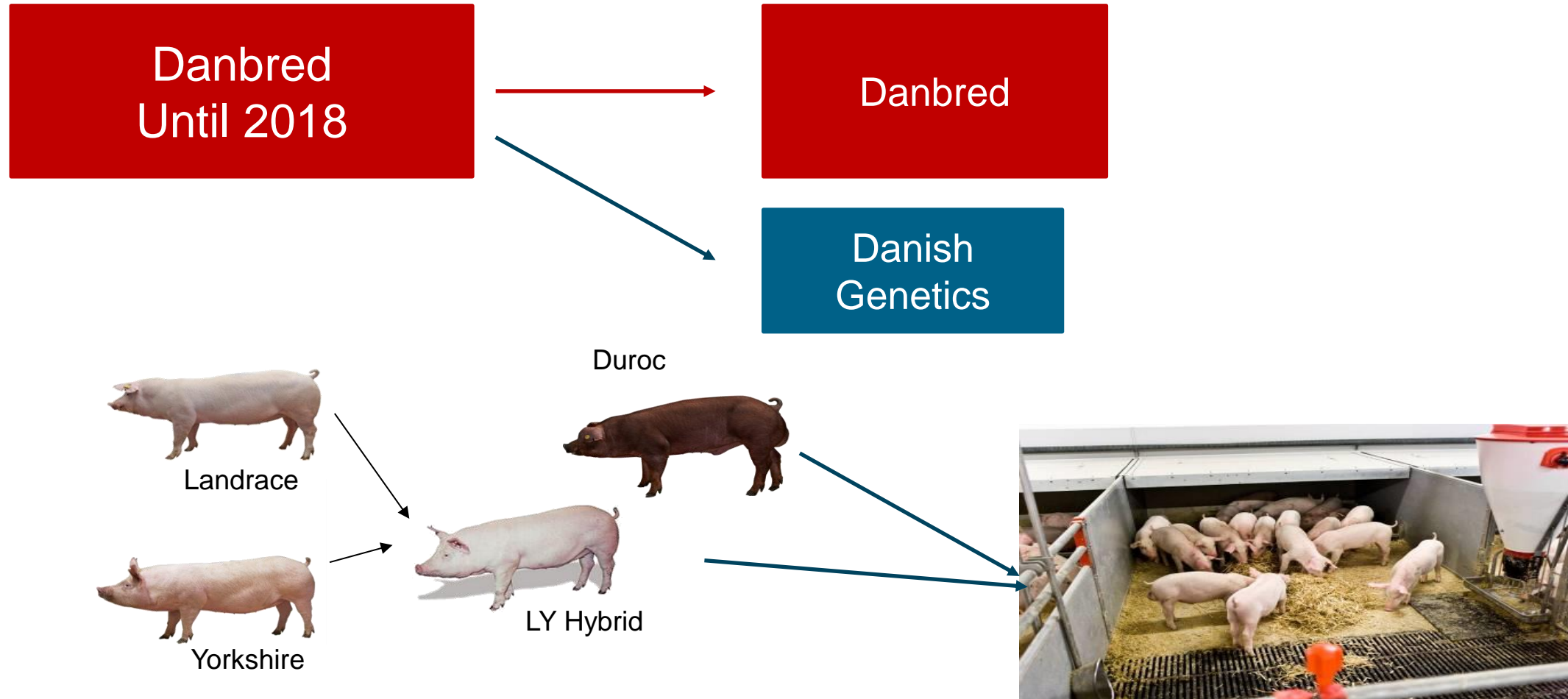


Germany.  
Polen etc



Sows reduced 10% i 2023 from many years around 1,03 million sows  
Pigs slaughtered in Denmark lowest in more than 30 years – export of 30 kg piglets stable

# Danish pigs are > 95% from Danish farmer owned breeding companies



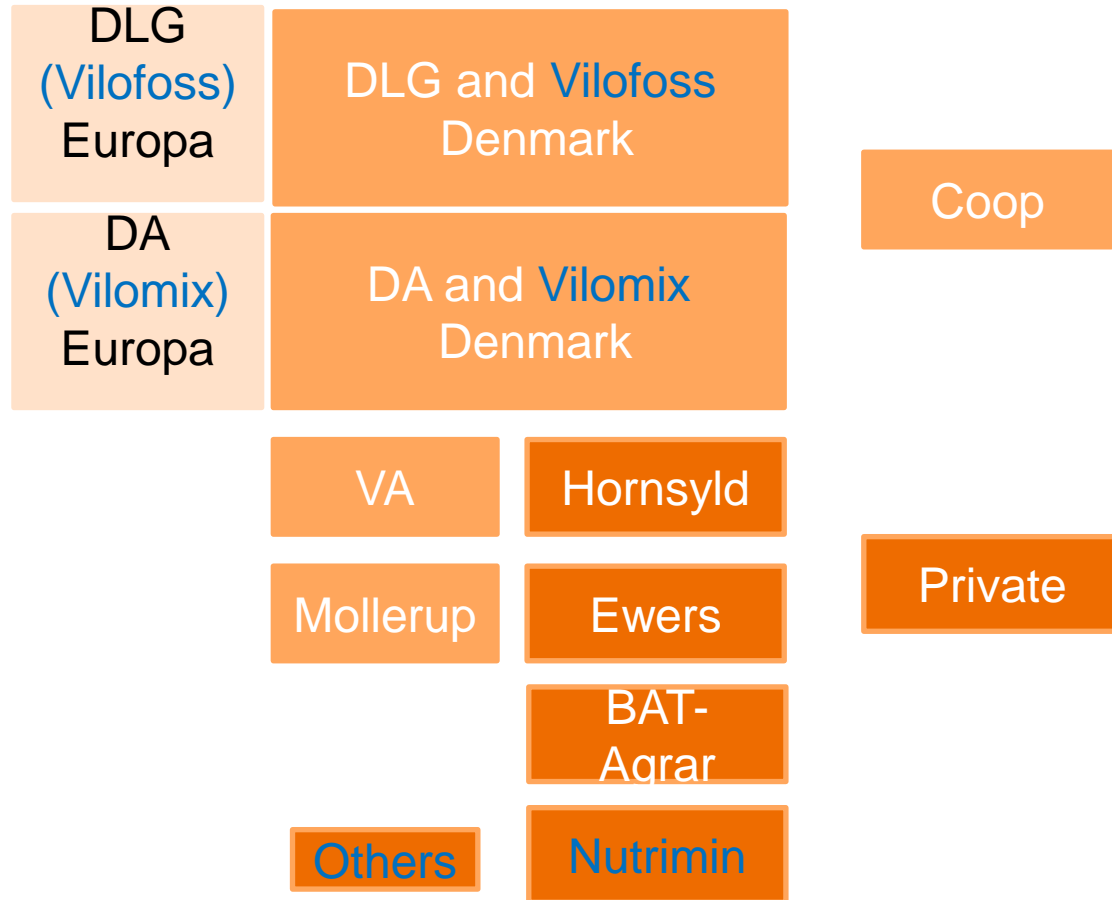
# Development in efficiency, national average

Genetics !! – but also feed and management

	2002	2007	2012	2017	2022
Weaned piglets per sow per year	24,1	26,5	29,6	33,6	34,1
Daily gain, piglet	420	440	442	451	465
FU per kg gain, piglet	2,0	2,02	1,95	1,87	1,77
Kg feed per kg gain, piglet	1,82	1,84	1,77	1,70	1,61
Daily gain, 30-115 kg	843	890	907	969	1040
FU per kg gain, 30-115 kg	2,96	2,91	2,91	2,77	2,65
Meat %	60,0	60,3	60,4	60,7	62,5

# Participants in Danish Pig Production

Feed Industry, 60% to home mixing



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DLG  
(Vilofoss)  
Europa

DLG and Vilofoss  
Denmark

DA  
(Vilomix)  
Europa

DA and Vilomix  
Denmark

Coop

VA

Hornsyld

Mollerup

Ewers

Private

BAT-  
Agrar

Others

Nutrimin

Meat

Danish Crown

TICAN

Others



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Danish  
Agriculture and  
Food Council  
(Politics)

