

Rye in the feeding of pigs – extremely interesting from a financial perspective

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Rye has established itself a fixed constituent in pig feed in recent years. Pig farmers have come to value rye, particularly in Northern Germany where the soil is not suitable for anything other than the cultivation of rye. Its suitability as a pig feed, moreover, has been proven in numerous studies. Numerous reservations previously held have been thrown overboard. Thanks to new breeds any decline in the feed absorption, stiffened bones or a deterioration of the stool consistency are things of the past. Bitter compounds are no longer a factor in the new breeds. Now with higher ratios of rye in the feed rations, negative effects are no longer expected even from the non-starch polysaccharides responsible for poorer stool consistency. But what is apparent at the current time is a significant difference in the price between rye and the other types of cereal used in the feeding of pigs. With a price difference of up to 5 Euro, the pig farmers should delay no longer and realise the maximum amount of rye possible.

Table 1 shows how the cost-effectiveness of rye is close to that of wheat. For those in the field, cost-effectiveness of a feedstuff is an important reason for its use. The cost-effectiveness is determined using the substitution method. The starting basis comprises a typical protein feedstuff and an appropriate energy feedstuff. For the feeding of pigs these are post-extraction soya meal and wheat. The calculation is based on the criteria lysine pca (praecaecally available) and energy. The feedstuff under evaluation is analysed to determine the quantity of post-extraction soya meal and wheat required to achieve its lysine pca and energy content. Multiplying the corresponding quantities by the market prices produces the nutrient comparison price of the feedstuff under analysis. Whenever rye is between 0.5 and 1 Euro cheaper on the market than wheat, it pays off to use it in the feeding of pigs. The costs of the protein feedstuff on the other hand are practically irrelevant. In the current situation, the economic use of rye is certainly established.

Table 1: What can rye (9% RP) cost in (in €/dt) if wheat (11% RP) and post-extraction soya meal (43% RP) cost ?

	Wheat price	15	20	25
Soya price				
30		14.30	19.20	24.10
40		14.25	19.15	24.00
50		14.20	19.10	23.90

(based on Hollmichel calculation programme,
<http://www.proteinmarkt.de/downloads/futtermittellistenund-rationsberechnung/>)

The constituents of rye

Table 2 shows the importance of knowing the value of the cereal in hand when calculating the feed ration. If we look at the constituents of rye in 2011 and 2012, there is a huge difference particularly regarding the raw protein and lysine content. Whereas rye containing 9.5 - 10.5 % raw protein was harvested everywhere in 2011, in 2012 the harvest only achieved 8 - 8.5 %. The spreads within the years are even more distinct. Variety, soil, fertilizer and other parameters create very different effects here. Differences of up to 100% were recorded between the samples submitted. If the actual feed ration is calculated using average values, e.g. 3.5 g lysine, but the real figure is at the lower end (e.g. 2.8 g lysine), half a gram of lysine is rapidly lost per kg of fattening pig feed.

Table 2: Constituents of rye and wheat in the Munster and Oldenburg Lufen (*Agricultural Tests and Research Institutions*)

Parameter	Rye						Wheat
	2010		2011		2012		2012
	LUFA NRW	LUFA North- West	LUFA NRW	LUFA North- West	LUFA NRW	LUFA North- West	LUFA NRW
ME (MJ)*	13.6 (13.1 - 14.0)	13.6 (13.4 -13.9)	13.8 (13.5 -14.0)	13.7 (13.4 -14.0)	13.7 (12.9 -14.1)	13.5 (13.2 -13.7)	14.1 (12.9 - 14.3)
Raw protein (g)	97 (83 -125)	95 (76 -120)	94 (71 -123)	105 (77 -140)	85 (73 - 102)	83 (77 -140)	108 (76 - 137)
Lysine (g)	3.6 (3.2 - 4.4)	3.5 (3.0 -4.3)	3.5 (2.8 -4.3)	3.8 (3.0 -4.8)	3.2 (2.9 -4.0)	3.2 (2.8 - 4.1)	3.1 (2.7 -3.5)

Compared to wheat, rye contains about 0.2 - 0.4 g more lysine. This difference is actually significantly hereby when based on the raw protein. However, because the lysine from rye (76%) is slightly less digestible than that from wheat (88%), rye contains a similar amount of lysine pca as wheat.

Special aspects for use?

As already mentioned above, rye contains significant amounts of non-starch polysaccharides. At around 11% the proportion in rye is two to three percentage points more than in wheat, triticale or corn and only two percentage points less than that of barley. The brake this puts on the transport of feed through the digestive tract may impact not only on the feed absorption (feeling of satiety), but can also cause the migration of bacteria (e.g. coli bacteria) from the large intestine to the small intestine thereby leading to diarrhoea symptoms. This affects younger animals in particular. The effect is much less apparent among fattening pig. There does not seem to be any clear effect achievable by using certain enzymes in the fattening.



Rye is readily useable in the feeding of pigs.

Compared to the other cereal types, rye contains the smallest proportion of polyunsaturated fatty acids. Because a share of the dietary fatty acids is embedded into the fat of the pigs, rye brings clear

benefits in relation to the consistency of the fat. It has been known for some time that rye produces a solid pork fat.

One problem encountered in some years is the susceptibility of rye to the ergot fungi *Claviceps purpurea*. These fungal hyphae produce the damaging and extremely toxic alkaloid ergotamine and ergotamine (vestibular disorders, paralysis, spasms and abortions). But this can be effectively countered through agro-technical measures such as mixing in population rye into the seed. Cleaning procedures have also proved expedient. It should also be noted that for consumer protection reasons, feedstuff laws have prohibited blending with ergot-free or low-ergot feedstuffs since 2003. Previously traded at a high price, the bitter compounds and 5-n-alkylresorcinols are now irrelevant in today's varieties.

