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Original Research

Pigs

Effect of feeding Actigen™ to sows during gestation and lactation and on piglet performance

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Summary

Actigen™ is a second generation, unique bioactive fraction derived from the outer cell wall of a specific strain of yeast, *Saccharomyces cerevisiae*, where it acts in the gut to bind pathogenic bacteria, preventing disease and competition for nutrients. In the current trial, 260 sows were used and fed either an unsupplemented control diet or one containing Actigen™ at 0.08% of the formulation during gestation, farrowing and lactation, to assess its impact on sow and piglet performance. Results showed significant increases in feed intake for sows fed Actigen™ pre-farrowing, but this was reversed during lactation, leading to a 7 kg saving in feed intake per animal. At birth, piglets weighed 42 g more in litters from Actigen™-fed sows compared to the control group. Weaning weight of the total litter from Actigen™ sows was significantly higher ($P < 0.05$) by 3.3 kg, although individual piglet weights were the same. Sows showed no significant loss in body weight during the trial, indicating that the improved piglet production was related to improved nutrient availability and perhaps Ig status of piglets due to the addition of Actigen™ in the diet.

Keywords: Actigen: yeast: sows: piglets: performance

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Introduction

Actigen™ (ACT) is a second generation, unique bioactive fraction derived from the outer cell wall of a specific strain of yeast, *Saccharomyces cerevisiae*, formulated to be used in animal diets. This yeast-derived product has been developed for more than twenty years, with a large body of research demonstrating its mode of action and efficacy in many species, especially where antibiotics have been removed from feeds. The active component attaches to the fibriae present on the surface of pathogenic bacteria, preventing their attachment and colonisation in the gut (Spring *et al.*, 2000). Its ability to interact with the gut wall and associated immune moieties has been proven to promote immune-competence in young animals, especially when suckling and at weaning (Brennan *et al.,* 2012). In sows, it makes more nutrients available, due to the removal of competition for nutrients by gut microflora, leading to better maintenance of body condition, more piglets born and improved return to service intervals (Miguel *et al.,* 2002; Le Dividich *et al.,* 2009; Lazarevic *et al.*, 2010).

Commercial trials with gestating and lactating sows have proven that ACT can increase immunoglobulin (Ig) expression in milk (Spring *et al.,* 2003) thereby promoting immune protection in young piglets. The prevention of competition for nutrients in sows due to better gut health, as well as immune status, body composition and feeding regime can have a major influence not

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only on Ig status, but also on colostrum and milk quality, allowing piglets better availability of nutrients from the start of suckling (Fahmy, 1972; Klobasa *et al.,* 1987; Goransson, 1990; Zou *et al.*, 1992; Darragh and Moughan, 1998). More efficient digestion with less competition for nutrients is important to maintaining sow condition, allowing her to return to service in a timely manner (Klaver *et al.*, 1981). These changes lead to fewer digestive disorders and diarrhoea at weaning, and better productive performance through to slaughter weight in growing and finishing pigs. In recent trials conducted in 2014 in a commercial pig breeding herd monitored for a 12 month period, ACT supplementation in sow diets prior to parturition gave improved milk Ig levels by 59% and piglet birth weight was increased by 0.19 kg relative to unsupplemented control sows and their litters (McArdle, unpublished).

When piglets undergo weaning, their own acquired immunity needs to be robust enough to prevent digestive problems that can reduce growth performance and welfare. Changing from a milk-based to a cereal-based diet resulted in changes in the gut and increased enzyme secretion which can impact digestion and uptake of nutrients. Ensuring the successful transfer of piglets from milk to meal is essential for productive performance, as each extra 100 g in body weight at weaning is considered equivalent to one day less to reach final slaughter weight, saving time, labour and feed costs (Cooper *et al.*, 2001). Heavier weaners are considered more efficient at converting feed into gain, and have leaner carcasses at slaughter. Over a twelve month period where a commercial pig breeding herd was monitored, 0.61 more piglets were born per litter, with a 0.5 kg higher average weaning weight at 1.5 days earlier from ACT supplemented sows (Alltech, personal communication). After weaning, time to service was reduced by 0.6 days. Such improvements could have major economic implications for pig producers. Therefore, the objective of the following trial was to evaluate the effect of supplementing ACT in feed throughout the gestation and lactation on both sow and piglet performance.

Materials And Methods

Two hundred and sixty sows and their litters were used in the trial. The sows were crossbred, using JSR Genepacker 90 (LWxLR) and PIC Camborough (LWxLR) xWhite Duroc), with a JSR 900 sire being used for breeding the trial piglets. All pigs were sourced from the Harper Adams University sow herd. PMWS was present in the herd but with low mortality (<3% post-weaning), and the herd was PRRS and enzootic pneumonia positive, and vaccinated accordingly for both.