Local farmer  
organisations

Local advisory service

SEGES Innovation

Aarhus University  
Copenhagen University

Meat

Danish Crown

TICAN

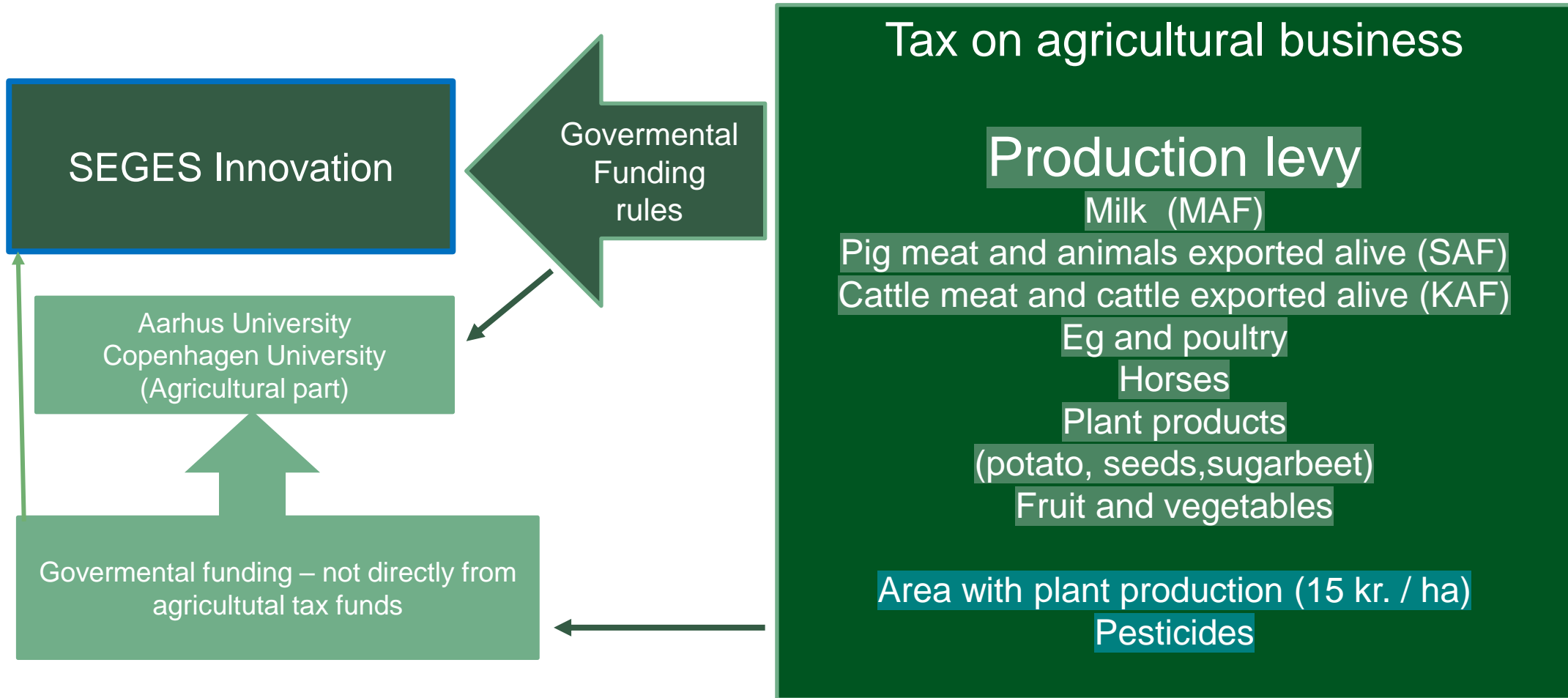
Others

Pig research

DanBred

Danish Genetics

# Funding agricultural research



# Nutritional recommendation board

- first publication in 1991

- SEGES Innovation updates nutritional recommendations every year
  - SEGES Innovation initiates changes - when new data from experiments
  - Goal: economic optimum recommendations – but including health (diarrhea) and environmental viewpoints
- Board members:
  - SEGES Innovation (I am Chairman)
  - Aarhus and Copenhagen University
  - 3 lokal feed advisors (Selected by Advisors working with nutrition)
  - Repræsentatives from all mentioned feed companies earlier slide
- This means good acceptance of recommendations – and > 95% follows

# Special Danish in feed evaluation

- Energy evaluation – all use the same system
  - Energy is Physiological available energy (close to net energy in practise)
  - Based on simple analyses and two in vitro digestibilities – working in practise!
  - < 200 € for energy determination in nearly all feed samples
  - We can control declarations for energy (Only in Denmark)

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  - < 200 € for energy determination in nearly all feed samples
  - We can control declarations for energy (Only in Denmark)
- Protein evaluation
  - We use tables values – but correction for analysed digestibility for grain
- Phosphorus evaluation – with increasing phytase dose
  - Special Danish Benchmarking system – FTU dose to 100% effekt
  - Other countrys look in our table for this evaluation
  - All phytase products are implemented in the same evaluation system
  - Feed companies goes for lowest price for 100% dosis

## Feed and medical regulation

- Yellow card for too much medicine compared to average and goal
  - Diarrhea for piglets after weaning is the main problem
- Ban on growth promoters > 20 years ago (Denmark first, then EU)
- Ban on medical zinc from June 2022 after weaning (medical = 1500-3000 ppm)
  - Now max 150 ppm piglets (120 added)
  - Now max 120 ppm from 12 weeks (30 kg)

## Fokus in our most recent feed research

- Feed for piglets without medical zinc and medication
  - Low, lower and very low protein levels
  - Inverse phase feeding
  - "Overdosing" free amino acids
- Economic optimal protein and amino acid level for growing finishing pigs as their genetic capacity improves
  - Big experiment with 7 levels of protein combined with 5 levels of amino acid addition
- Lowering of phosphorus by use of phytase
  - How low can we go using high doses of phytase
- Feeding with lower climatic impact

### 3 important piglets experiments

Recommendations are based on large experiments!

- Danish recommendations for amino acids in diets for piglets
  - Low protein and modified amino acid profiles !
- Experiment 1: inverse fase feeding
  - 13 years old very principal experiment
- Experiment 2: addition of 4 amino acids to low protein diets
  - Effect on productivity
- Experiment 3: addition of 5 amino acids to 4 levels of protein
  - Effect on productivity
  - Effect on treatments against diarrhea

