Effect of roughage on pig health and performance

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Roughages – a diverse group of feedstuffs

- Roughage - general name for feedstuff with high fibre content.
- For pig feeding purposes the Neutral Deterget Fibre (NDF), Acid Detergent Fibre (ADF) and lignin contents of the feedstuffs are more informative than crude fibre content
  - Better linked to the nutrient digestibility of the feedstuffs in pigs than crude fibre

- Grass based roughages are often mixtures of plants (clover, timothy, lucerne, herbs, common vetch, ryegrass…)
  - For pigs these can be offered fresh (cut, pasture) or ensiled
  - Hay - dried grass
- Corn as a whole plant
- Whole crop cereals with the plant and cereals harvested before ripening for feed
- By-products of food industry (i.e. sugar beet pulp)
- Cereal straw (enrichment, bedding)

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Composition and digestibilities of two fresh roughages

(Laurinen et al. 2001, unpublished)

	Common vetch (vicia sativa)	Persian clover (Trifolium resupinatum)	Grass- red clover (46:46), 8 % others	Concentrate (barley-pea-rapeseed cake)
Dry matter, g/kg	179	109	160	897
Composition, g/kg d.m.				
Crude protein	196	196	187	178
Ash	180	89	108	53
NDF	336	271	376	206
Lysine, g/16g N	4.6	5.1	4.8	5.0
Net energy, MJ NE/kg d.m.	4.7	7.3	5.5	11.0*
Total tract digestibility,%				
organic matter	50	68	53	83
crude protein	55	64	52	80
NDF	21	50	36	50

*calculated value

Composition and digestibilities of two ensiled roughages

(Carlson et al. 2010)

	White clover-grass silage (60:40)	Whole-crop pea-barley (25:75)	Concentrate (barley-soybean-wheat)
Dry matter, g/kg	430	320	900
Composition, g/kg d.m.			
Crude protein	169	118	226
Ash	111	61	59
Soluble NSP	37	27	63
Total NSP	327	350	148
Lysine, g/16g N	4.4	3.7	11.6
Gross energy, MJ GE	18.9	19.0	18.9
Total tract digestibility,%			
dry matter	79	79	
crude protein	79	81	
total NSP	66	58	

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Feeding pigs with roughages in practice

- Composition and digestibility of roughage differs greatly by the plant(s) included, climate conditions during growth and stage of growth
  - At least dry matter and crude protein with NDF (and ADF) content would be worth analysing to give an idea of availability of energy and protein in the feedstuff
- Early harvested roughages are more digestible
- Stems are more fibrous than leaves, pigs can pick leaves if allowed
- Palatability of roughage is better if finely chopped (1-3 cm) and moist.
- Pigs usually prefer concentrate over roughages if both are given *ad libitum*
- Best cost efficient practices in delivering the roughages are variable.

Feeding pigs with roughages in practice

- If using ensiled roughages make sure first class ensiling quality, pigs are more sensitive to quality reductions than ruminants (no mold, soil, pathogenic bacteria)
- If fed to appetite, leftovers should be cleaned off regularly to prevent feed spoilage and palatability problems
- Roughage given in the pen and especially rearing pigs outdoors increase time used for eating related actions, this may increase the daily energy requirement.
- Size of stomach and hindgut fermentation are small in small pigs – limitations in intake and digestion of roughage.
- Roughages of high insoluble fibre content with coarse chopping may challence the manure removing system.

General health effects of roughages

- Roughages have two important gastrointestinal tract health effects:
  - Decrease the occurrence of stomach lesions
  - Fibrous feed increase fermentation in colon which discourages pathogenic bacteria colonisation
- Roughage supports sow fertility:

  less repbreedings needed.
- Fibre increases the passage

  rate of the feed in the intestine –

  prevents constipation (but reduces nutrient absorption)
- Behavioural aspects:
  - Fibre also supports the satiety feeling
  - Roughages support the natural behavioural models of pigs: rooting and chewing which reduces aggressive and/or stereotypic behaviour.

Roughages and fattening pigs – meeting pig requirements

- Fecal digestibility of energy from fresh or ensiled clover-grass can vary 31-67 %, crude protein 38-61 % and NDF 33-56 %.
- The daily intake of roughage of growing pig can be max. 15 % of d.m. intake, when fed twice daily restrictedly (~1.3 kg silage of 20 % d.m. content).
- The ability of the pig to utilise nutrients from roughages increases as pig grows.
- Requirement of most amino acids and mineral decreases as pig grows.
- The price of feeding with roughages is worth checking: in Finland silage has increased feed costs even with moderate inclusions.

Roughages and fattening pigs – behaviour and health

- Access to roughage increases the activity of pigs and prevents abnormal and aggressive behaviour (i.e. tail biting).
- In behaviour studies several types of roughages have been tested, any roughage is better than no roughage.
- But if alternatives are available:
  - Whole crop silage from oats, vetch and lupine preferred over barley-pea whole crop silage, clover-grass silage, green grass meal, clover-grass hay and fodder beets (Olesen et al. 2000)
- Straw bedding reduces foot lesions, but if they occur, they are more severe.

Roughages and fattening pigs – carcass and meat quality

- Fibre in roughages during restrictively fed finishing period help to prevent feeling of hunger and fat accretion to the carcass.
- High slaughter loss – heavy intestines, less meat from carcass
- Roughages contain more polyunsaturated fatty acids than concentrates.
- With high roughage feeding, resulting pork fat will contain more polyunsaturated fatty acids.
  - Health statement for meat
  - Caution with salami production as stability of soft pork fat in salami may not be good enough
- In cattle high amounts of roughages in diet known to cause fat yellowness (carotene in feed), beware of that in pork too.

Roughages for sows

- Any roughage in feed or as bedding improves sow fertility (less likely repeat breeders)
- Sows on bedding and fed roughage have more opportunities to express the species specific behaviour than sows with no bedding or roughage – less stress.
- Outdoors sows use up to 50% of their time on feed related actions.
- Organic matter from early stage harvested hay is 60-70% digestible in sow gut.

Roughages for pregnant sows

- During pregnancy restricted feeding aims at keeping the sow in good body condition, not too fat, not too skinny
- During early pregnancy mainly membranes and fluids develop, energy and protein requirements at apporximately maintenance level – no need for extra feed
- On the other hand, the ability to eat large amounts of feed during lactation period should be maintained during pregnancy
- Bulky feed (including i.e. roughages) without changing the daily dietary energy supply is essential for well-being of loose housed pregnant sows as it prevents:
  - Feeling of hunger
  - Vulva biting
  - Aggressive behaviour
  - Stress for restriction of species special behaviour
  - Stereotypic behaviour (manipulating pen components, chains, bars)
- *If roughage is given from a separate rack, crowding and aggressions may occur beside the rack instead of concentrate feeder.*
- Rate of provision of fibre at around 300 g NDF/kg feed

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Roughages for lactating sows and piglets

- High fibre feeds (i.e. roughages) during late pregnancy reduces risk of agalactia after farrowing.
- High producing lactating sows need energy and protein dense feed to be able to produce max. 10-12 kg/d milk for the piglets.
- The amount of milk produced depends on the number of piglets (amount of milk suckled)
- Fibre (i.e. roughages) in feed help to prevent constipation

- For organically grown piglets it is important to learn eating of roughages as young as possible.
- Piglets will taste the sow feed and roughages
- Similar feed (roughage) odours in milk during suckling period and in feed after weaning help piglets to survive the weaning stress
- As piglest have only limited ability to utilise nutrients from high fibre feedstuffs, roughages serve as stimuli and learning.

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Thank you for your attention!