Use of Crude Glycerol in Diets for Sows

Lee J. Johnston, Professor
Swine Nutrition and Management, University of Minnesota

Including up to nine per cent crude glycerol in diets for lactating sows has no effect on sow performance compared with a typical corn-soybean meal diet, according to Lee Johnston and co-authors associated with the University on Minnesota Swine Extension.
The production and use of renewable fuels such as ethanol from corn and biodiesel from soybean oil has exploded in rural America. There are many benefits generated by production and use of these fuels but there are also challenges. One important challenge is utilization of the co-products generated during biofuel production. A logical use for these co-products is in livestock feeds. Ethanol production has received the most attention recently as there are numerous groups determining the utility of dried distillers grains with solubles in swine feeds.

Rapidly expanding biodiesel production will produce an abundant supply of glycerol, the co-product of biodiesel production. During biodiesel production, 100 pounds of fat or vegetable oil (usually soybean oil) is combined with 10 pounds of methanol to yield 100 pounds of biodiesel and 10 pounds of crude glycerol. In fiscal year 2007 (1 October to 30 September), actual production of biodiesel totalled 450 million gallons. For each gallon of biodiesel produced, about 0.66 pounds of crude glycerol are generated. Consequently, about 148,500 tons of crude glycerol were produced in fiscal year 2007.

Glycerol has many uses. Glycerol is used: to moisten, sweeten and preserve foods, as a moisturising agent and emollient in cosmetics and toiletries, as a component of drugs and pharmaceuticals, to soften and reduce shrinkage in paper manufacturing, to produce renewable propylene glycol (anti-freeze and de-icing solutions) and many others. Recently, there has been growing interest in the nutritive value of crude glycerol for various species and classes of livestock.

Glycerol is a three-carbon compound that could serve as an energy source in swine diets. However, limited research has been reported on the nutritional value of glycerol for swine. Researchers in Iowa determined that the energy content of crude glycerol is about 95 per cent of the energy present in corn. Although starch and fats have been traditional sources of energy in US swine diets, glycerol could become an important energy source for pork production if the continued production of biofuels uses starch from corn to make ethanol and a variety of fats and oils are used to make biodiesel.

Glycerol also plays a role in water balance of the body. Several authors have reported that consumption of glycerol enhances water retention in humans. Consumption of glycerol-containing water increased blood volume, and decreased heart rate, body temperature and urinary output of human endurance athletes during exercise in hot conditions. Glycerol's role in water balance may play a role in helping lactating sows cope with the stress of milk production during hot weather.

The authors are unaware of any published reports of feeding glycerol to breeding swine. Dietary glycerol may increase water intake of sows and improve milk production since milk is about 80 per cent water. Glycerol feeding increases concentration of glucose in blood of rats. Glucose is also an important input for production of lactose (milk sugar) in the mammary gland and lactose secretion by mammary cells is an important controller of milk yield. So dietary glycerol may increase lactose production and consequently milk yield of sows. With these thoughts in mind, we designed a study to evaluate the effects of increasing concentrations of crude glycerol in diets for lactating sows.

Three hundred and forty-five sows were assigned to corn-soybean meal based diets containing zero, three, six and nine per cent crude glycerol. Crude glycerol contained 86.1 per cent glycerol, 6.01 per cent salt, and < 100 ppm methanol. Due to the salt content of crude glycerol, supplemental salt was excluded from diets containing six and nine per cent crude glycerol. Dietary treatments were imposed on day 109 of pregnancy. After sows farrowed their litters, they were allowed to consume as much of their assigned experimental diet as they wanted.

Inclusion of up to nine per cent crude glycerol had no significant effects on sow weight or backfat losses, litter size or weight at weaning or time required for the sow to rebreed after pigs were weaned (Table 1). Dietary treatment tended to influence daily feed intake of sows mostly due to the difference in feed intake between sows fed three and six per cent glycerol. An explanation for the lower feed intake of sows fed the six per cent glycerol diet is not apparent. The researchers measured water disappearance during lactation and respiration rate of a randomly-selected subset of sows assigned to each treatment. These measures provide some indication of how sows adjusted to heat stress during summer when this experiment was conducted. Dietary glycerol had no influence on water use or respiration rate of sows. Results of this study suggest that including up to nine per cent crude glycerol in diets for lactating sows has no effect on sow performance compared with a typical corn-soybean meal diet. Furthermore, dietary crude glycerol does not appear to improve the sow's ability to cope with heat stress during lactation.