5.367 piglets 7-30 kg

28,000 piglets 7-30 kg

6,600 piglets 7-30 kg

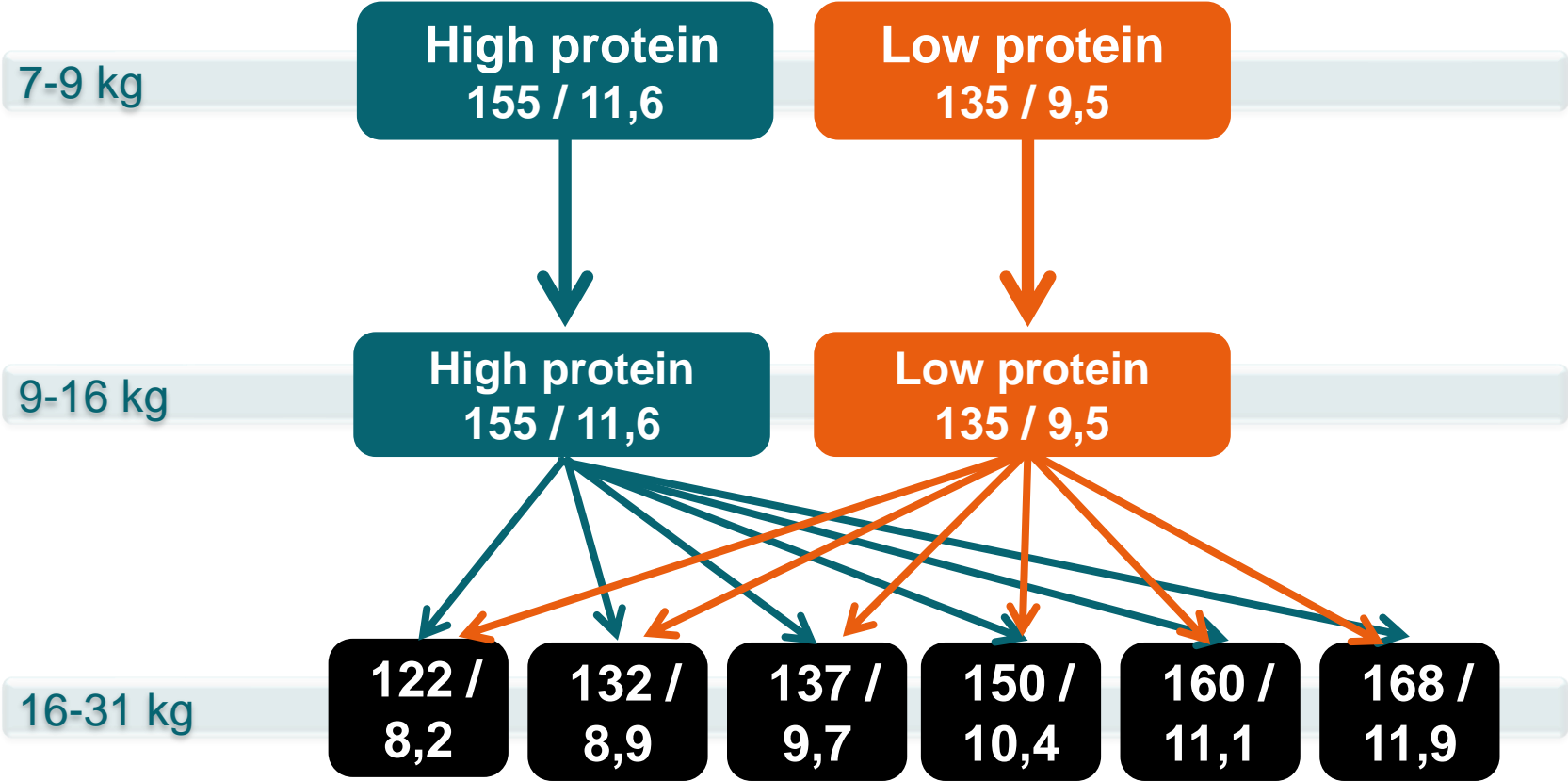


# Idealprotein for piglets – and inverse fase feeding

Pct. of lysine	2011 experiment
Methionine	32
Methionine+Cystine	54
Treonine	61
Tryptofane	22
Isoleucine	58
Leucine	102
Histidine	34
Fenylalanine	57
Fenyl.+Tyrosine	111
Valine	67

# Ideal protein for piglets, design

Level of st. dig. protein og st. dig. lysine (g pr. FU)



# Ideal protein for piglets

240 pens and 2700 piglets / mixture before 16 kg

From 7 to 16 kg	High PROTEIN	Low PROTEIN	difference
St. d. protein, g / FUgp	155	136	
St. d. lysine, g / FUgp	11,2	9,5	
Daily gain, gram	353 <sup>a</sup>	316 <sup>b</sup>	- 10 %
FU / kg gain.	1,58 <sup>a</sup>	1,70 <sup>b</sup>	+ 8 %
Feed intake, FU / day	0,55	0,53	- 4 %
<b>Days of treatment per piglet (out of 25 dage from 7 til 16 kg)</b>	<b>1,6</b>	<b>0,5</b>	<b>- 69 %</b>

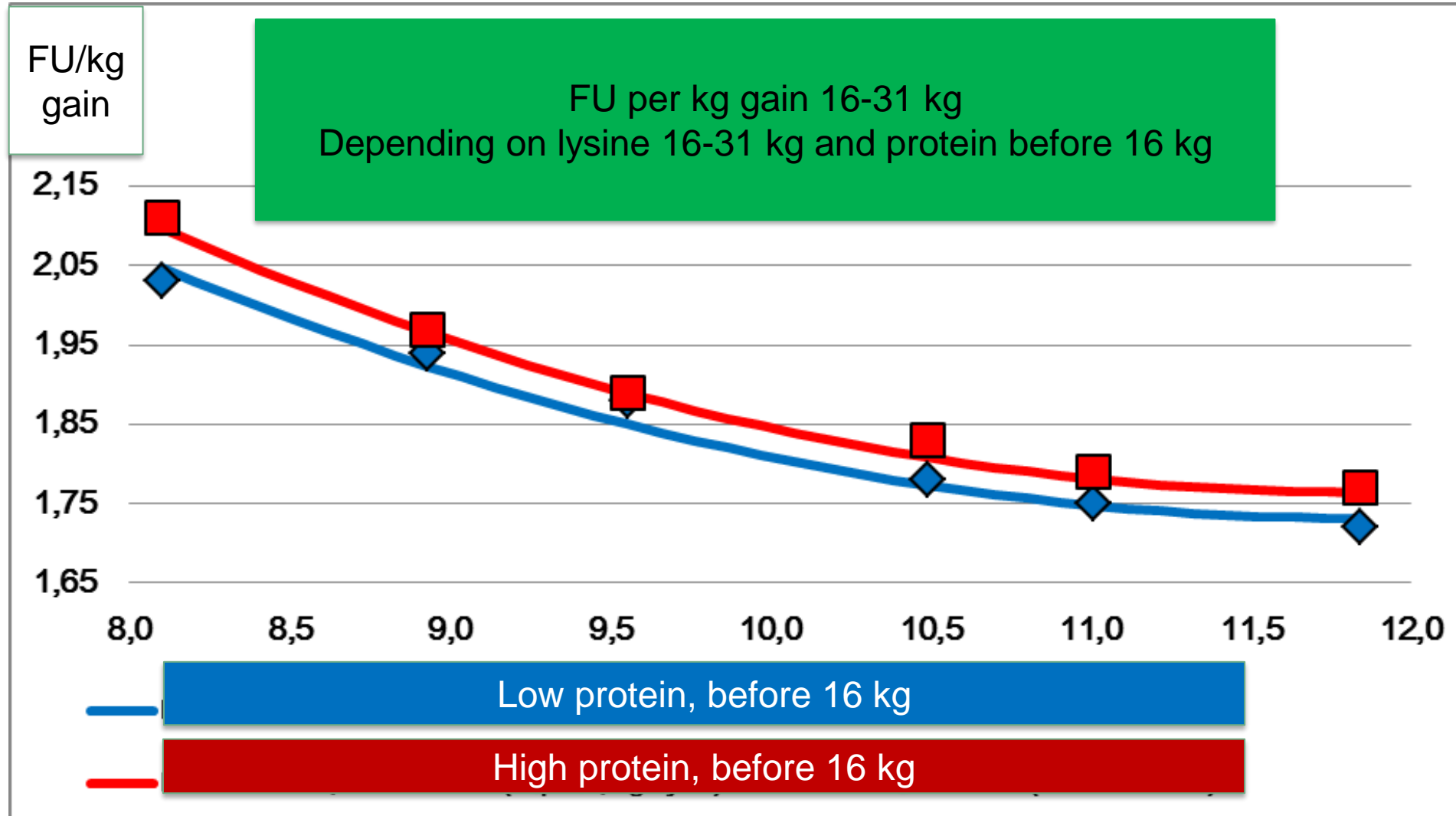
# Idealprotein for piglets 16-31 kg

treatments against diarrhea (80 pens and 900 piglets / group)

Gruppe	1	2	3	4	5	6
Dig. protein, g/FU from 16 kg	122	132	137	150	160	168
Dig. lysine, g/FU from 16 kg	8,2	8,9	9,7	10,4	11,1	11,9
Days in treatment for diarrh�a, 16-31 kg						
Low protein before 16 kg	0,3	0,4	0,3	0,4	0,6	0,9
High protein before 16 kg	0,2	0,4	0,4	0,5	0,6	0,7
All together	<b>0,3 a</b>	<b>0,4 ab</b>	<b>0,3 ab</b>	<b>0,4 ab</b>	<b>0,6 ab</b>	<b>0,8 b</b>

