

# Withdrawal of Corn DDGS from Late Finisher Rations: Effects on Performance, Carcass Traits and Economic Variables

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## Background

Corn distiller's dried grains with solubles (DDGS) is a co-product of ethanol production with nutritional characteristics (i.e., high fat, high protein) that allow it to displace more costly ingredients in least-cost diet formulations. The majority (~90%) of the fatty acids in corn DDGS are unsaturated. Because carcass fat in pigs generally reflects dietary fat composition, feeding high levels (~30%) of corn DDGS through to market could reduce carcass fat quality.

It may be possible to feed diets high in corn DDGS to grower-finisher pigs, but still minimize adverse impacts on carcass quality by withdrawing corn DDGS from finisher diets prior to market.

## Objective

The objective of this study was to evaluate the effects of different withdrawal patterns of corn DDGS from finisher diets on performance, carcass characteristics, meat quality and fat composition.

This poster summarizes the effects of the different withdrawal strategies on performance, carcass traits and economic variables.

## The Approach

Approximately 1000 crossbred barrows and gilts (~30 kg) housed in 50 single sex pens received either a wheat-soybean meal control (i.e., negative control) diet or a diet containing 30% corn DDGS for the first 3 phases (d0-63) of the grow-finish period. For the last two finisher phases (d 63 - 84 and d 84 - 105), pigs fed 30% corn DDGS were assigned to one of 3 withdrawal regimens or remained on the 30% corn DDGS (i.e., positive control) diet through to market weight (Table 1).

**Table 1.** Dietary inclusion of corn DDGS (%) in each treatment, by phase.

Treatment	Dietary Inclusion of Corn DDGS, %				
	Phase 1 (0 - 21 d)	Phase 2 (21 - 42 d)	Phase 3 (42 - 63 d)	Phase 4 (63 - 84 d)	Phase 5 (84 - 105 d)
0/0 (control)	0	0	0	0	0
30/30	30	30	30	30	30
20/20 Strategy	30	30	30	20	20
20/10 Strategy	30	30	30	20	10
20/0 Strategy	30	30	30	20	0

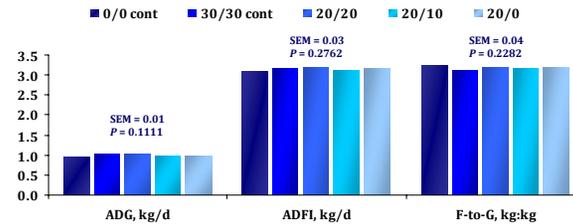
Pigs were weighed as a pen on d 0, 21, 42, 63, 84, 91, 98, and 105 to determine pen average weight and daily gain (ADG). Feed disappearance was measured for each pen on the same days to determine average daily feed intake (ADFI) and to calculate feed efficiency (gain-to-feed, G:F). Pigs were weighed on the day they were shipped and the number of days on test recorded.

Pigs were shipped over the course of 4 weeks based on weights achieved on d 84, 91, 98 and 105 to reflect current commercial practice. On each shipping day, a 10% subsample of the pigs representing each treatment was sent to Sturgeon Valley Pork (St. Albert, AB), with the remainder being sent to Britco (Langley, BC) for slaughter. Carcass measurements including warm carcass weight (WCW), lean depth in mm (LD) and fat depth in mm (FD) were obtained for the subsample of pigs in order to calculate dressing percentage (DRESS) and to estimate lean yield (LYLD) using the following equation:

$$\text{Lean Yield, \%} = 68.1863 - (0.7833 \times \text{FD}) + (0.0689 \times \text{LD}) + (0.008 \times \text{FD}^2) + (0.0002 \times \text{LD}^2) + (0.0006 \times \text{FD} \times \text{LD})$$

## Results

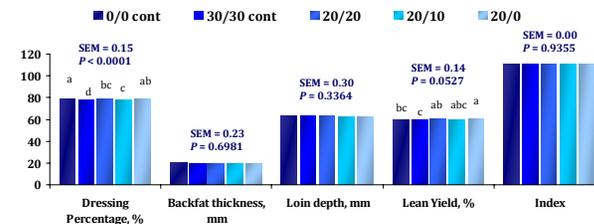
Animal performance was not affected by treatment (Figure 1). Weight gain (ADG), feed intake (ADFI) and feed efficiency (F-to-G) were similar across treatments.



