



Fibres for fertility

THE INCLUSION OF RAW FIBRE IN SOW DIETS HAS MANY POSITIVE EFFECTS. AN EXTENSIVE TRIAL IN GERMANY INVESTIGATED THE EFFECTS OF ADDING A NEW NATURAL LIGNOCELLULOSE RAW FIBRE CONCENTRATE TO THE DIET ON THE FERTILITY PARAMETERS IN BREEDING SOWS.

BY DIRK BÜTTNER.

The life cycle of a breeding sow is characterised by changing feeding requirements based on its respective reproductive periods. During the lactation period high digestibility is needed. During the gestation period, much more restricted energy and nutrient requirements should be considered, while also ensuring that the breeding sow is sufficiently satiated. An important satiation factor in sow feeding is raw fibre. Raw fibre is made up of substances that are difficult for the animal to digest. In human nutrition the raw fibre fraction is labelled as indigestible organic matter. These raw fibres do much more than just satiate breeding sows. They also: stimulate bowel movements, speed up the intestinal transit time, cause chymus to swell, affect feed intake (mechanical and chemical satiation), bind with undesirable metabolic products such as toxins, affect the gastro-intestinal volume of the digesta and maintain a healthy gastro-intestinal tract. In order to fulfil these functions, minimum raw fibre content is needed in the feed ration. During rationed feeding, the content should be 6% raw fibre for gestation sows. In lactating sows, a content of 4.5% per kg feed is required.

FIBRES ARE NOT ALIKE

Raw fibre is not a uniformly consistent feed component and therefore not all raw fibres are alike. The quality criteria of the raw fibre carriers include the amount of bacterially fermentable substance (BFS), the water-holding capacity (WHC), the speed of swelling as well as the ingredients and the microbial status. BFS is the sum of fermentable nitrogen-free extracts and digestible raw fibres in the colon less the starch and sugar content. These are primarily structural substances such as pectin, hemicellulose, cellulose and β-glucan. Because pigs lack the enzymes needed for decomposition, these substances are first microbially decomposed and fermented in the colon. Sugar beet pulp is especially rich in BFS. The WHC value gives the water-holding capacity of feed after two hours (that is, a product with a WHC value of 2.5 l/kg can bind up 2.5 times its own weight). Within the range of common raw fibre carriers, sugar beet pulp shows the highest WHC value of 3.41 l/kg (Table 1). The swelling speed of a feed is another influencing factor on the feed consumption of animals. The faster the feed starts to swell in the intestinal tract, the less time is required to reach satiation. Again, sugar beet pulp is in first place compared with other raw fibre carriers.

However, sugar beet pulp also has disadvantages. By feeding high amounts of sugar beet pulp, the faecal consistency becomes greasy and slimy which negatively influences the hygiene of both animals and the stables. Furthermore, the high calcium and potassium content of sugar beet pulp is responsible for disorders of the anion cation balance, which promotes the so-called MMA complex. Wheat bran is also a raw fibre source, which is often used in feed formulations even though its use is questionable for several reasons. Firstly, excessive amounts of mycotoxins can be present, and secondly, wheat bran is known for showing high amounts of phosphorus, which can cause problems especially in farms with limited space.

NOVEL FIBRE CONCENTRATE

The optimal exclusive raw fibre carrier does not appear to exist, causing the feed manufacturing industry recently to offer so-called fibre mixes to combine the positive qualities of the different raw fibre concentrates. A new trend in these concentrates for sows could be the use of raw fibre concentrates based on insoluble lignocellulose. The raw fibre content of the novel raw fibre concentrate (Arbocel® RC) according to analyses is at least about 66%, which makes it possible to achieve a total raw fibre content of 6% in the feed ration through the addition of only 2.5% of this product in grain-based feed formulations. The main components of this concentrate are cellulose and lignin, i.e. exclusively insoluble fibre



Dirk Büttner completed his studies in agricultural science at the University Gießen in Germany in 1996. In 1997 he worked as product manager for a German feed company and moved in 1998 to work as product manager for a veterinary pharmaceutical company. In 2000, Büttner followed a national traineeship in agricultural administration laws and since 2002 he has worked for LSZ Forchheim as research coordinator.

	Dry matter content ¹ (g/kg)	Raw fibre (g/kg)	ME (MJ/kg)	BFS ¹ (g/kg)	WHC (l/kg)
Barley	880	50	12.65	62	1.29
Oat meal	880	102	11.22	59	1.88
Oat bran	910	230	5.67	120	--
Wheat bran	880	118	8.83	174	2.42
Wheat grit bran	880	85	10.48	198	1.88
Sugar beet pulp	910	187	8.19	460	3.41
Malt sprouts	920	133	9.87	184	--
Colza oil meal	880	117	10.47	186	1.70
Sunflower meal	900	200	8.94	204	2.34
Soy bean hulls	900	344	2.94	351	2.81
Dried grass meal	900	245	5.42	250	2.69
Raw fibre carrier ²	920	665	Approx. 2.50	--	8.00