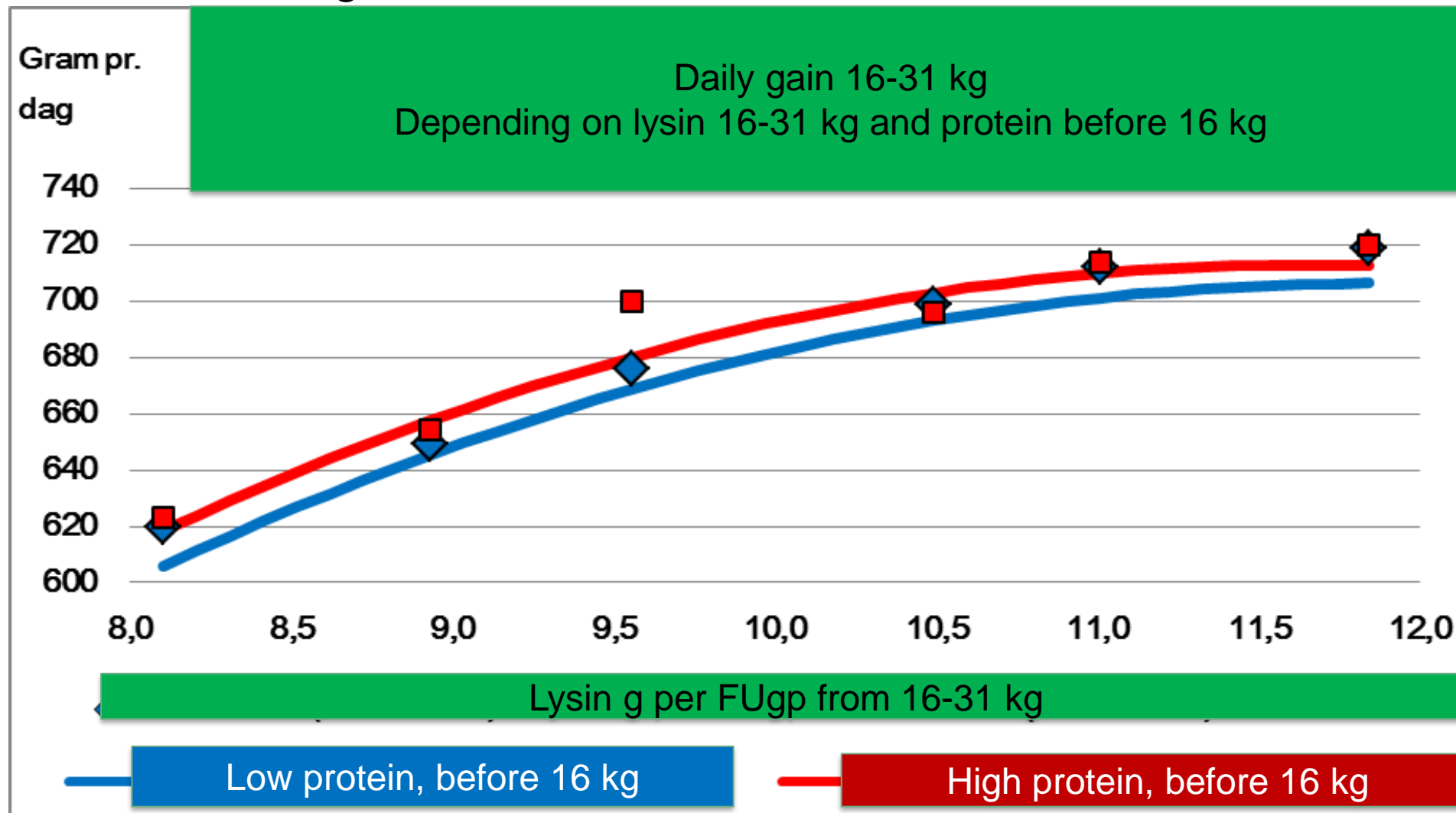
# Ideal protein for piglets

Results 16-31 kg

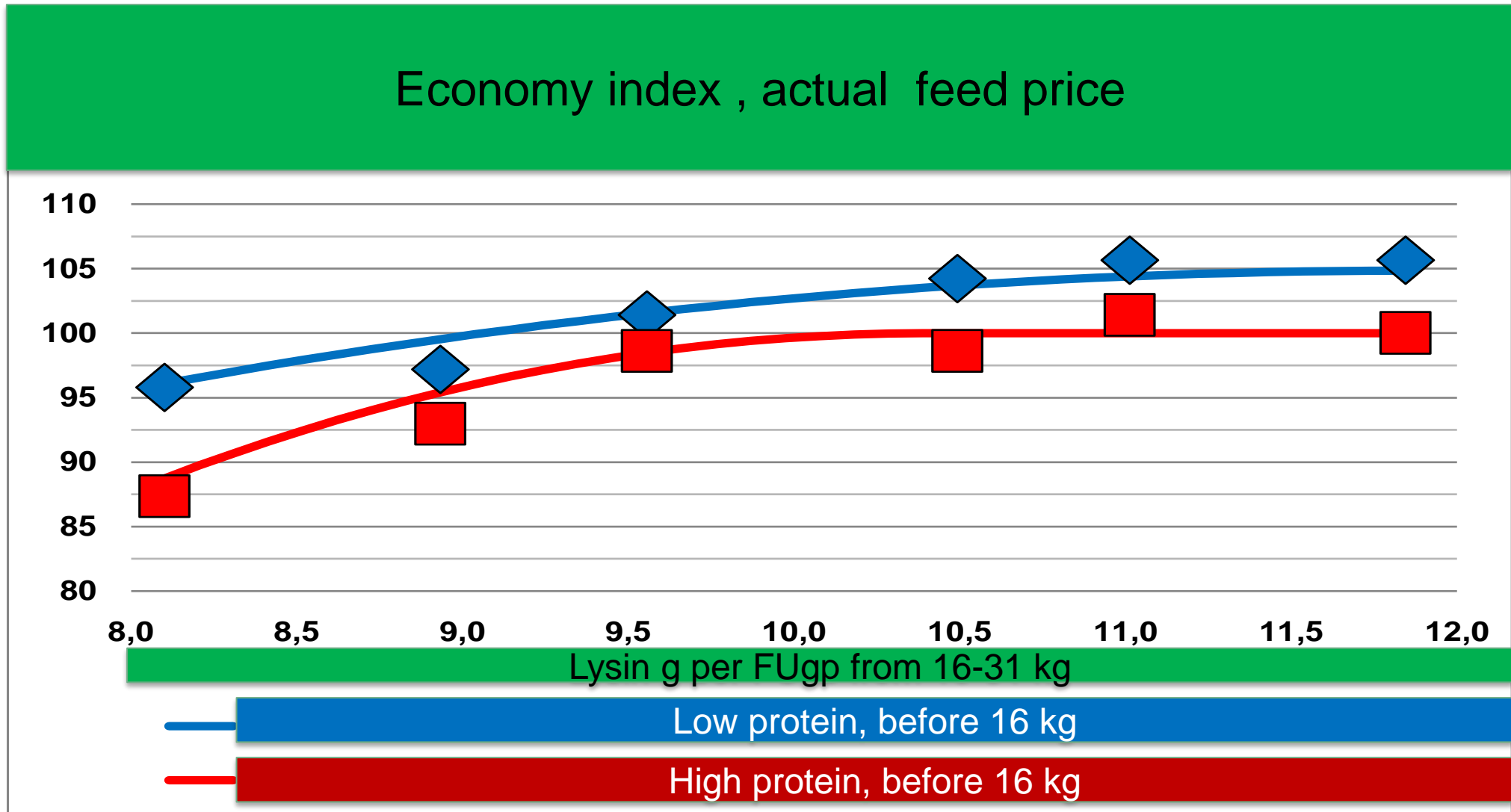


# Ideal protein for piglets

Results 16-31 kg



# Ideal protein for piglets, actual prices 2011

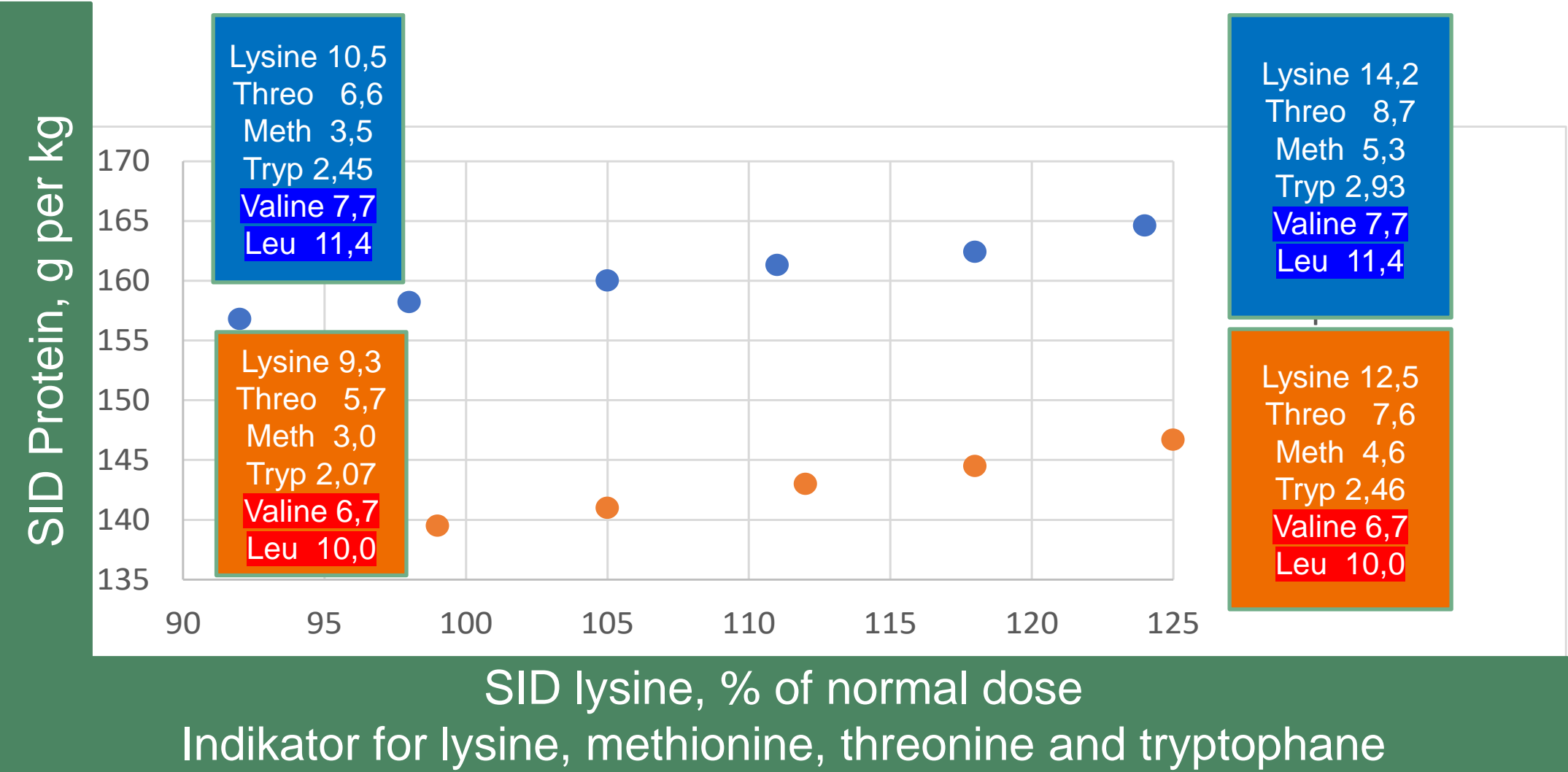


