CANADIAN EXPERIENCE WITH FEEDING DDGS

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INTRODUCTION

Distillers Dried Grains with Solubles (DDGS) is a primary co-product of ethanol production from dry milling of cereal grains. Developing new markets for this co-product is essential for the ethanol industry's profitability and sustainability. However, livestock producers are being affected by increased ethanol production, as prices for feed grains are increasing, impacting cost of production. The burden on livestock producers may be decreased as DDGS can be used as both an energy and protein source in livestock rations. Since DDGS production in Ontario is expected to reach 1.5 million tonnes and a massive expansion in the U.S. continues, large quantities of DDGS will be available for livestock feeding.

In the United States approximately 15 percent of the DDGS produced is incorporated into swine diets. In contrast, very little is utilized by the swine industry in Ontario. Therefore research at Ridgetown College – University of Guelph, using Chatham DDGS (GreenField Ethanol), was undertaken to investigate the suitability of this protein and energy source for swine diets in Ontario.

PROJECT OBJECTIVES

The project evaluated the effects of feeding dried distillers grains with solubles (DDGS) to pigs based on measurements of growth, feed intake, economic returns and carcass quality. The following objectives were specifically addressed:

a) To determine the effects of feeding DDGS (GreenField Ethanol - Chatham plant) at 10 and 20 percent of the ration based on pig growth rate, feed intake and efficiency, and carcass quality.
b) To determine the economic benefits of feeding DDGS from the Chatham plant in pig growing and finishing diets.

METHODS

Trial #1

After a three week adjustment period, ninety-six pigs (33.2 ± 5.8 kg) officially began the trial on July 13th, 2004. Each pen (3 barrows and 3 gilts) was randomly assigned to one of three grower diets until they averaged 70 kilograms (within pen) of body weight (BW). Pigs were then fed an assigned "finisher" diet until they were marketed ($\geq$ 110 kg BW) by pen. The following dietary treatments were fed:

a. Grain corn, SBM and premix (Table 1). A grower diet (0.83 % lysine) was fed until the pigs were 70 kg (per pen) followed by a finisher diet (0.69 % lysine) until they were marketed.
b. Similar diets and feeding strategy to control group. However a 10 percent inclusion rate of DDGS was added to replace some of the SBM as a protein source. To achieve similar levels of lysine an increased protein (CP) level was needed in the grower (19.1%) and finisher (16.8%) diets.
c. Similar diets and feeding strategy to control group with 20 percent DDGS added. An increased protein level was again needed in the grower (20.5%) and finisher (18.2%) diets to achieve similar dietary lysine levels.

The pigs (pens) were fed *ad libitum* with a required feed refusal or weighback taken once weekly. Ultrasound measurements (backfat and loin eye depth) were taken at the beginning of the trial, five weeks later and before the pigs were marketed by pen. All pigs were slaughtered at one location where carcasses were weighed and graded.

Table 1. Composition of experimental diets fed during growing and finishing feeding periods, kg of ingredient per tonne.

	Control Diet		10% DDGS Diet		20% DDGS Diet	
Ingredients	Grower	Finisher	Grower	Finisher	Grower	Finisher
Corn Grain (kg)	719	784	634	698	548	612
SBM (48%)	254	194	239	180	225	166
DDGS	-	-	100	100	200	200
RCAT Vitamin – Mineral Premix	27	22	27	22	27	22

Trial #2

Ninety-six pigs (48.8 ± 5.2 kg) were again randomly assigned to a pen and grower diet until 70 kilograms BW. They were then fed an assigned finisher diet until market weight ($\geq$ 110 kg BW) with similar methodologies (trial 1) and data collected. The following dietary treatments were formulated and fed:

a. Grain corn, SBM (control diets) and premix. A grower diet [17% CP (0.8% lysine)] was fed until the pigs were 70 kg BW followed by a finisher diet [14% CP (0.6% lysine)] until they were marketed.
b. Similar diets and feeding strategy to control group. However a 10 percent inclusion level of DDGS + additional crystalline lysine was added to produce diets with similar lysine content.
c. Similar diets and feeding strategy to control group. However a 20 percent inclusion level of DDGS + crystalline lysine was added to produce diets with similar lysine content.

d. Crude protein levels were similar to control diets. However a 10% inclusion level of DDGS was added with no additional lysine supplementation. Dietary lysine levels were therefore significantly reduced [0.7% (grower diet) & 0.5% (finisher diet)].

RESULTS FROM EXPERIMENT #1

All growth, feed intake, cost and carcass measurements (Table 2) were not influenced by DDGS inclusion level (0, 10 or 20% of diet). Days to market, daily gain, feed intake and feed efficiency (F/G) estimates were similar for each dietary treatment.