Sows were allocated to one of two dietary treatments – either a control (unsupplemented) diet or one containing ACT (Alltech Inc. KY) at 0.08% of the total diet formulation. Sows were allocated to diets on the basis of genotype and equalised for parity between treatments. Pens containing eight sows each were allocated to the dietary treatments and these animals remained in the same group throughout gestation. Animals that returned to oestrus and were re-bred stayed within their group but were housed separately when pen mates moved to the farrowing room, which occurred seven to eight days prior to farrowing. Farrowing pens were fully slatted crate systems arranged in two rooms with sows allocated evenly between rooms.

All sows were fed to appetite from previous litter weaning to mating and then restricted to 2.4 kg per day supplied via volumetric dispensers during gestation. Sows received the lactation ration when they entered the farrowing house and were fed 2.5 kg per day until farrowing, whereby the amount rose on the standard Stotfold scale (a standardised feeding strategy for sows) to 11 kg per day depending on litter size. Sows were weighed on entry and exit of the farrowing house. Milk replacer was made available to piglets from birth, and prestarter feed from day 14. Milk replacer was formulated containing whey protein, palm and coconut oil and premix. The prestarter diet main ingredients comprised whey protein, full fat soya, oat flakes, palm oil and wheat with premix to balance. Piglets received 1.3 litres of milk replacer each and were offered 0.85 kg of prestarter diets.

Diets were formulated to meet NRC (2012) requirements and based on commercial (UK) gestation and lactation rations (Table 1). Diets were manufactured by a UK national feed compounder as 3 mm pellets. Milk replacer and piglet feed composition and analyses are shown in Table 2.

All piglets were tagged and individually weighed at birth and at approximately three days of age and at weaning. Any cross fostering was done within the first 24 hours within treatments and recorded for each piglet. Feed intake was measured on a daily basis and averaged per sow when group-housed, or expressed on an individual basis in the farrowing house. During lactation, weekly feed intakes were calculated at seven day intervals. The

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Table 1. Diet specifications and nutrient analysis

Raw Material	Dry sow diet (%*)	Lactating sow diet (%*)
Barley (62 kg/hl)	10.00	11.90
Wheat	36.90	37.90
Wheatfeed	46.60	23.20
Maize Germ	0.00	8.30
Soya HiPro extruded	0.00	7.20
Peas	0.00	5.00
Fat Hispec (vegetable base)	1.00	1.00
Molasses	2.50	2.50
Mineral and mineral premix	3.00	3.00
Total	100.00	100.00
Nutrient Analysis		
Oil B	4.58	4.60
Protein	12.04	14.28
Fibre	5.08	4.25
Ash	4.61	4.98
Salt	0.45	0.58
Calcium	0.64	0.73
Phosphorus	0.49	0.50
Energy (DE MJ/kg)	12.57	13.16
Lysine	0.46	0.81
Methionine	0.19	0.25
Vitamin A (IU/kg)	100000.00	100000.00
Vitamin D3 (IU/kg)	1875.00	1875.00
Vitamin E (IU/kg)	50.00	100.00

NB Treatment diets contained 0.08% ACT.
*all as % unless otherwise stated in first column.

actual duration of gestation was calculated for each sow, and no farrowing was induced. The weaning to first service and effective service intervals were recorded post-weaning. Total piglets born, numbers alive, stillborn, mummified, fostered, joint ill incidence and all health treatments and mortality were recorded. Pigs were observed daily for signs of ill health. Sick animals were treated as necessary and recorded by ear tag including the reason for treatment, medication received, date and duration of treatment. For welfare reasons, sick piglets were removed and the weight recorded. Mortality was recorded on an individual piglet basis.

The trial was run according to Harper Adams University standards of ethical treatment of animals.

Table 2. Analysis of milk replacer and prestarter diets for piglets

Nutrient	Milk replacer	Pre-starter diet
Crude protein %	22	20
Crude fibre %	0	1.9
Crude fat %	14	13
Ash %	7.5	8
Lysine %	2	1.5
Calcium %	0.8	0.6
Sodium %	0.5	0.5
Phosphorus %	0.7	0.6
Vitamin A IU/kg	25000	12500
Vitamin D3 IU/kg	6000	2000
Vitamin E IU/kg	250	250

Data was analysed using the GLM procedure of UNISTAT release 5.5 (London, UK), with confidence limits sets at 95% ($P < 0.05$).

Results

At the start of the trial, there were no significant differences between the control group or ACT-fed groups of sows. From entry into crates until farrowing, feed intake was higher for the sows fed ACT ($P = 0.0014$), however intake was significantly lower for the sows fed ACT during the first two weeks post-farrowing (data not shown), leading to an overall decrease in total feed consumed for the ACT group ($P = 0.0128$; Table 3).

Piglets from sows fed ACT were significantly heavier at birth ($P = 0.0009$) compared to those from the control group. Sows fed ACT had more piglets at day three and weaning (Table 4), with the ACT sow litters being younger and more numerous ($P < 0.05$) compared to the control. Litter weight at weaning was significantly higher ($P = 0.0395$) and the piglets were 0.6 days younger in litters from sows fed ACT versus the control group.

Table 3. Performance of sows fed control or ACT-supplemented feeds during gestation and lactation

Parameter	Control	ACT	P value
Dry sow start weight (kg)	207.799	205.131	0.6639
Sow wt entry farrowing (kg)	257.341	256.947	0.9442
Sow wt at weaning (kg)	228.377	225.404	0.5989
Feed intake duration of gestation (kg/sow):	288.31	287.27	0.5202
Feed eaten entry-farrowing (kg)[1]	18.16^a	19.68^b	0.0014
Feed intake wk 1 after farrowing (kg)	26.43	26.19	0.4956
Total feed eaten post farrowing (kg)[2]	197.83^b	190.55^a	0.0128
Wean to effective service interval (days)	5.6	5.7	0.7343

[1]Sows house 7-8 days pre farrowing. Means with different superscripts vary significantly ($P < 0.05$). [2]Although offered on the Stotfold scale for intake, sows were allowed to eat to their biological requirement.

Table 4. Effects of ACT fed to sows on piglet litters

Parameter	Control	ACT	P value
Total piglets born	14.567	14.102	0.3051
No piglets born alive	13.693	13.448	0.5950
No piglets stillborn	0.947	0.712	0.1792
No piglets mummified	0.439	0.408	0.7781
Piglet birth weight (kg)	1.509^a	1.551^b	0.0009
Total litter weight born (kg)	20.976	20.996	0.9755
No. piglets day 3 after birth	12.123^a	12.464^b	0.0339
Litter weight day 3 (kg)	23.515	23.660	0.7967
Litter age weaning	26.614^b	26.024^a	0.0028
No piglets weaned	11.658^a	12.080^b	0.0081
Litter weight weaning (kg)	95.9^a	99.2^b	0.0395
Age weaning per piglet (days)	26.6^b	26.1^a	<0.0001
Weaning wt per piglet (kg)	8.2	8.2	0.6254

Means with different superscripts vary significantly ($P < 0.05$).

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Discussion

Feeding ACT to sows during gestation and lactation had various benefits, including reduced feed costs due to decreased feed intake post-farrowing. The piglets from the ACT supplemented group were heavier at birth and weaning, more numerous and attained weaning at a younger age compared to the control group. As the ACT supplemented sows consumed less feed during lactation, this suggested that milk production and quality was enhanced by supplementary ACT, despite intakes being significantly lower, and hence sows were using feed more efficiently without loss in body weight. This is in agreement with the published work of Miguel *et al.* (2002) and Lazarevic *et al.* (2010) who reported that ACT supplements made more nutrients available to the sow, by promoting correct gut microflora, promoting body weight and reproductive performance. Although not measured in this trial, it may be assumed (based on previous data) that the sows fed ACT would have had higher levels of Ig in their colostrum and increased milk nutrient profiles, both of which would have improved piglet health, viability and growth. Maintaining sow body weight, achieving heavier piglets at weaning, requiring less time to attain weaning and reduced wean to oestrus intervals are all important to the economics of pig production. Time, labour and feed costs are saved by weaning piglets earlier. In addition, heavier piglets at weaning have been shown to need less time to reach target slaughter weights - which has been calculated at one day saved for each 100 g higher weaning weight (Cooper *et al.*, 2001). In the case of this trial, nearly half a day was saved.

Conclusions

The trial demonstrated various economic and performance benefits for sows and their piglets when gestation and lactation diets were supplemented with ACT. Such improvements in performance and reductions in feed costs demonstrated a net improvement of £22 per sow (at current pricing on trial date) per year, which amounted to 3.8:1 return on investment in the breeding herd. This was attributed to the combination of performance factors that were enhanced by feeding ACT. Economics of pig production, and benefits in early piglet growth are typically carried over throughout the growing period until slaughter weight, and it would be expected that pigs from dams fed ACT would have higher subsequent growth rates and higher carcass yields at slaughter.

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Declaration of Interest

Dr. Jules Taylor-Pickard and Mr. Terry McArdle are employees of Alltech Biotechnology Centre, Ireland.

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