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Economic Optimum Use of Wet Distillers Grains in Feedlots

Kyle J. Vander Pol
University of Nebraska-Lincoln

Galen E. Erickson
University of Nebraska-Lincoln, gerickson4@unl.edu

Terry J. Klopfenstein
University of Nebraska-Lincoln, tklopfenstein1@unl.edu

Darrell R. Mark
University of Nebraska-Lincoln, dmark2@unl.edu

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Galen E. Erickson
Terry J. Klopfenstein
Darrell R. Mark [1]

Summary

An economic analysis was conducted using feedlot performance, current feed ingredient prices, trucking, and cost of feeding inputs to determine economics of feeding wet distillers grains plus solubles (WDGS) at five dietary inclusions. The analysis also incorporated positive corn basis into the model. Cattle returns are greatest when incorporated WDGS is fed at 30 to 40% of DM at feedlots located between 0 and 60 miles from the plant. As distance of the feedlot increases from 60 to 100 miles from the plant, optimum inclusion is between 20 and 30% of dietary DM. Either a 5 or 10 cent positive corn basis decreases net returns on cattle by approximately $2 for each $0.05 increase in corn bushel price, but optimum inclusion amounts do not change based on distance from the plant. Results indicate more than just the cost of the product influence the economics of feeding WDGS.

Introduction

It is well documented that incorporating wet distillers grains plus solubles (WDGS) into feedlot diets yields energy values greater than corn (Ham et al., *1994 Nebraska Beef Report*, pp. 38-40; Vander Pol et al., *2006 Nebraska Beef Report,* pp. 51-53). As a result, WDGS popularity has increased especially in close proximity to ethanol plants. Another contributing factor leading to increased use is the rapid expansion of the ethanol industry, resulting in a relatively stable price.

The energy value of WDGS relative to corn is 120 to 180% depending on inclusion amount of 10 to 50% of diet DM (Vander Pol et al., *2006 Nebraska Beef Report,* pp. 51-53). However, WDGS is typically priced at 90 to 95% the price of corn at the ethanol plant. Therefore, the relatively high value compared to price has encouraged WDGS use by feedlots. However, WDGS is a relatively wet product, with average DM between 30 and 35%. WDGS typically replaces corn in feedlot diets. Due to the higher moisture content, the price is presumably greater to deliver WDGS to the bunk compared to corn. Therefore, in order for WDGS feeding to be profitable, the higher energy value associated with WDGS has to be able to make up for the increase in delivery cost at the bunk associated with feeding WDGS relative to corn.

Therefore, the objectives of this research were to determine the economic benefit of feeding WDGS relative to feeding a typical high concentrate corn based finishing diet. Energy value, inclusion rate, distance from the plant, increased feeding cost and corn price sensitivity impact on the economics were also evaluated.

Procedure

Performance Inputs

Twenty-one treatment means from 11 published research trials conducted in Illinois, Iowa, and Nebraska that involved feeding WDGS across a range of inclusions from 10 to 50% of DM were compared to develop an equation to predict the energy response (energy relative to corn) of feeding WDGS compared to corn. Because the energy value changes with inclusion amount, an equation was developed and was a linear relationship of $y = -0.84x + 164.2$ ($R^2 = 0.28$), where x equals percentage dietary inclusion of WDGS and y is the energy value relative to corn. For the economic modeling, inclusions of 10, 20, 30, 40, and 50% (DM basis) were evaluated.

The energy value of WDGS relative to corn for all 21 treatment means used was calculated utilizing feed efficiency values from each treatment comparison. The equation was based on comparing the WDGS treatment to that experiment's control performance. Therefore, WDGS energy value relative to corn was calculated as: ((WDGS feed efficiency - control feed efficiency)/control feed efficiency)/WDGS inclusion (DM basis). Therefore, using a published control value (Vander Pol et al., *2006 Nebraska Beef Report,* pp. 51-53) and calculated energy values for each inclusion level, allowed calculation of an adjusted feed efficiency value for each of the five WDGS inclusions.