**Figure 1.** Effect of corn DDGS withdrawal strategy on average daily gain (ADG), average daily feed intake (ADFI) and feed efficiency (F-to-G)

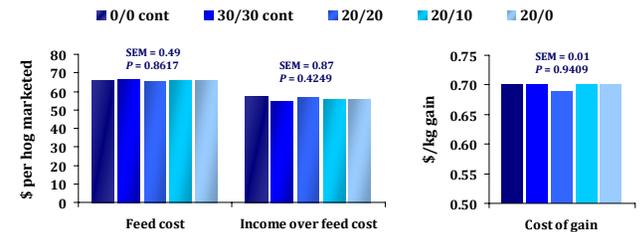
Carcass traits were also largely unaffected by corn DDGS withdrawal strategy (Figure 2). Only dressing percentage was different among treatments. Hogs on the 30/30 treatment had a lower dressing percentage than hogs on the 0/0 control. Implementing the withdrawal strategies improved dressing percentage incrementally. The 20/0 strategy resulted in similar dressing percentage to that of the 0/0 control.

Lean yield tended to decrease in hogs from the 30/30 compared to the 0/0 control. Implementing a withdrawal strategy increased yield and hogs from the 20/0 treatment showed a trend toward higher lean yield than the 0/0 control.



**Figure 2.** Effect of corn DDGS withdrawal strategy on dressing percentage and carcass traits.

There were no differences in economic variables, which were similar among the treatments compared (Figure 3). Total feed cost and income over feed cost in dollars per hog marketed were not different among treatments. Nor was the cost of gain, expressed as dollars per kg of gain.



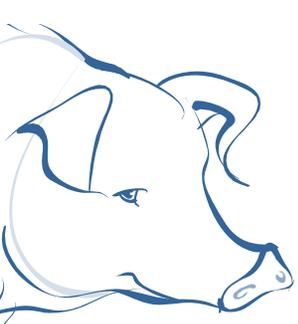
**Figure 3.** Effect of corn DDGS withdrawal strategy on total feed costs and income over feed costs (\$/hog marketed) and cost of gain (\$/kg gain).

## Take home message

Aside from a small reduction in dressing percentage and a trend toward lower lean yield between hogs from the 30/30 treatment and the 0/0 control, there was no difference among treatments in performance, carcass traits or economic variables. Implementation of the 20/0 withdrawal strategy resulted in similar dressing percentage and a trend toward superior lean yield compared to the 0/0 control. Producers who feed 30% corn DDGS through to market weight should consider marketing their hogs approximately 2 kg heavier in order to obtain similar dressed weights as pigs fed no corn DDGS.

## Acknowledgements:





# Withdrawal of Corn DDGS from Late Finisher Rations: Effects on Pork Quality, Retail Appearance and Sensory Evaluation

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## Background

Corn distiller's dried grains with solubles (DDGS) is a co-product of ethanol production with nutritional characteristics (i.e., high fat, high protein) that allow it to displace more costly ingredients in least-cost diet formulations. The majority (~90%) of the fatty acids in corn DDGS are unsaturated. Because carcass fat in pigs generally reflects dietary fat composition, feeding high levels (~30%) of corn DDGS through to market weight could impact carcass fat quality.

It may be possible to feed diets high in corn DDGS to grower-finisher pigs, but still minimize adverse impacts on carcass quality by withdrawing corn DDGS from finisher diets prior to market.

## Objective

The objective of this study was to evaluate the effects of different withdrawal patterns of corn DDGS from finisher diets on performance, carcass characteristics, meat quality and fat composition.

This poster summarizes the effects of the different withdrawal strategies on pork quality, sensory evaluation and retail appearance.

## The Approach

Approximately 1000 crossbred barrows and gilts (~30 kg) housed in 50 single sex pens received either a wheat-soybean meal control diet or a diet containing 30% corn DDGS for the first 3 phases (d0-63) of the grow-finish period. For the last two finisher phases (d 63-84 and d 84-105), pigs fed 30% corn DDGS were assigned to one of 3 withdrawal regimens or remained on the 30% corn DDGS diet through to market weight (Table 1).