## Experiment 2 – increasing levels of 4 amino acids

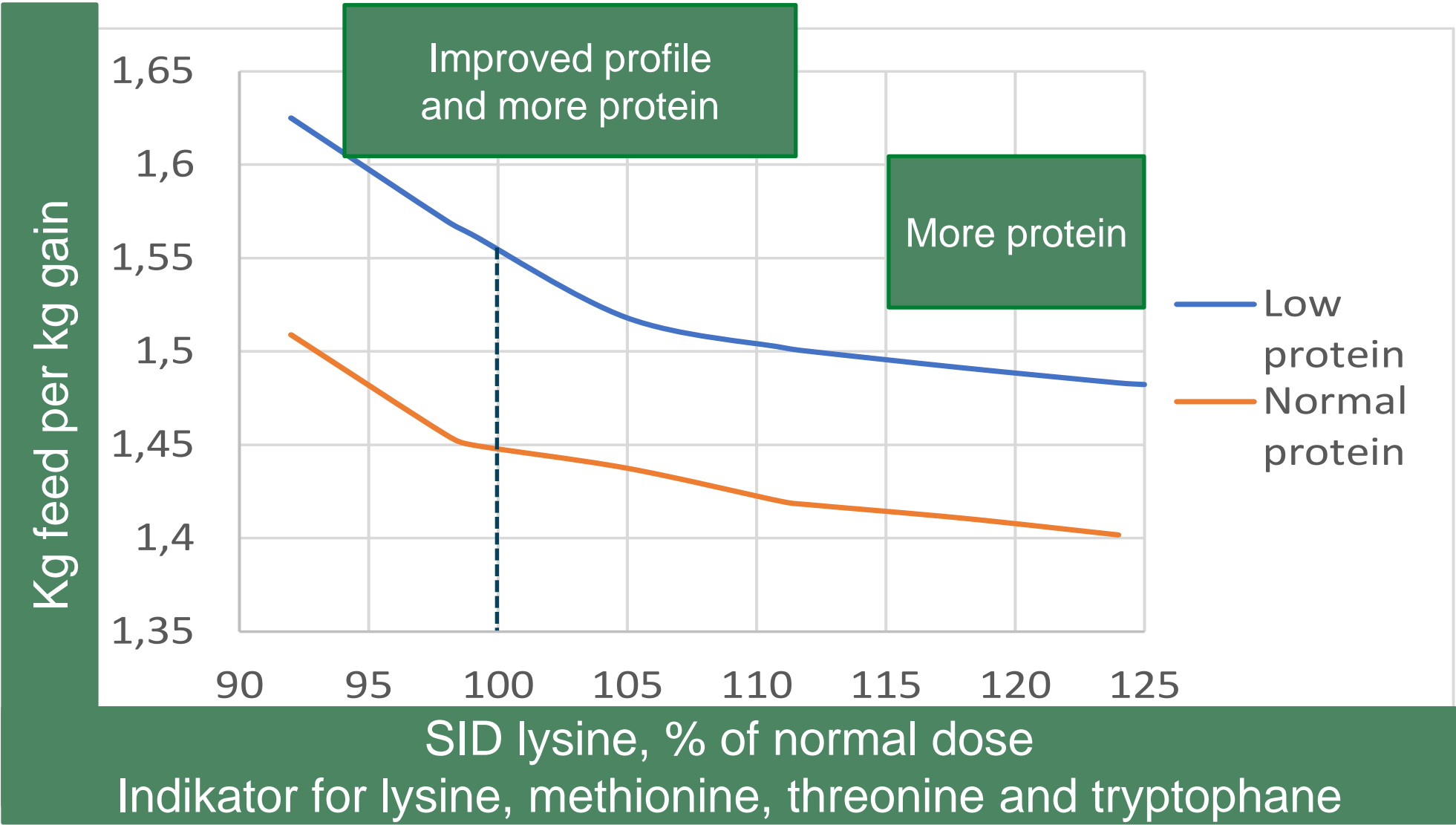
- 2 levels of protein
- 6 levels of lysine, threonine, methionine and tryptophane
- Levels as percent of earlier "ideal profile"
  
