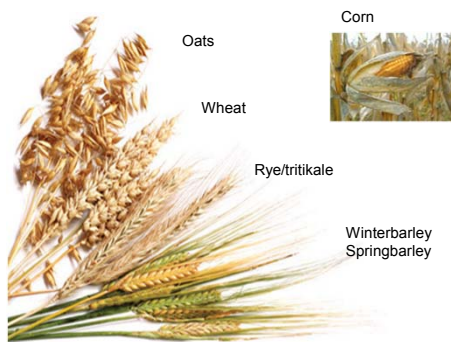




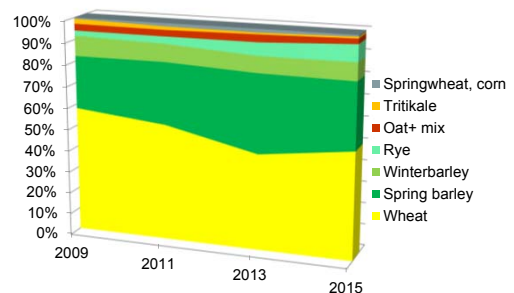
AGENDA

- Grain production in Denmark
- Import of oilseedmeal
- Typical feed composition
- Selfsufficiency typical pig farm, homemixing
- Where does protein and lysine come from in typical feed
- Could we increase selfsufficiency of protein in Danish pig feed
- Rye and fabia beans

GRAIN IN DENMARK



GRAIN HARVESTED, % OF WEIGHT IN DENMARK



DANISH HARVEST 2015

- Production of grain in Denmark, 2015
 - Total : 10.023.000 ton
 - Wheat: 5.029.000 ton
 - For feed (>95%) and bread (< 5%)
 - Barley : 3.806.000 ton
 - For feed (75% ?) and beer (25% ?)
- Production of rapeseed
 - 826.000 ton = 8,3 % of grain production
 - 30% rapeseed oil, 70% rapeseed meal
- Production of legumes
 - 51.400 ton
 - Peas 21.000 ton = 0,2 % of grain production
 - Fabia Beans = 30.000 ton ? (0,3% of grain)

CONSUMPTION OF PROTEINRICH, DANMARKS STATISTIK



NUTRIENT IN GRAIN AND PROTEINRICH INGREDIENTS

	Protein,* g/kg	FUgp	FUsow	Lysine g/kg	P, g/kg
Wheat	86	1,15	1,13	2,7	2,6
Barley, spring	83	1,05	1,05	3,3	2,8
Rye	73	1,09	1,08	2,7	2,6
Fabia bean	253	0,87	0,90	16,0	4,6
Pea	204	1,01	1,02	14,3	3,9
Soybeanmeal, dehulled	464	0,96	0,98	28,5	6,3
Rapeseed meal	357	0,73	0,79	19,7	9,4
Sunflowermeal	374	0,68	0,74	13,1	10,0
Potato protein	773	1,09	1,07	61,1	3,9

Protein = Crude protein = N x 6,25



FEED FOR PIGS IN DENMARK

Feed ingredients	Pct. average	Mio. ton 2014
Grain and biproducts	75	5,2
Proteinrich feedstuffs	21	1,4
Fat /Oil	1	0,1
Minerals, amino acids, vitamins, enzymes	3	0,2

*) Pig production 2014:

1,030 mill sows, 30 mill. piglets, 19,3 mill. slaughter pigs
1.5 mill ton, 1.25 mill. ton, 4,1 mill. ton

Production of feed:

- 50-55 pct. on farm mixing, slowly increasing



Category	Pigs 32-107 kg	Lactating, sow	Pregnant Sow
Wheat	43	37	38
Barley	30	35	38
Soybeanmeal	10,5	15	5
Rapeseed meal	5	3	4
Sunflowermeal	5	3	3
Wheat bran	2	1	6
Molasses	1,4	1	1
Palm oil	1,0	2	1
Minerals, CaCO ₃ , MCP, NaCl	2,1	2,7	2,0
Lysine, HCl (78% lysine)	0,3	0,24	0,1
Other amino acids	0,2	0,11	0,01
Vitamins + mikrominerals, enzymes	0,2	0,2	0,2