Feed costs (grower & finisher diets) were determined for years 2003 and 2004 by taking ingredient inclusion rates and multiplying by an appropriate corn grain (Chatham + $20 per tonne), soybean meal (Hamilton + $20 per tonne) and DDGS price (Chatham + $20 per tonne). A constant vitamin-mineral premix charge ($600 per tonne) was also included in each cost estimate. Costs of gain were then determined for each DDGS inclusion level by year. Since daily gain, feed intake and feed costs per tonne were similar, costs of gain were also comparable (P>0.05) for each dietary treatment.

Table 2. Effects of dietary treatment on pig growth rate, feed intake and cost, and carcass quality.

	Control Diet	10% DDGS Diet	20% DDGS Diet
	Growth Rate		
Number of pigs	30	36	30
Final Weight (kg)	113.3	114.0	113.6
Days to Market (by pen)	75.7	78.0	77.9
Average Daily Gain (kg)	1.06	1.04	1.04
	Feed Intake & Efficiency		
Total Feed Intake (kg)	220.5	218.4	215.7
Average feed intake (kg/d)	2.9	2.8	2.8
Feed efficiency (F/G)	2.7	2.7	2.7
Gain cost ($/kg) – 2003	0.60	0.60	0.59
Gain cost ($/kg) – 2004	0.62	0.61	0.60
	Carcass Measurements		
Hot Carcass weight (kg)	91.8	92.5	91.7
Yield Index (%)	60.4	60.0	60.3
Grade Fat (mm)	19.3	20.4	19.0
Muscle depth (mm)	61.7	62.8	62.1

*All LS means within row were similar (P > 0.05)

RESULTS FROM EXPERIMENT #2

Days to market (Table 3), daily gain, feed intake and feed efficiency (F/G) estimates were similar (P>0.05) for each dietary treatment. Similar daily gain and feed intakes were expected as control and diets containing crystalline lysine were balanced to a constant (first limiting amino acid) lysine level. Dietary differences for loin and fat depth, and feed cost ($/kg gain) were also not present (P>0.05). Similar growth rate, feed intake and efficiency estimates were also observed by Wahlstrom et al. (1970), Spiehs et al. (1999), Cook et al. (2005), and DeDecker et al. (2005) when DDGS containing diets were compared to typical corn-soybean meal diets. Cook et al. (2005), DeDecker et al. (2005) and Xu et al. (2007) indicated that performance was not impaired when diet contained up to 30% DDGS. In contrast Whitney et al. (2006) reported a reduced ADG when DDGS was fed at either 20 or 30% of the diet despite similar levels of daily feed intake. As a result, feed to gain (F/G) was increased for the 30% DDGS group. Linneen et al. (2007) also observed a linear ADG and daily feed intake decline as DDGS inclusion level increased from 0 to 20 percent. Reasons for the variation in performance are difficult to quantify but may be due to source analytical differences in DDGS quality (deLange et al. 2007).

Table 3. Effects of dietary treatment on pig growth rate, feed intake and cost, and carcass quality.

	Control Diet	10% DDGS + Lysine	20% DDGS + Lysine	10% DDGS no Lysine
Growth Rate				
Number of pigs	24	21	23	16
Days to Market (by pen)	56.6	56.7	55.2	56.6
Average Daily Gain (kg)	1.13	1.12	1.14	1.09
Feed Intake & Efficiency				
Total Feed Intake (kg)	174.7	170.6	171.3	170.9
Average feed intake (kg/d)	3.1	3.0	3.1	3.0
Feed efficiency (F/G)	2.8	2.7	2.7	2.6
Cost of gain ($/kg) – 2003	0.62	0.59	0.59	0.56
Cost of gain ($/kg) - 2004	0.64	0.60	0.59	0.57
Carcass Measurements				
Dressing Percentage	79.6	79.8	79.4	79.5
Yield Index (%)	61.3	61.1	60.5	60.8
Grade Fat (mm)	17.1^{a}	17.8^{ab}	19.3^{b}	18.5^{ab}
Muscle depth (mm)	62.0	62.6	61.3	64.0

[a] and [b] LS means within row that do not share a common superscript differ significantly (p < 0.05).

Cook et al. (2005) and Whitney et al. (2006) also reported similar back fat and carcass lean measurements to 30% DDGS while loin depth was reduced in the Whitney (2006) experiment. Our results (Tables 2 & 3) indicate similar ($P>0.05$) carcass measurements when diets contained 20% DDGS or less.

CONCLUSIONS

- When diets were balanced to a constant lysine level (growing and finishing phase) similar growth rate, feed intake and efficiency estimates were obtain when diets containing 0, 10 or 20 percent dried distillers grains and solubles (DDGS).

- Feed intakes were similar for each dietary treatment indicating that DDGS was a highly palatable feedstuff for the pigs during the growing and finishing phase (35 to 110 kg body weight).

- Carcass measurements were similar for each dietary treatment with comparable dressing percentage, lean yield index, loin depth and backfat thickness observed.

- Gain costs were similar for each DDGS inclusion level. However due to similar feed efficiencies, gain costs were strongly related to ingredient costs. Therefore producers are advised to incorporate DDGS when this co-product is favorably priced relative to corn and soybean meal.

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