- Lysine, % of normal is an indicator for level of added 4 amino acids



# Design experiment 2. ● = 1300 piglets



# Exp. 2. Effect of increasing dose of 4 amino acids



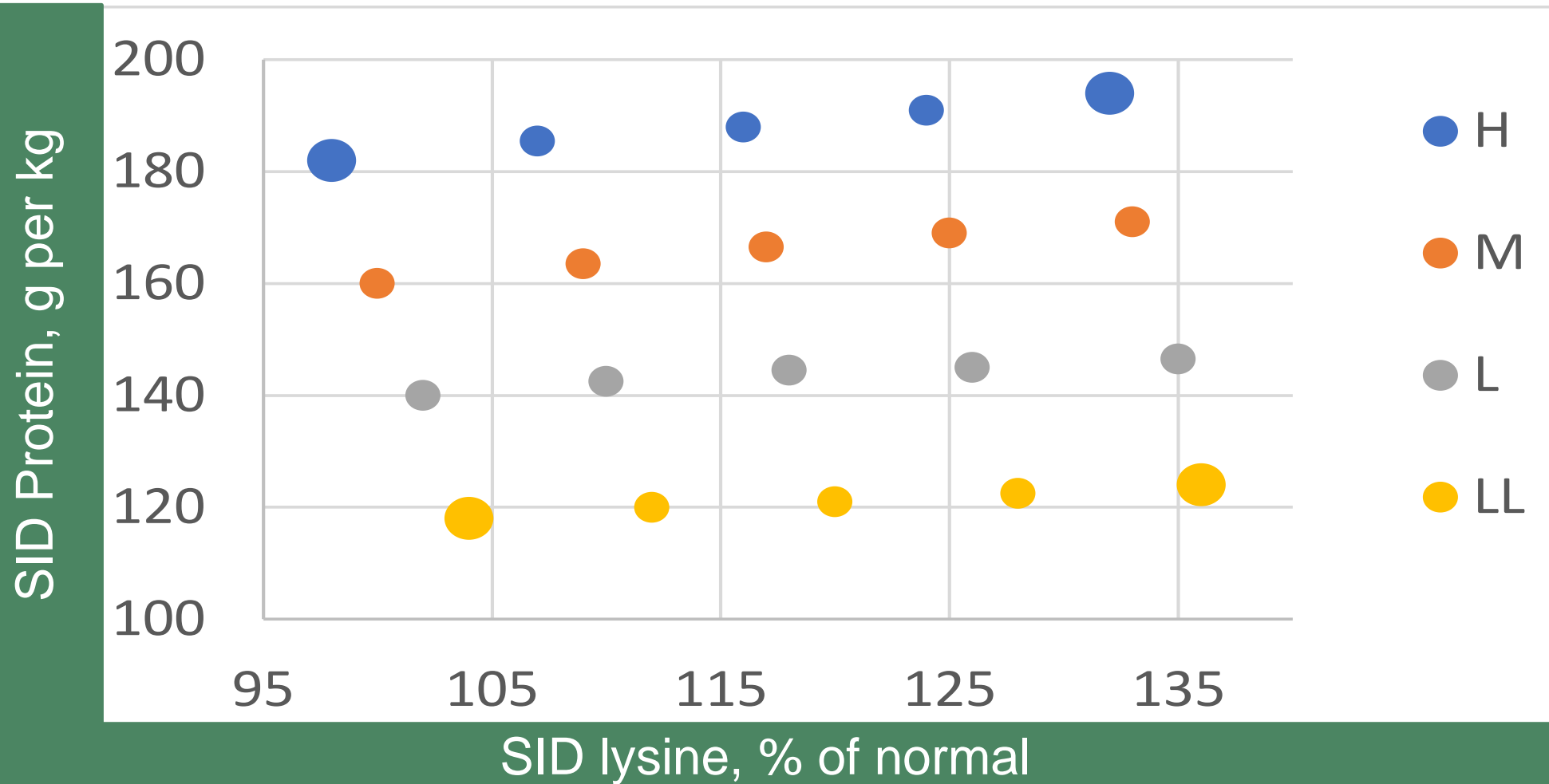
## Experiment 3

- 4 levels of protein

H = High  
M = medium  
L = low  
LL = very low

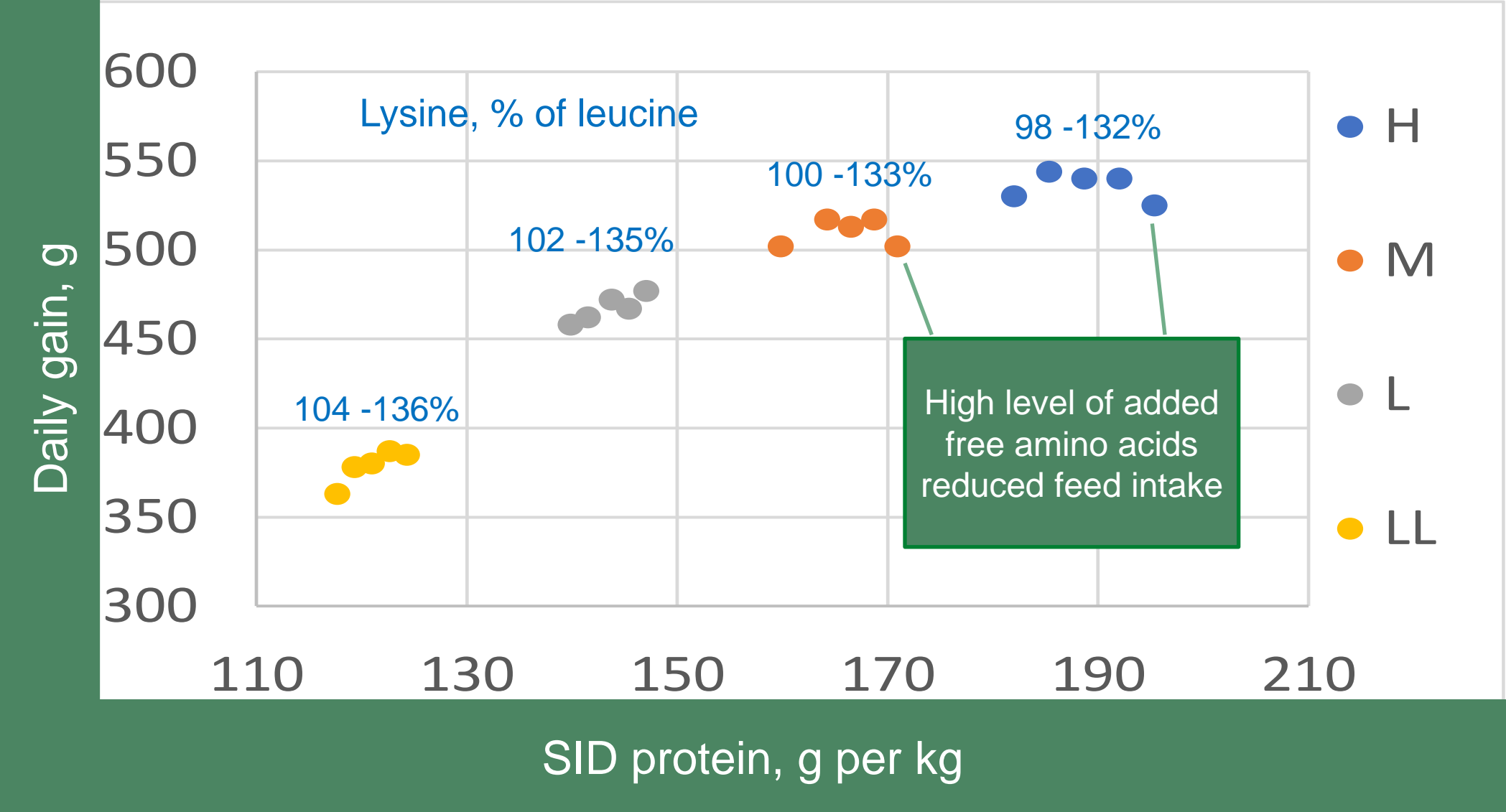
- 5 levels of added amino acids
  - Including lysine, methionine, treonine, tryptofane and valine
- Lysine , % of normal is an indikator of level of all 5 amino acids compared to traditional "profile"