**Table 1.** Dietary inclusion of corn DDGS (%) in each treatment, by phase.

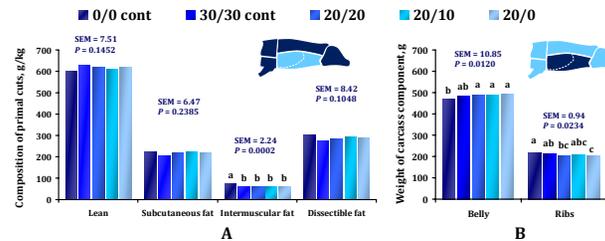
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30/30	30	30	30	30	30
20/20 Strategy	30	30	30	20	20
20/10 Strategy	30	30	30	20	10
20/0 Strategy	30	30	30	20	0

Pigs were shipped over the course of 4 weeks based on weights achieved on d 84, 91, 98 and 105 of the study, to reflect current commercial practice. On each shipping day, a 10% subsample of the pigs representing each treatment was sent to Sturgeon Valley Pork (St. Albert, AB).

After overnight chilling, carcasses were transported from Sturgeon Valley Pork in a refrigerated truck to Agriculture and Agri-Food Canada's research station at Lacombe, AB, where quality, sensory attributes and retail appearance of fresh pork were evaluated.

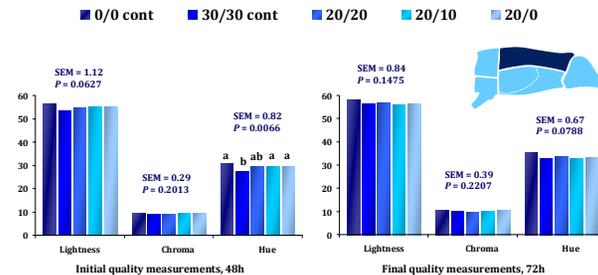
## Results

Treatment had a few effects on yield and composition of primal cuts. Feeding 30% corn DDGS or implementing one of three DDGS withdrawal strategies reduced the amount of intermuscular fat in each of the four primal cuts (picnic, butt, loin and ham) and all four leanest cuts combined. Implementing the three DDGS withdrawal strategies also increased the weight of the squared, trimmed belly, which proportionately reduced the weight of the spare ribs (Figure 1).



**Figure 1.** Effect of corn DDGS withdrawal strategy on a) composition of all primal cuts (i.e., ham, loin, picnic and butt) combined; and, b) weight of ribs and squared, trimmed belly.

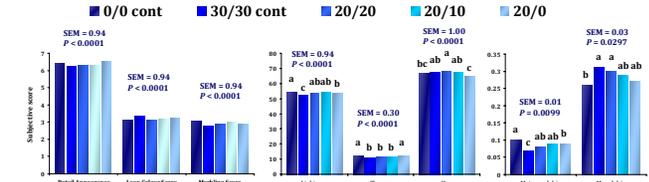
Loin quality was not affected by treatment, except for differences in lightness of uncooked loin chops, measured with a light reflectance camera (Figure 2). Loin chops from the 30/30 treatment were darker than the 0/0 control 48h after slaughter. The 20/10 and 20/0 withdrawal strategies resulted in loin chops with similar lightness to the 0/0 control at 48h after slaughter. There were no differences in objective colour measurements among treatments at 72h after slaughter.



**Figure 2.** Effect of corn DDGS withdrawal strategy on initial (48h) and final (72h) objective colour measurements of uncooked loin chops using a light reflectance camera. Higher lightness values indicate more light is reflected back (i.e., the surface appears whiter or paler), chroma refers to the intensity of colour saturation and hue describes the extent of a specific tint (e.g., light pink).

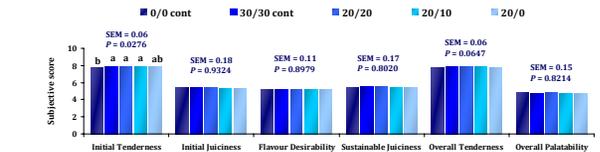
Five trained panelists scored retail appearance and marbling lower, but lean colour higher for loin chops from the 30/30 treatment compared to the 0/0 control after 3 days in a refrigerated retail case. The panel scored chops from the 20/10 and 20/0 treatments similar to those from the 0/0 control for all measures of retail acceptability (Figure 3).