Category	7-10 kg	10-20 kg	20-32 kg
Wheat	53,8	48,5	46,4
Barley	15	15	15
Soybeanmeal	12	18	22
Rapeseed meal + sunflowermeal	0	4	8
Fishmeal	4	2	0
Soyprotein, concentrate	4	2	0
Molasses, whey, potatoprotein	4	3	2
Palm oil	4	4	3
Minerals, limestone, MCP, salt	2,5	2,7	2,8
Lysine	0,3	0,4	0,4
Other amino acids	0,2	0,2	0,2
Vitamins + mikrominerals, enzymes	0,2	0,2	0,2



WETFEEDING

60-70% OF HOME MIXING

= COMPUTERIZED AUTOMATIC MIXING AND FEEDING



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HOME- MIXING

Typical dry feed

- Wheat
- Barley
- Protein-mineral mix
 - Soybeanmeal
 - Rapeseedmeal
 - Sunflowermeal
 - Minerals
 - Aminoacids
 - Vitamins + enzymes

Typical wet feed

- Wheat
- Barley
- Whey+ Water
- Soybeanmeal
- Mineral mixture
 - Ca, P, Aminoacids, mikrominerals, vitamins, enzymes

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PIG PER 100 KG N IN SLURRY (ANIMAL UNIT)

	2002	2010	2014
Sow, piglets to 7 kg	4,3	4,3	4,4
Weaned piglets per sow/Year	23	27	30
Piglets 7,0 - 31 kg	167	206	215
Pigs 31-110 kg	30,7	33,9	36,8

Relative values	2002	2010	2014
Sow, piglets to 7,2 kg	100	100	102
Weaned piglets per sow/year	100	117	130
Piglets 7,0 - 31 kg	100	123	129
Pigs 31-110 kg	100	110	120



MANURE USE AND AVAILABLE LAND

- Feed consumption per 1,4 Animal unit (= per ha)
 - Slaughter pigs = $36,8 \times 1,4 \times 224 = 11.500$ feed units (FEsv)
 - Piglets = $215 \times 1,4 \times 46,3 = 14.000$ feed units (FEsv)
 - Sows = $4,4 \times 1,4 \times 1510 = 9.300$ feed units (FEso)
- Combined = 11500 Feed Units pr ha.



SELSUFFICIENCY GRAIN?

- Requirement = 11,500 FU pr ha = 10.700 kg feed
- Grain normally = 60-75% of feed = 6.400-8000 kg
- National average, crop yield per ha, 2009-2011
 - Wheat = 7.100 kg
 - Winterbarley = 5.850 kg
 - Springbarley = 5.300 kg
- Expected to increase, more N from 2016



SELSUFFICIENCY GRAIN?

- Requirement = 11.500 FU pr ha = 10.700 kg feed
- Grain normally = 60-75% of feed = 6.400- 8.000 kg
- Typical crop distribution, pig farm, % of area:
 - Rapeseed = 20%
 - Winterwheat = 40% ($\times 7.100 = 2.840$ kg per avg. ha)
 - Winterbarley = 20% ($\times 5.850 = 1.170$ kg)
 - Springbarley = 20% ($\times 5.300 = 1.060$ kg)
 - Average, 80% grain = 5.070 kg grain pr ha)



SELSUFFICIENCY DEPENDS ON

- Crop distribution
- Is crop used for pig feed (or beer?) or oil or bread
- Type of soil and yield per ha
- How much land does the farmer own
 - < 1,4 AU pr ha = High selfsuf., grain
 - = 1,4 AU pr ha = Good selfsuf, grain (50-100%)
 - > 1,4 AU pr ha = Not selfsuf., grain
 - Manure = slurry for neighbouring farmers
- Selfsufficiency of protein ?
 - On individual farm level or on national (/EU) level?
 - Far away!