# Experiment 3, design. A ● is 23 pens of 12 = 276 piglets

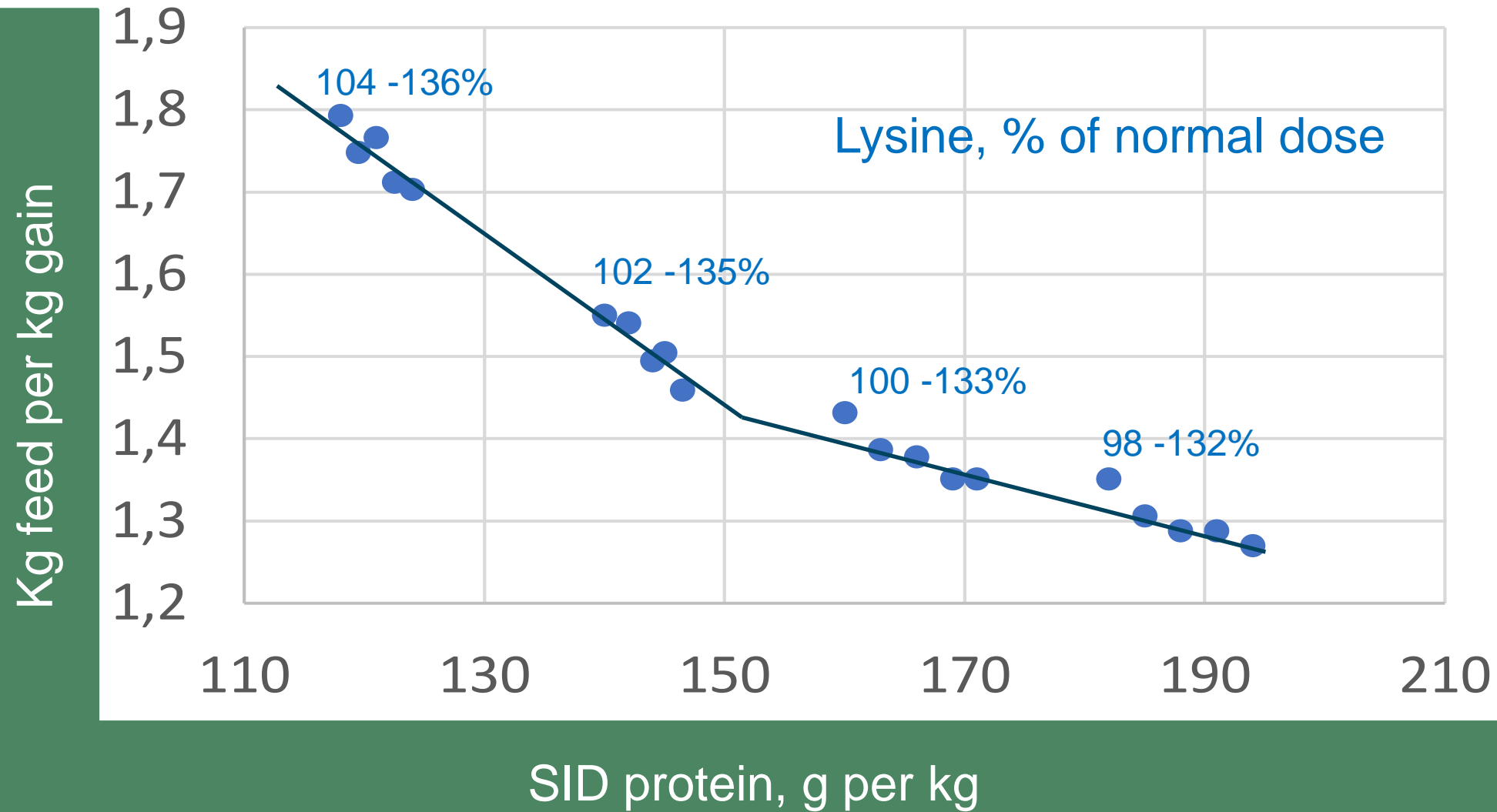


Indikator for lysine, methinine, threonine, tryptophane and valine

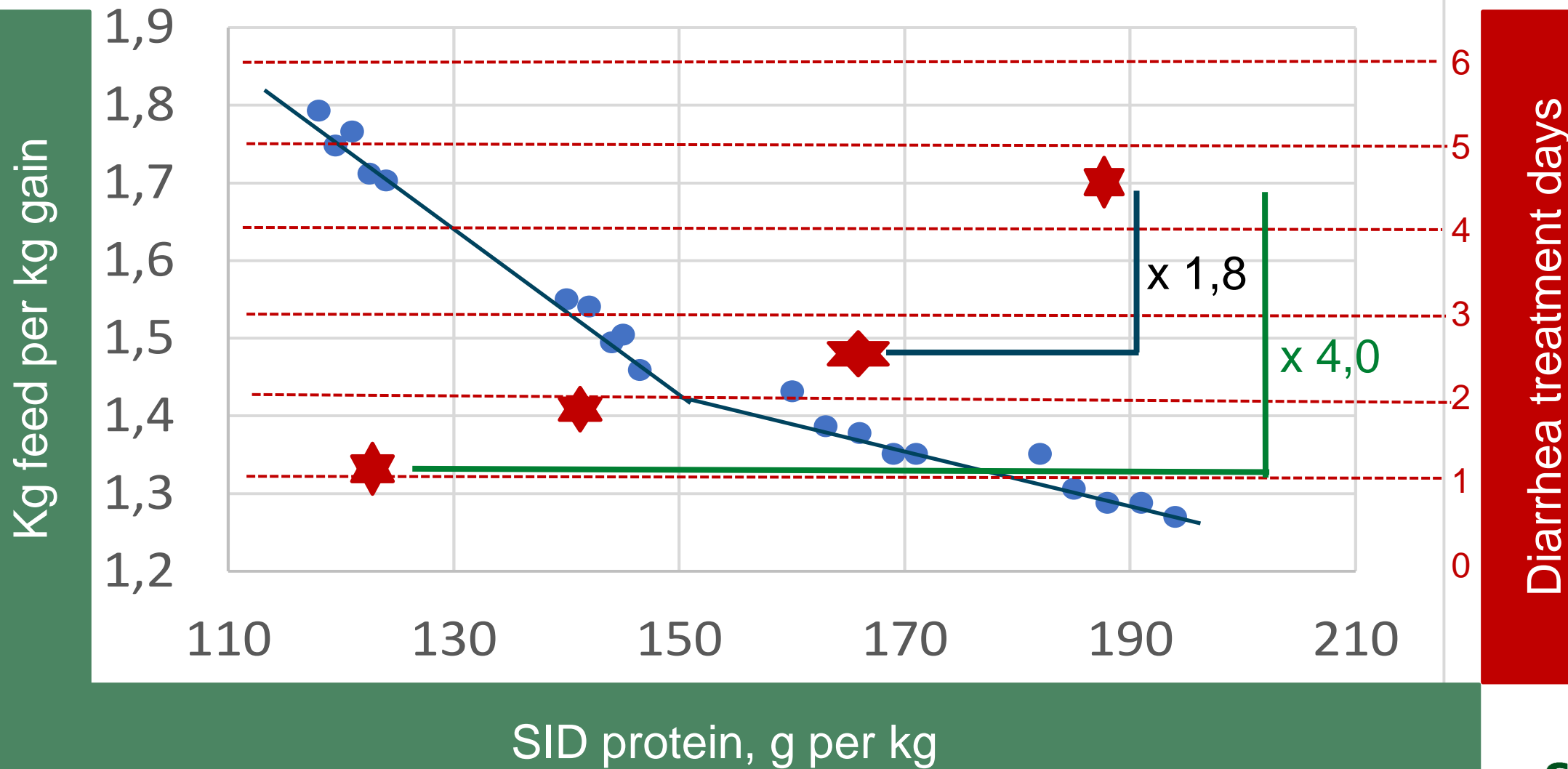
# Daily gain, experiment 3



# Feed conversion as function of digestible protein, exp. 3

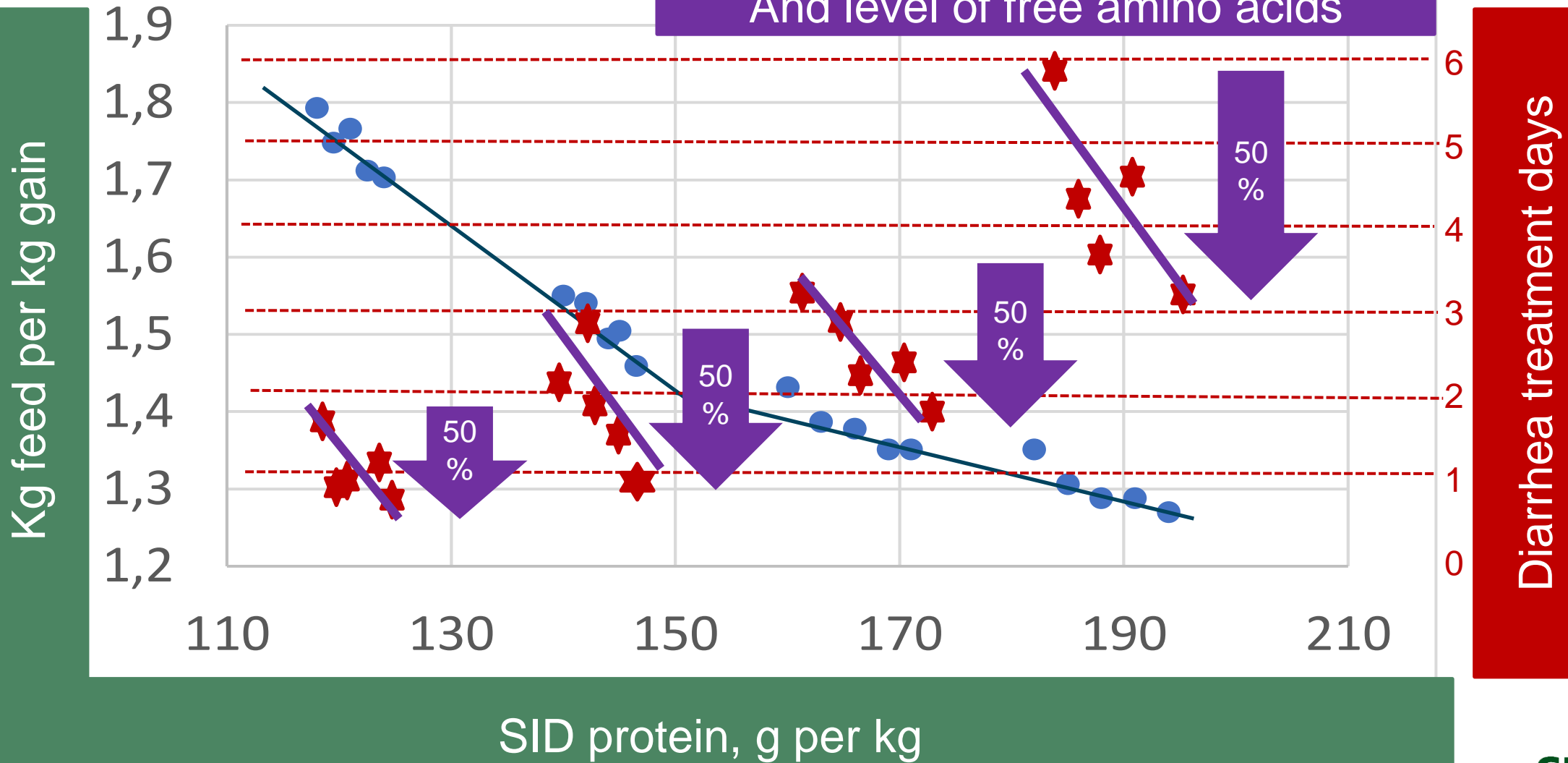


# Feed conversion + diarrhea as funktion of digestible protein, exp. 3



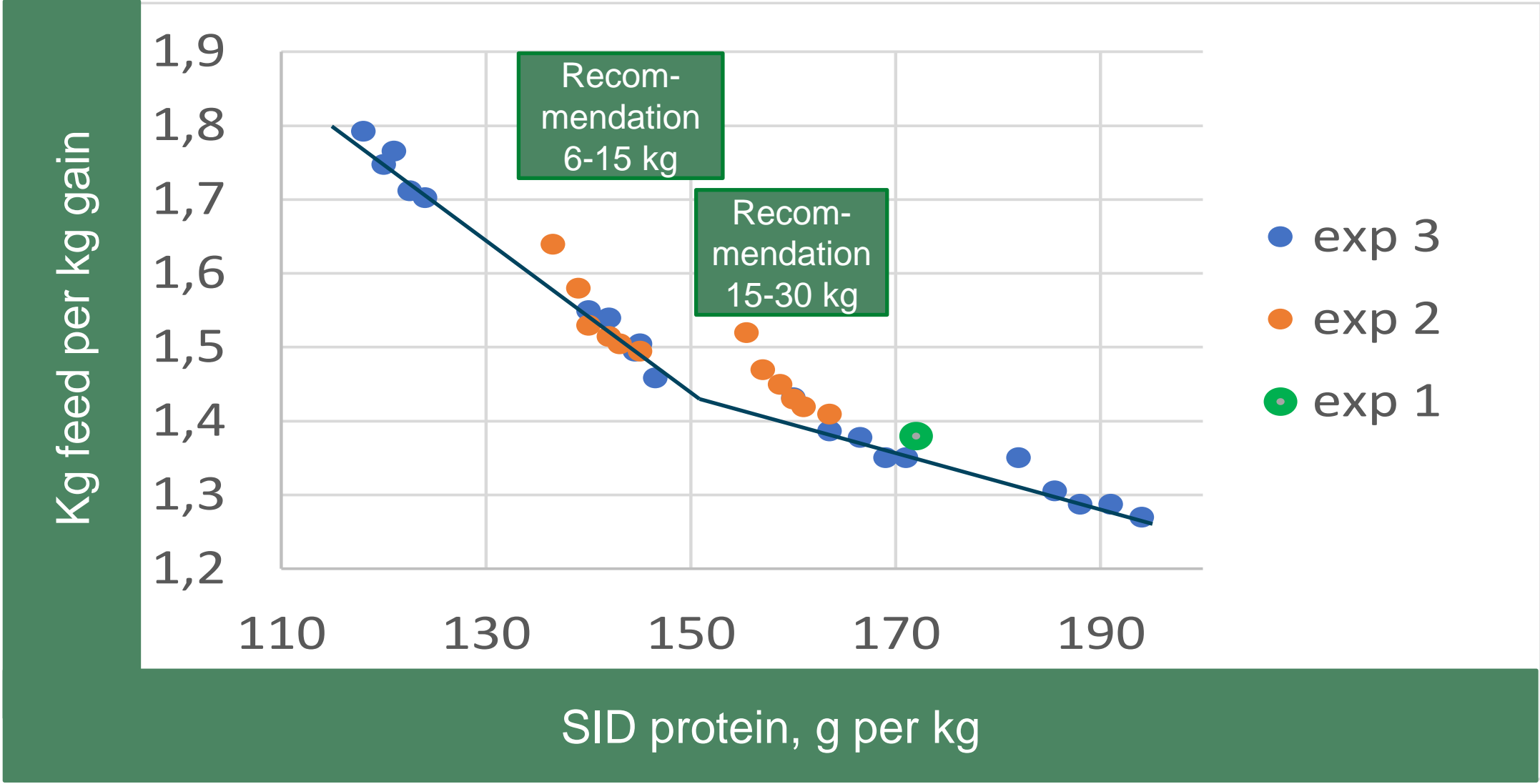
# Feed conversion + diarrhea as funktion of digestible protein

And level of free amino acids





# Feed conversion 3 newest experiments



## Main conclusions – piglet experiments

- More protein improves growth and feed conversion
  - But increases diarrhea treatments
- Adding 5 amino acids 35% above normal
  - Improved daily gain and feed conversion - at all protein levels
  - 50% reduction in diarrhea treatments - at all protein levels
  - At least same effect as 2500 ppm zinc in Danish experiments
- To consider
  - 35% extra amino acids are expensive
  - > 20% extra amino acids = lower feed intake at the higher protein levels
  - Danish recommendations are 10-15% ekstra amino acids added - compared to international recommendations

# Take home messages

- Danish pig production is 70-90% farmer owned
  - Feed industry, slaughter house, advisory service, breeding, and Danish food and Agriculture board
- Good coordination and use of same system
  - Feed calculations systems
  - Recommendations
- Goal recommendation: economy and low environmental impact and low use of antibiotics (less resistant bacteria)
- Feed recommendations are based on big experiments with DanBred pigs