¹Source: modified according to Kirchgessner (1997)
²Arbocel® RC



Thailand study

To analyse the effects of raw fibre concentrates on reproduction performance of breeding sows also in Asian countries, in which soy-corn based feeding (and not cereal-based) is practiced, a long-term study (180 days) at the Sermkasikit Farm, Tak in Thailand was undertaken. 16.0% conventional rice bran was substituted by 2.0% of this concentrate in the soy-corn based feed ration of gestating sows and 6.0% by 1.0% in lactating sows. Feeding this raw fibre concentrate to pregnant sows increased the average daily feed intake during lactation by 3.8% compared to the control group. Regarding reproductive performance, the litter size was increased by 0.9 piglets, and one piglet more per sow per year was produced due to a lower mycotoxin load of the diet and a higher satiation of the sows. Also, faeces consistency was improved and the prevalence of MMA could be reduced by topdressing 50g per sow per day of the concentrate 14 days before farrowing.

materials that are scarcely fermented in the digestive tract of pigs.

The WHC of this concentrate corresponds to around 8l/kg. An additional benefit is that it contains nearly no minerals, meaning that a negative effect on the anion cation balance can be ruled out. A further advantage of the product as cited by JRS (J. Rettenmaier & Söhne, Germany), is the high speed of swelling of the product (complete swelling in about one minute). The reason for the comparably high speed of swelling is based on the specific fibre structure of the product. Both the swelling capacity (WHC) and the speed of swelling play an essential role, especially in the ad libitum feeding of pregnant sows. The product's feed hygiene is also an important factor as the product is supposed to be free of mycotoxins and (plant) stock parasites.

REPRODUCTION PERFORMANCE

To test the efficacy of the new raw fibre concentrate, a 15-month trial was conducted with 110 breeding sows from the 'Forchheimer Sauenherde' (Forchheim sow herd). In the trial, 110 Baden-Württemberg hybrid sows (LW x LR) were used after their second litter. The animals were divided into a control and a trial group. In the trial feed rations, wheat bran was replaced with 2.5% of the raw fibre concentrate for sows during early pregnancy and with 2.0% in lactating sows.

The number of sows returned to estrus was 14.5% in the control group, and so within the range of tolerance but also distinctively above the level of the trial group with a value of 3.6% sows returned to estrus (Table 2). In the present study it was not apparent whether this very low number of sows returning to estrus in the trial group was only a result of the feeding of the raw fibre concentrate. However, a DON-value of 3mg/kg (data not shown) was analysed in the mineral feed mix of the control group during the gestation period.

The piglets were weighed at day three after farrowing,

high explains the comparatively high birth weights. Another parameter would be the occurrence of the MMA complex (mastitis, metritis, agalactica) which is, economically speaking, one of the most significant diseases in piglet and sow production. Sows rarely fully recover from metritis (infection of uterus), which is often responsible for physiological damage. However, the appearance of MMA was not detected during the study.

FAECES CONSISTENCY

The dry matter content in faeces is an indicator for the raw fibre content of the feed: the higher the raw fibre content of the feed, the higher the water content of the faeces. Despite the fact that the raw fibre content in the tested concentrate formulation was higher compared to the control feed ration, the dry matter contents in the trial group showed values of around 1.5% (absolute approximately 5%) above the level of the control group. This is due to the fact that the tested concentrate has a specific fibre structure and only consists of insoluble fibres meaning it does not contain fermentable fibres. In both groups the faecal consistencies improved substantially.

GOOD ALTERNATIVE

In the present study it was possible to substitute 12.0% of a common raw fibre concentrate with 2.5% of the new raw fibre concentrate (Arbocel® RC) in sows during early pregnancy and 12.5% raw fibre with 2.0% of the fibre concentrate in lactating sows. In this context, an increase in the feed energy value of 0.2 MJ ME/kg feed on average and a decrease of the phosphorus content of the feed was observed in the trial group. The lower phosphorus content is quite an important aspect especially in regions with prolific livestock. The exceptionally low rate of sows returned to estrus and the half extra piglet in the trial group, although not statistically significant, both help contribute to the economical success of the product.

It could not be ascertained, however, to what extent these effects were related to the use of the product. However, the improved feeding hygiene aspect mentioned above was confirmed at least in sows during early pregnancy. Although the tested product has barely any fermentable substances, there were no problems with a too firm or dry faecal consistency in the trial group as compared to the control group. The product proved to be a good source of raw fibre in the present study and is recommended as an alternative raw fibre source for feed formulations in the future. However, the advantages of the product still have to be proven in further experimental studies. <-

TABLE 2 - REPRODUCTION PERFORMANCE OF BREEDING SOWS DURING THE STUDY.		
Parameter	Control group	Trial group ¹
Sows returned to estrus (%)	14.5	3.6
Total number of newborn piglets per litter	12.2 +/- 2.7	12.5 +/- 2.3
Number of new live born piglets per litter	11.7 +/- 2.49	12.3 +/- 2.28
Weight of piglets at day of farrowing		
(3rd day of life) (kg)	1.63 +/- 0.31	1.62 +/- 0.26
Weaned piglets per sow/litter	9.7 +/- 2.1	9.9 +/- 2.1
Sows not pregnant (%)	7.3	0
Occurrence of MMA	0	0
¹ Arbocel® RC	Note: data are means +/- std	