AMINOACID IN PROTEIN G/16 G N = % OF PROTEIN

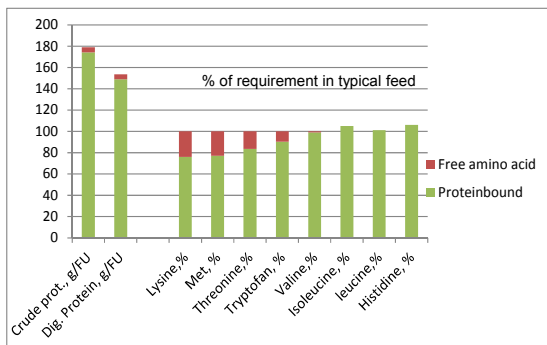
	Ideal protein	Wheat	Barley	Soybean meal	Rapeseed meal	Sunflo. meal
Lysine	7,0	3,1	3,8	6,1	5,5	3,5
Methionine	2,1	1,6	1,7	1,3	2,0	2,2
Threonine	4,5	3,0	3,5	3,9	4,4	3,7
Valine	4,8	4,3	5,1	4,7	5,2	5,0

Ideal protein is the best aminoacid composition, if the goal is maximum growth per kg protein in feed (similar to aminoacids in bodyweight gain)
Ideal protein combined with low protein level minimizes N in slurry without compromising gain and feed conversion

In practical feeding free amino acids makes protein more ideal
Eg. Lysine, methionine, treonine, tryptofan and valine



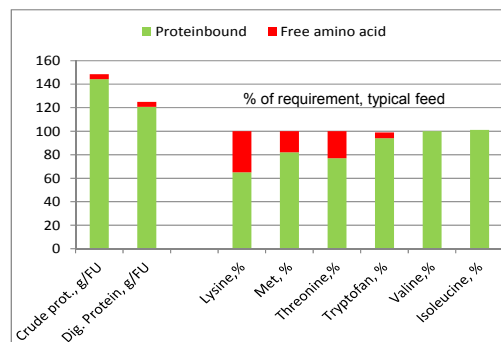
PIGLET FEED



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FEED FOR PIGS 30-110 KG



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WHERE DOES PROTEIN COME FROM = BEST GUESS!

	Digestible protein		
	Sows	Piglets	32-107kg
Grain	65%	35%	45%
Byproducts	5%	1%	5%
Oilseedmeal	28%	49%	49%
Other	2%	15%	1%
Free lysine	1,5%	1,7%	2,3%



WHERE DOES PROTEIN COME FROM = BEST GUESS!

	Digestible protein			Digestible lysine		
	Sows	Piglets	31-110kg	Sows	Piglets	31-110kg
Grain	65%	35%	45%	35%	15%	22%
Byproducts	5%	1%	5%	5%	2%	8%
Oilseedmeal	28%	49%	49%	42%	38%	44%
Other	2%	15%	1%	3%	15%	1%
Free lysine	1,5%	1,7%	2,3%	22%	27%	30-37%



WHERE DOES PROTEIN COME FROM = BEST GUESS!

	Digestible protein			Digestible lysine		
	Sows	Piglets	32-107kg	Sows	Piglets	32-107kg
Grain	65%	35%	45%	35%	15%	22%
Byproducts	5%	1%	5%	5%	2%	8%
Oilseedmeal	28%	49%	49%	42%	38%	44%
Other	2%	15%	1%	3%	15%	1%
Free lysine 2013/14	1%	1,7%	1,5%	22%	27%	30-37

Danish Pig Production:

Grain = 75-80% of energy, 45% of protein and 25% of lysin
Soybean, Rapeseed and sunflowermeal = 15-20% of energy, 45% of protein, 37% of lysin
Frie lysine = 30% of lysine



MORE PROTEIN IN DENMARK?