Before being made into feed, rye too should be given a rest period of 4 - 6 weeks following harvesting. Because rye is very inclined to sprout if harvesting conditions are damp, this should be taken into account when used for feeding. If at all possible, sprouted grain should not be fed to farrowing sows or piglets. Fattening pigs are clearly less sensitive in this respect.



Rapeseed in extraction meal form and rye are a good combination in the feeding of pigs.

If triticale is combined alongside higher proportions of rye, the rye proportion possible is reduced by a third of the triticale share due to the high NSP content (e.g. at 30% triticale, the maximum recommended rye share in the final fattening phase is 40%). The proportion of rye should be reduced in the event of foam formation in liquid feed. The addition of vegetable oil can also possibly reduce the problem.

Pig feed trials

In recent years many feed trials have been carried out in the teaching and research institutions of the northern German states. A selection is presented in Table 3. All of these tests confirmed the possibility of using high quantities of rye (> 50%) in the fattening of pigs at a high gain level. No negative effects on feed absorption occurred. The high use of rye tends to have different effects in relation to the feed conversion ratio parameter. The carcass quality is not impaired through feeding with rye. There is however a tendency towards better carcasses. If, when considering the financial impacts of using rye, we look at the results of Weber et al, the two rye groups, at € 2 and € 5 respectively, have higher surpluses per fattening place than the control group.

A test focusing on piglets detected no negative effect on feed absorption and consequently the daily gains, caused through the use of rye, so that by maintaining the DLG's (*German Agricultural Society*) recommended upper limit of 15 % rye in piglet feed, farmers could use rye in the piglet feed without any concerns.

Table 3: Tests with different proportions of rye in pig fattening and piglet rearing

Author	Rye proportion	Daily gains (g)	Feed absorption (g/animal/day)	Feed conversion ratio (kg/kg)	MFA/index points (% or IP/kg)
Pig fattening					
Alert 2005	0	830	2.36	2.84	57.6
	45	833	2.41	2.89	57.6
Meyer et al. 2003	0	795	2.33	2.94	0.963
	64	809	2.27	2.83	0.986
Meyer et al. 2011	5 / 15 /25 up to 7.5 % RES	958	2.4	2.46	0.974
	10 / 30 /50 up to 15 % RES	966	2.52	2.56	0.969
Weber et al. 2004	0	812	2.57	3.21	55.8
	15 / 30	836	2.64	3.2	55.4
	30 / 60	770	2.54	3.32	57.1
Piglet rearing					
Weber et al. 2004	Iden				
	0	479	0.75	1.57	-
	10 / 20	463	0.73	1.59	-
	15 / 30	495	0.79	1.60	-
	Ruhlsdorf				
	0	373	0.66	1.76	-
	10 / 20	388	0.68	1.76	-
15 / 30	388	0.64	1.64	-	

Table 4 contains additional recommendations on using rye in the feeding of pigs.

Table 4: maximum rye proportions (DLG recommendation)

Piglets up to 15 kg	0
Piglets over 15 kg	15*
Pre-fattening phase	30
Initial fattening phase	40
Middle fattening phase	50
Final fattening phase	50
Sows	25*

*Rye with no ergot infection

Rye and rapeseed meal reduce feeding costs

The use of rye and rapeseed meal in the feeding of fattening pigs is highly interesting for not only farms that mix their own feed, but ready-made feed producers too. This is demonstrated by the feed rations set out in Table 5. If we assume an approximate consumption of 30 kg pre-fattening feed, 100 kg initial fattening feed and approx. 130 kg final fattening feed for the fattening operation, the addition of rye and rapeseed meal results in feed cost savings of € 3 - 5 per animal. The fact that these feed rations are effective is demonstrated by empirical evidence and the tests performed by Ms. Meyer in 2011.

Component	Price*	Feed ration with rye			Feed ration without rye		
		Pre-fattening phase 25 - 40 kg LM	Middle fattening phase 40 - 80 kg LM	Final fattening phase 80 - 120 kg LM	Pre-fattening phase 25 - 40 kg LM	Middle fattening phase 40 - 80 kg LM	Final fattening phase 80 - 120 kg LM
Wheat	24.5				45.5	41.5	35.5
Barley	24	22.9	18	21.5	30	38	51
Rye	18.7	30	40	40			
Triticale	23.2	20	17	20			
Post extr. soya meal 43 % RP	46	17	10	5	20	16	10
RES	30	5	5	10			
Rapeseed oil	105	2	2	1	1.5	1.5	1
Mineral feed	div	3	3	2.5	3	3	2.5
ME (MJ)		13.2	13.1	12.9	13.3	13.2	13
Raw protein (g/kg)		174	161	144	177	164	142
Lysine (g/kg)		11.7	10.6	8.2	11.5	10.4	7.8
lysine pca (g/kg)		10.3	9.2	6.8	10.2	9.3	6.8
Costs (€/t)		29.31	27.38	25.31	31.07	30.04	27.8

*Price as of June 2013

Mineral feed: Pre-fattening: Lysine 11.5%, Met 2.65; Thr 5.8%; Ca 21%, P 2.3%
 Middle fattening: Lysine 11%, Met 2; Thr 5.5%; Ca 19%, P 1.2%
 Final fattening: Lysine 8.0%, Met 1.0; Thr 2.5%; Ca 22%

To summarise, it may be stated that the use of up to 50% rye in fattening pig feed rations does not result in any losses in the biological performance of the animals, but does produce clearly positive effects on the economic efficiency of the fattening process.