Objective colour measurements and the proportion of meat pigments in different colour states were different between the 30/30 and 0/0 controls. All three withdrawal strategies improved these measurements relative to the 30/30 control.



**Figure 3.** Effect of corn DDGS withdrawal strategy on selected subjective, objective colour and meat pigment measurements relating to retail acceptability of loin chops after 3 days in a refrigerated retail case.

Twenty trained taste panelists did not perceive any differences in the chops based on 20 criteria. Burgers (80% lean, 20% fat ground) manufactured from pork from the 30/30 control, 20/20 and 20/10 treatments scored higher for initial tenderness compared to the 0/0 control, whereas 20/0 burgers scored intermediate (Figure 4).



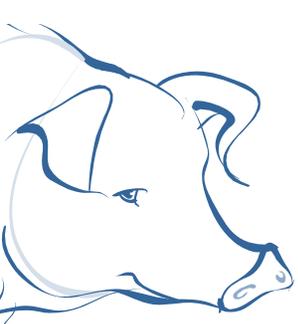
**Figure 3.** Taste panel scores for various taste attributes of burgers manufactured from pork resulting from different corn DDGS withdrawal patterns from late finisher diets.

## Take home message

Despite minor impacts on composition of primal cuts, the weight of ribs versus the belly and retail appearance, dietary treatment had little impact on sensory evaluation of cooked chops and burger patties. Feeding pigs 30% corn DDGS through to market weight therefore would appear to yield pork with similar or better quality and sensory attributes as feeding no corn DDGS at all.

## Acknowledgements:





# Withdrawal of Corn DDGS from Late Finisher Rations: Effects on Backfat and Belly Quality

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## Background

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It may be possible to feed diets high in corn DDGS to grower-finisher pigs, but still minimize adverse impacts on carcass quality by withdrawing corn DDGS from finisher diets prior to market.

## Objective

The objective of this study was to evaluate the effects of different withdrawal patterns of corn DDGS from finisher diets on performance, carcass characteristics, meat quality and fat composition.

This poster summarizes the effects of the different withdrawal strategies on backfat and belly quality.

## The Approach

Approximately 1000 crossbred barrows and gilts (~30 kg) housed in 50 single sex pens received either a wheat-soybean meal control diet or a diet containing 30% corn DDGS for the first 3 phases (d0-63) of the grow-finish period. For the last two finisher phases (d 63-84 and d 84-105), pigs fed 30% corn DDGS were assigned to one of 3 withdrawal regimens or remained on the 30% corn DDGS diet through to market weight (Table 1).

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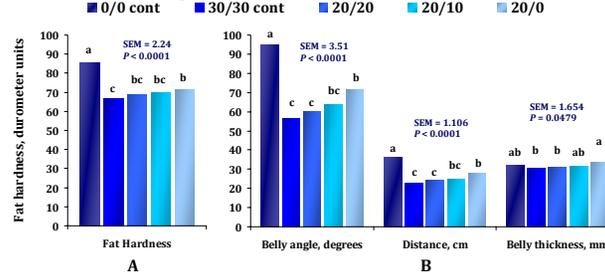
Pigs were shipped over the course of 4 weeks based on weights achieved on d 84, 91, 98 and 105 to reflect current commercial practice. On each shipping day, a 10% subsample of the pigs representing each treatment was sent to Sturgeon Valley Pork (St. Albert, AB).

After overnight chilling, carcasses were transported to Agriculture and Agri-Food Canada's research station at Lacombe, AB where carcasses were dissected into primal cuts and fat quality and composition analyses were conducted.

## Results

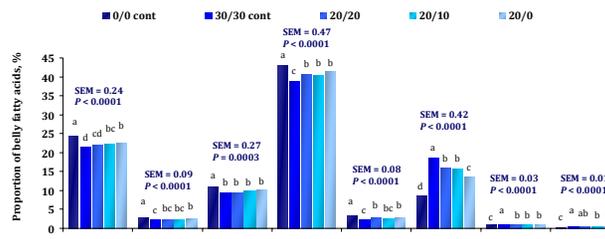
Backfat from 30/30 hogs was softer than that from 0/0 control hogs (Figure 1a). Reducing to 20%, followed by entirely removing corn DDGS from the last finisher diet prior to hogs reaching market weight improved, but did not entirely restore backfat hardness.