For ADG, one data set was used that evaluated all the theoretical inclusions of 10, 20, 30, 40, and 50% (Vander Pol et al., *2006 Nebraska Beef Report,* pp. 51-53). The observed quadratic ADG equation as WDGS increased was used to develop an ADG prediction equation across WDGS inclusion levels. The equation was $y = -0.0007x^2 + 0.04x + 3.66$ ($R^2 = 0.91$), where x equals dietary inclusion of WDGS and y equals predicted ADG at that inclusion. Using this equation and the five WDGS inclusions to be evaluated (10, 20, 30, 40, and 50% of DM) allowed calculation of an adjusted ADG for each inclusion. The estimate for DMI was calculated using adjusted ADG divided by adjusted feed efficiency.

After adjusted ADG values were determined for each inclusion, these values were used to determine the number of days on feed a typical feedlot animal would need to be fed to achieve the same final body weight as a feedlot animal fed 0% WDGS for 153 days. For example, the control cattle gained 3.66 lb/d for 153 days (560 lb). Because cattle fed WDGS have greater ADG, less days are required to gain 560 lb. Therefore, days on feed were necessary for yardage calculations, and for appropriate DMI at each inclusion amount.

Feed Ingredient Prices and Return

WDGS are typically priced between 90 and 95% the price of corn at the plant, therefore, we assumed WDGS was priced at 95% of the corn

Table 1. Cost of feeding, adjusted days on feed, and yardage adjustments for cattle fed 10, 20, 30, 40, or 50% WDGS relative to an animal fed 0% WDGS for 153 days.

WDGS Inclusion[a]	10%	20%	30%	40%	50%
DMI, lb/day[b]	24.9	25.3	25.3	24.8	23.9
Adjusted DOF, day[c]	139.3	132.1	129.6	131.4	137.9
Yardage adjustment, $/head[d]	4.25	6.49	7.25	6.68	4.68
Total DMI, lb[e]	3469	3346	3280	3265	3298
DM of diet, %	70.6	63.5	57.7	52.9	48.8
Total feed (as is), lb[f]	4917	5273	5685	6175	6761
Feeding cost, $/head[g]	13.86	14.86	16.02	17.41	19.06

[a]WDGS inclusion as a percentage of diet DM.
[b]Calculated from adjusted ADG divided by adjusted gain:feed ratio.
[c]Adjusted days on feed equal total weight gain of control animal divided by adjusted ADG for each WDGS inclusion.
[d]Calculated from 153 days on feed minus adjusted days on feed multiplied by yardage cost ($0.31).
[e]DMI lb/d multiplied by adjusted days on feed.
[f]Total DMI divided by ration DM percentage.
[g]Feeding cost equal total as-is feed for each WDGS inclusion minus total as-is feed for control, divided by total as is feed for control multiplied by $13.00.

Table 2. Return ($/head) above cattle fed a conventional corn based diet with no WDGS, utilizing 10-year average corn price at the plant, adjacent to and three distances from the ethanol plant.[a,b,c,d]

WDGS Inclusion[e]	10%	20%	30%	40%	50%
Adjacent to plant	16.10	24.99	29.49	29.79	25.38
30 miles from plant	14.62	22.12	25.27	24.20	18.30
60 miles from plant	13.13	19.25	21.05	18.59	11.23
100 miles from plant	11.14	15.42	15.43	11.12	1.79

[a]Ten-year average corn price = $2.30/bushel.
[b]Values account for adjusted days on feed.
[c]Values account for increased costs of feeding.
[d]Trucking cost equal $2.50/mile.
[e]WDGS inclusion as a percentage of diet DM.

price, FOB (i.e., at the plant). Prices for corn and alfalfa hay were 10-year averages, equating to $2.30/bushel and $54.54/ton, respectively (*www.feuzmarketanalysis.com*). Current prices at the time of analysis were utilized for other basal ingredients, which were primarily micro ingredients totaling 5% of DM, or typical of a dry supplement.

Returns ($/hd) for feeding a steer 10, 20, 30, 40, or 50% WDGS relative to a steer fed 0% WDGS (i.e., 80% corn alone) for 153 days were calculated by determining the break even price of WDGS, or the price you could pay for WDGS when profits were equivalent to the control cattle. This was the cost of the control diet minus the cost of the basal ingredients in the five different WDGS diets divided by the amount (ton equivalent) of WDGS used in that diet. The difference between the break even cost and actual cost of WDGS for the amount of WDGS fed determined the $/head return for WDGS at each of the five dietary inclusions.

Corn Basis, Trucking Cost, Distance from the Plant, and Feeding Costs

It has been postulated that the presence of an ethanol plant will increase the demand for corn within close proximity of the plant, thus increasing the basis (cash price minus futures price) of corn in the immediate area. To account for this potential increase in corn price, price was increased either 0, 5, or 10 cents/bushel at the plant. Given these scenarios, and WDGS priced at 95% that of corn, a positive corn basis at the plant would result in a higher price paid for WDGS and corn remaining in the diet. In addition, a sensitivity component was included in the model to determine at what price feeding WDGS is more or less profitable. Inputs for this component were $1.80, $2.30, and $2.80/bushel corn at the plant.

Trucking costs at the time of analysis were assumed to be $2.50/loaded mile based on a 25 ton (as is) load. Since all feedlots are not immediately adjacent to the ethanol plant, we evaluated the economics for a feedlot 0, 30, 60, and 100 miles from the ethanol plant.

The cost of feeding WDGS in feedlots is greater than corn since WDGS has a much higher moisture content relative to corn, and there is a cost associated with hauling wet feed (more total weight) to a given feedlot pen. Therefore, we assumed the cost of feeding 0% WDGS was approximately 1/4 of yardage ($0.32/steer/d) giving a cost of feeding of $13.00 for a control (corn only) steer for 153 days. The increased feeding cost would account for equipment, labor, fuel, etc. To calculate the increase in feeding cost for diets utilizing WDGS we multiplied the percentage increase in as-fed amount of feed hauled to a pen by the $13.00 cost of feeding 0% WDGS for each WDGS inclusion we evaluated.

Results

The increased costs of feeding WDGS at five inclusions, adjusted days on feed, and corresponding yardage adjustments are presented Table 1. Days on feed, which are derived using the ADG values calculated for the five different dietary inclusions follows a quadratic pattern as dietary inclusion increases. Days on feed is lowest for cattle fed 30% WDGS (130 days), and highest for cattle fed 10% WDGS (139 days) assuming control cattle are fed 153 days. The reduced days on feed equates to a savings of $7.25 for an animal fed 30% WDGS. As mentioned previously, the cost of feeding a diet containing 0% WDGS for 153 days (153 days = industry average) is estimated to be $13.00 per animal. Because WDGS is a relatively wet product, the cost of feeding increases from $13.86/hd at a 10% inclusion, to $19.06/hd at a 50% dietary inclusion.

Assuming that feeding WDGS does not effect corn price, return ($/hd) near the plant, as well as 30, 60, and

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100 miles from the plant are presented in Table 2. These results suggest that feedlots at or near the plant have the greatest economic advantage to use a 40% WDGS dietary inclusion. However, as distance from the plant increases to 30 miles, the return is highest for WDGS inclusions between 30 and 40%. The economic optimum inclusion is decreased as the distance from the plant reaches 100 miles. Between 60 and 100 miles from the ethanol plant it is most economically favorable to utilize between a 20 and 30% dietary inclusion of WDGS.

Data evaluating a 5 cent/bushel positive corn basis at the ethanol plant are presented in Table 3. As with the ten-year average corn price, a 5 cent/bushel increase in corn price favors a 40% WDGS inclusion at or near the plant. At a distance up to 30 miles away the economic advantage of feeding WDGS is highest between a 30 and 40% inclusion. As distance from the plant and subsequent trucking cost increase up to 100 miles away from the plant, the economic advantage to feeding WDGS is highest between 20 and 30% dietary inclusion.

If corn basis at the ethanol plant is increased to 10 cent/bushel, the trends for the economic optimum inclusions do not change (Table 4). However, the overall return above cattle fed a conventional corn diet is decreased compared to a $0.05 basis or 0 basis. Therefore, as corn basis increases with ethanol plant construction, there is a lower return than if the plant had no impact on corn price. However, even if corn price increases, the feedlot has larger net returns with WDGS than without the by-product feed. The only scenario that is negative return was feeding 50% WDGS at a feedlot 100 miles from the ethanol plant. Further, the sensitivity analysis using either $1.80, $2.30, or $2.80/bushel corn generated similar trends as the corn basis data. A key to these results is the conventional corn comparison is cheaper because this assumes the ethanol plant was not built. Therefore, both the corn and the WDGS (priced relative to corn) are higher priced.

Table 3. Return ($/head) above cattle fed a conventional corn based diet with no WDGS, assuming a 5 cent/bushel increase above the 10-year average corn price at the plant, adjacent to and three distances from the ethanol plant.[a,b,c,d]

WDGS Inclusion [e]	10%	20%	30%	40%	50%
Adjacent to plant	14.64	21.86	26.44	26.78	22.34
30 miles from plant	13.17	18.99	22.22	21.18	15.26
60 miles from plant	11.70	16.12	18.00	15.58	8.19
100 miles from plant	9.73	12.29	12.37	8.11	-1.25

[a]Ten-year average corn price = $2.30/bushel.
[b]Values account for adjusted days on feed.
[c]Values account for increased costs of feeding.
[d]Trucking cost equal $2.50/mile.
[e]WDGS inclusion as a percentage of diet DM.

Table 4. Return ($/head) above cattle fed a conventional corn based diet with no WDGS, assuming a 10 cent/bushel increase above the 10-year average corn price at the plant, adjacent to and three distances from the ethanol plant.[a,b,c,d]

WDGS Inclusion [e]	10%	20%	30%	40%	50%
Adjacent to plant	9.57	19.73	23.39	23.75	19.31
30 miles from plant	8.08	15.86	19.17	18.16	12.23
60 miles from plant	6.60	12.99	14.95	12.56	5.15
100 miles from plant	4.61	9.16	9.32	5.09	-4.28

[a]Ten-year average corn price = $2.30/bushel.
[b]Values account for adjusted days on feed.
[c]Values account for increased costs of feeding.
[d]Trucking cost equal $2.50/mile.
[e] WDGS inclusion as a percentage of diet DM.

A primary driver for the use of WDGS in finishing diets has been the improved feed efficiency associated with the product. From an economic standpoint, it appears that the improved feed efficiency drives the economic advantage when using the product at specific levels. However, certain scenarios such as increased trucking and feeding costs can significantly reduce the economic benefit associated with the use of WDGS. It is important also to note that feeding a product high in moisture and phosphorus can impact the costs associated with shrink and manure handling which were not evaluated in this model. Other research (Kissinger et al., *2006 Nebraska Beef Report,* pp. 94-97) evaluating the cost of managing feedlot manure phosphorus suggest that the cost of handling the additional manure phosphorus generated by feeding by-products such as WDGS is roughly $0.75 to $1.00/hd going from 0 to 30 or 40% DM inclusion.

In conclusion feedlot managers and nutritionists should evaluate more than just the price of WDGS when determining an optimum dietary inclusion level. Based on these results, it appears that returns have been good for feedlots in close proximity to ethanol plants using wet by-products. The performance data, along with these economic data, suggest that up to 40% WDGS (DM basis) can be fed, which is probably more than is commonly used today.

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[1]Kyle J. Vander Pol, research technician; Galen E. Erickson, assistant professor; Terry J. Klopfenstein, professor, Animal Science, Lincoln. Darrell R. Mark, assistant professor, Agricultural Economics, Lincoln.