- Possibilities
 - More rapeseed (Max 15-20% of area)
 - More peas
 - Was widely used around 1990
 - EU-subsidies
 - Fabia beans, most promising !
 - Lupins
 - DDGS from bioethanol – might come
- Obstructions
 - Only economical with high prices of soybean, rapeseedmeal and sunflowermeal
 - Fabia beans (new varieties) have neutral economy
 - Will decrease selfsufficiency with grain (energy)



WHY FABIA BEANS

Politics, environment, economy

- New varieties, higher yield
- New feeding experiments
- Good in crop rotation



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FABIA BEANS FOR PIGS

- NOT HEAT TREATET

- 25% for piglet
 - 3 varieties – both white and coloured
 - Slightly better results than control (soybeanmeal)
- 20% for pigs 30-110 kg, Wetfeeding
 - 0,7% lower feed efficiency (Statistical signifikant, but not practical significant)

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VARIATION IN NUTRIENTS, SAME VARIETY, FUEGO,

Forseg	Piglet Exper.	Pigs 30-110 Batch nr. 1	Pigs 30-110 Batch nr. 2	Pigs 30-110 batch nr. 3
Crude protein, %	25,2	23,7	22,4	24,5
FUgp per 100 kg	95	89	75	73
Value per kg fabia bean				
Kr. pr 100 kg	144	138	123	127

Tabel value: 84 FEsv/100 kg
Analyses relevant!

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RYE

- New Hybrids higher yield on sandy soil
 - Dry-resistant, low input, , good winter-stability
 - 1 kg of rye has lower cost of production than barley and wheat
- Rye gives lower daily gain for pigs (10-15 g per 10% in feed)
 - Probably because of soluble fiber content
 - Feed conversion, OK (FU/kg gain)
 - Lower protein and energy = Price below wheat, needed
- Rye gives risk of ergot
 - Risk for reproduction and other problems
 - Promizing results for pregnant sows ongoing experiment
 - Hybrids "pollen+" are better than old hybrids
- Rye is increasing in Denmark
 - Better varieties and good experiments – we can calculate consequences for gain for growing pigs



CONCLUSIONS

- Denmark is selfsufficient with grain
- Denmark needs to import protein
 - We supplement with free amino acids to minimize protein in pig feed
- Pig farms with home mixing normally are 60-100% selfsufficient with grain
 - Because they own the needed land according to maximum 1,4 animal Unit pr ha (140 kg N)
- Lower selfsufficiency = don't home mix
- It is not easy to change to higher selfsufficiency of protein
 - Effect is lower selfsufficiency of grain
 - But Fabia bean will increase (from nearly zero)
 - Both ecological and conventional



MAXIMUM IN FEED

	Soy-bean-meal	Rape-seed-meal	Lupin	Fabia* beans	Peas
Piglets, %	10-20	5-15	10	20	5-15
32-107 kg, %	(30)	15 (7 reelt)	15	20	40
Sows, %	(30)	12	0	0	10

*One experiment = no problem

*Second experiment = reduced growth

20% pea, lupine or fabia bean in feed does not give enough protein, because of lower protein content than soybeanmeal



ALTERNATIVES TO SOYBEAN PROTEIN

Råvare	FUgp pr 100 kg	Karakteristika
Soybean-meal	96	46-47% crude protein. (Toasted to destroy trypsininhibitor)
Rapeseed-meal	71-99	31-34% crude protein. Problem: glucosinolates (10-25 Mikromol/kg) Max in feed : 1-2 mikromol /kg
Peas	101	20-22 pct. protein, Risk of Diarrhea/Higher moisture in fæces Only white flower types (tannin, trypsininhibitor)
Fabia beans Hestebønner	87	25% crude protein. Good results also coloured varieties (tannin and glucosides.)
Sweet lupin	79	31-33 pct. crude protein, only varieties with under 0,03 % alkaloides



SELF SUFFICIENCY DEPENDS ON

- Crop distribution
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