Belly thickness was reduced in 30/30 and 20/20 hogs compared to the 0/0 controls (Figure 1b). Belly thickness of 20/10 and 20/0 hogs, however, was similar to the 0/0 controls. Similarly, when bellies were draped over a bar to rate belly fat hardness, the 30/30 and 20/20 treatments reduced both the distance between the two hanging ends and the angle formed at the bar compared to bellies of 0/0 control hogs. The 20/10 and 20/0 withdrawal strategies improved bar angle and distance compared to the 30/30 treatment, but did not restore these parameters to levels observed for the 0/0 controls.



**Figure 1.** Effect of corn DDGS withdrawal strategy on a) backfat hardness, and b) selected measures relating to belly quality.

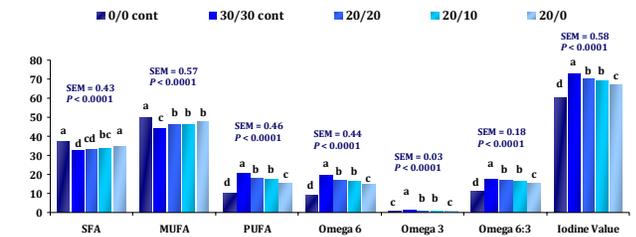
Belly fat from hogs on the 30/30 had a higher proportion of unsaturated fatty acids (C18:2n-6, C18:3n-3, C20:4n-6), and consequently a lower proportion of saturated (C16:0) and monounsaturated (c9-16:1, c9-18:1, c11-18:1) fatty acids compared to 0/0 control hogs (Figure 2). Implementing any of corn DDGS dietary withdrawal strategies for the last two finishing growth phases prior to market weight resulted in mostly intermediate fatty acid content (between the 30 and 0% DDGS).



**Figure 2.** Effect of corn DDGS withdrawal strategy on proportions of specific fatty acids in belly fat expressed as a percentage of total fatty acids.

The proportion of polyunsaturated fatty acids (PUFA), including omega-6 and 3, was higher; while saturated (SFA) and monounsaturated (MUFA) fatty acids were lower in belly fat of 30/30 hogs compared to 0/0 control hogs (Figure 3). The three corn DDGS withdrawal strategies generally yielded fatty acid profiles in belly fat intermediate to the 0/0 control and 30/30 treatment. The most aggressive withdrawal strategy (i.e., 20/0) did however yield similar SFA content to the 0/0 control.

Iodine value (or number) is a measure of the relative amount of unsaturated fatty acids in a fat sample and should be no higher than 70 to 74 in pork to avoid issues with soft fat. Iodine value was higher in all corn DDGS treatments relative to the 0/0 control, but none of the values exceeded the 70-74 range. The 20/0 strategy yielded belly fat with an iodine value of 67, which was still higher than the value of 60 obtained for the 0/0 control, but well below the value of 72 observed for the 30/30 treatment.



**Figure 3.** Effect of corn DDGS withdrawal strategy on relative proportions of saturated (SFA), mono- (MUFA) and poly-unsaturated fatty acids (PUFA); omega-3 and omega-6 fatty acids in, and iodine value of fat tissue in pork bellies.

## Take home message

Feeding corn DDGS generally resulted in softer fat, both in backfat and belly. Soft fat resulted from a shift in the fatty acid profile towards a greater proportion of polyunsaturated versus saturated and monounsaturated fatty acids. Differences were most evident between the 30/30 treatment and the 0/0 controls. Although the withdrawal strategies improved fatty acid profiles, even the most aggressive withdrawal strategy (i.e., 20/0) was unable to restore fat hardness to that of the 0/0 control.

We recommend that producers maximize the use of corn DDGS in the grower phase and develop a finisher phase withdrawal strategy based on inclusion levels in earlier phases. However, we questioned the need for feeding programs that incorporate DDGS to achieve 'zero impact' on fat hardness.

## Acknowledgements:

