# Effects of Urea and Distillers Inclusion in Finishing Diets on Steer Performance and Carcass Characteristics

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## Summary with Implications

*An experiment was conducted to evaluate the effect of supplemental urea in dry rolled corn based finishing diets containing low inclusions of distillers grains. Treatments were set up in a 3 × 3 factorial arrangement. The first factor was wet distillers inclusion at either 10, 15, or 20% of diet DM. The second factor was urea inclusion at either 0, 0.5, or 1.0% of diet dry matter. Increasing inclusion of distillers linearly improved feed conversion and linearly reduced dry matter intake. An interaction for feed efficiency was observed where there was no effect of added urea when 10% or 20% distillers was fed and a quadratic effect was observed when 15% distillers grains was fed where 0.5% urea appeared to be optimum. Added urea in a finishing diet with 20 or 10% distillers has minimal impact on finishing performance; however, feeding 0.5% urea in a 15% distillers diet may be beneficial.*

## Introduction

Distillers grains are a good source of protein containing around 30% CP with 63% of this CP being rumen ungradable protein. With inclusions of distillers grains in finishing diets being greater than 25% over the past 10 years, protein has been over fed; therefore, meeting protein requirements (RDP and MP) hasn't been an issue. Previous research would suggest that when feeding distillers grains in dry rolled corn (DRC) based diets at greater than 25% of diet DM, no additional urea supplementation is needed to maintain animal performance. However, with increasing distillers grain price, inclusion of distillers has decreased to a level where adding supplemental urea may be beneficial. A recent survey suggested that, in the Midwest, the average inclusion of distillers in commercial feedlots is 19.9% of diet DM. Previous research has evaluated feeding 10 or 20% dry distillers with or without urea and they observed no performance response with added urea. However, there was a numerical improvement in feed conversion in the 10% distillers diet (*2005 Nebraska Beef Cattle Report*, pp 42–44).

With limited research on the topic, the objective of this research was to determine the effects of supplementing urea in dry rolled corn based finishing diets containing low inclusions of distillers grains.



## Procedure

Four hundred and thirty two crossbreed steers were utilized in a study at the Panhandle Research and Extension Center near Scottsbluff NE. Treatments were set up in a 3×3 factorial arrangement with factors consisting of three distillers inclusions (10, 15, or 20% of the diet DM) and three urea inclusions (0, 0.5, or 1.0% of diet DM). Diets were dry-rolled corn (DRC) based using corn silage as the roughage source (Table 1). A liquid supplement was utilized and contained either 0 or 1% urea and the 0.5% urea treatment was accomplished by mixing a 50:50 blend of the 2 supplements. Cattle were fed once daily in the morning and managed on a slick bunk protocol. Rumensin (Elanco Animal Health) was supplied to the cattle at 360 mg/hd/d and Tylan (Elanco Animal Health) was supplied at 90 mg/hd/d added to the diet using a micro machine (Animal Health International). Three blocks were used with one replication in the light block, three replications in the middle block, and two replications in the heavy block. This design totaled 54 pens with 6 replications per treatment.

Blood was collected twice during the finishing period for plasma urea nitrogen (PUN) analysis. Blood was collected from three randomly selected animals per pen in the morning prior to feeding. These same three animals were used for both blood collections. The first blood collection was on d 28 of the finishing period after all cattle had been fully adapted onto their respective finishing diet. The second blood collection was on d 92 of the finishing period.

Cattle were implanted with a TE-IS (Elanco Animal Health) on d 28 and reimplanted with a TE-S (Elanco Animal Health) on d 90 of the finishing period. The Heavy block was on feed for 153 days and the light and mid blocks were on feed for 167 days. Cattle were slaughtered at a commercial abattoir (Cargill Meat Solutions, Fort Morgan, CO) and carcass data collected.

Data were analyzed using the mixed procedure of SAS for performance, carcass and blood variables with block and treatment as fixed effects. Blood data were analyzed as a repeated measure over time. Due to missing carcass data on the heavy block, data from that block were omitted from the carcass and carcass adjusted analysis of performance leaving 36 pens with 4 replications per treatment for these observations.

## Results

Performance data are presented in Table 2. There were no significant interactions between distillers and urea inclusion ($P \geq 0.11$) with the exception of F:G so only the main effects are presented. There was a significant quadratic interaction ($P = 0.05$) between distillers and urea inclusion for carcass adjusted F:G (Figure 1). At 10% distillers, F:G appears to remain consistent as urea is increased in the diet. When feeding 15% distillers added urea appears to have a quadratic effect on F:G with lower F:G at 0.5% urea inclusion. For 20% distillers in the diet adding urea at 0.5% of the diet appears to have a negative impact on F:G while1.0% urea resulted in similar performance to the 0 urea control. This interaction would suggest that when

**Table 1. Diet ingredient composition as % of diet DM by treatment**

| | 10% Distillers | | | 15% Distillers | | | 20% Distillers | | |
|---|---|---|---|---|---|---|---|---|---|
| Ingredient | 0 | 0.5 | 1.0 | 0 | 0.5 | 1.0 | 0 | 0.5 | 1.0 |
| DRC, % DM | 69 | 69 | 69 | 64 | 64 | 64 | 59 | 59 | 59 |
| WDGS, % DM | 10 | 10 | 10 | 15 | 15 | 15 | 20 | 20 | 20 |
| Corn Silage, % DM | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Supplement[1] , % DM | 6 | 5.5 | 5 | 6 | 5.5 | 5 | 6 | 5.5 | 5 |
| Urea, % DM | 0 | 0.5 | 1.0 | 0 | 0.5 | 1.0 | 0 | 0.5 | 1.0 |
| Crude Protein, % | 10.8 | 12.2 | 13.6 | 12.0 | 13.4 | 14.7 | 13.1 | 14.5 | 15.9 |
| Initial MP Balance[2], g/d | -105 | -47 | 8 | -41 | 14 | 28 | -6 | 94 | 39 |
| Initial RDP Balance, g/d | -196 | -54 | 86 | -158 | -19 | 118 | -118 | 16 | 147 |
| Midpoint MP Balance[2], g/d | -51 | 15 | 70 | 17 | 86 | 95 | 67 | 168 | 115 |
| Midpoint RDP Balance, g/d | -210 | -58 | 94 | -170 | -21 | 126 | -127 | 17 | 158 |

[1] Micro machine was used to add 360 mg of Rumensin and 90 mg per steer of Tylan to the diet daily.

[2] Metabolizable Protein balance calculated using 1996 NRC Model to predict MP supply corrected for RDP balance deficiency if one existed (MP balance-(RDP balance*.64)). Initial MP balance is calculated for the end of the step up period and midpoint MP balance was calculated for the middle of the finishing period.

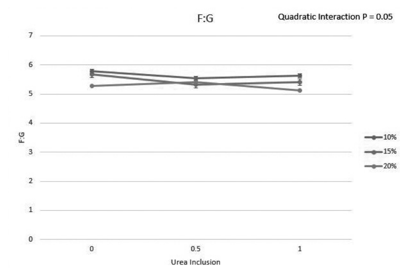


Figure 1. Carcass adjusted F:G interaction distillers level and urea inclusion.

feeding 10 or 20% distillers grains added urea in the diet has minimal benefit on performance but when feeding 15% distillers grains some added urea may be beneficial. However, with this type of interaction it is difficult to make conclusions and determine if the interaction is real or due to random variation in the data. Additionally, the missing carcass data from the heavy block of cattle may have had an effect on the data. A depression in animal performance for 20% distillers and 0.5% urea inclusion is the primary cause for the interaction, which is difficult to explain biologically.

The remaining performance variables were analyzed for main effects. For live performance, DMI and F:G decreased linearly ($P < 0.01$) with increasing inclusion of distillers grains. Additionally, a linear decrease ($P = 0.05$) in F:G was observed for increasing levels of urea in the diet. Visually, while not significant ($P = 0.26$) F:G appears to be quadratic with a plateau appearing at 0.5% urea. There was no difference ($P = 0.49$) in DMI observed for increasing urea levels. Average daily gain and final live weight increased linearly ($P < 0.03$) as distillers grains increased in the diet; however, ADG and final live weight tended to have a quadratic response ($P < 0.09$) with increasing levels of urea in the diet with maximum values at 0.5% inclusion.

For carcass adjusted performance, a tendency for a linear increase ($P \leq 0.08$) in final BW and ADG was observed for increasing levels of distillers grains. Both DMI and F:G linearly decreased ($P < 0.01$) as distillers grains was increased in the diet. Additionally F:G was linearly decreased ($P = 0.02$) with the addition of urea in the diet however, no other measures were significantly ($P \geq 0.14$) affected by urea inclusion.

A tendency for a linear increase ($P = 0.08$) in HCW was observed with increasing levels of distillers grains in the diet. Additionally, a linear increase ($P < 0.01$) in 12$^{th}$ rib fat thickness was observed with increasing levels of distillers grains in the diet. However, there were no other significant ($P \geq 0.15$) differences for carcass characteristic for either distillers or urea inclusion in the diet. Plasma urea nitrogen linearly increased ($P < 0.01$) for both added distillers and added urea in the diet. Others have found a minimum BUN value of 7 mg/100 mL to be necessary for optimum performance to be maintained. The values for the current trial are more than double (> 17.8) this value suggesting that there was more than enough excess nitrogen in the blood to maintain performance across all treatments.

## Conclusion

Based on these results, when feeding 10 or 20% distillers grains in a finishing diet added urea is of limited benefit for animal performance. However, when feeding 15% distillers grains in the diet adding 0.5% urea to the diet appears to improve feed efficiency. However, it is difficult to explain the variation across 10, 15, and 20% inclusion. Our conclusion is that urea supplementation was unnecessary. Increasing inclusion of distillers grains in the diet even from 10 to 20% improved gain and reduced intake, thereby improving feed conversion.

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**Table 2. Main effects of distillers inclusion and urea inclusion on performance**

| | Distillers, % diet DM | | | | *P*-Value | | Urea, % Diet DM | | | | *P*-Value | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Measure | 10 | 15 | 20 | SEM | Lin | Quad | 0% | 0.5% | 1.0% | SEM | Lin | Quad |
| *Live Performance* | | | | | | | | | | | | |
| Initial BW, lb | 617 | 616 | 615 | 1 | 0.06 | 0.94 | 617 | 616 | 616 | 1 | 0.22 | 0.75 |
| Final BW, lb | 1328 | 1337 | 1345 | 6 | 0.03 | 0.94 | 1328 | 1344 | 1338 | 6 | 0.19 | 0.09 |
| ADG, lb/d | 4.39 | 4.45 | 4.50 | 0.03 | 0.01 | 0.96 | 4.39 | 4.49 | 4.46 | 0.03 | 0.16 | 0.08 |
| DMI, lb/d | 24.1 | 24.0 | 23.4 | 0.2 | <0.01 | 0.16 | 23.9 | 23.9 | 23.7 | 0.2 | 0.49 | 0.61 |
| F:G | 5.49 | 5.40 | 5.18 | 0.002 | <0.01 | 0.25 | 5.43 | 5.32 | 5.32 | 0.002 | 0.05 | 0.26 |
| *Carcass Adjusted Performance* | | | | | | | | | | | | |
| Initial BW, lb | 583 | 582 | 581 | 1 | 0.09 | 0.99 | 582 | 583 | 581 | 1 | 0.43 | 0.25 |
| Final BW, lb | 1277 | 1293 | 1298 | 8 | 0.08 | 0.63 | 1277 | 1298 | 1293 | 8 | 0.15 | 0.18 |
| ADG, lb/d | 4.16 | 4.25 | 4.29 | 0.05 | 0.06 | 0.65 | 4.16 | 4.28 | 4.26 | 0.05 | 0.14 | 0.24 |
| DMI, lb/d | 23.5 | 23.2 | 22.6 | 0.2 | <0.01 | 0.55 | 23.2 | 23.3 | 23.0 | 0.2 | 0.45 | 0.46 |
| F:G | 5.65 | 5.46 | 5.26 | 0.002 | <0.01 | 0.93 | 5.56 | 5.43 | 5.38 | 0.002 | 0.02 | 0.50 |
| *Carcass Characteristics* | | | | | | | | | | | | |
| HCW, lb | 805 | 815 | 818 | 5 | 0.08 | 0.62 | 805 | 818 | 815 | 5 | 0.15 | 0.18 |
| Dressing % | 62.1 | 62.5 | 62.4 | 0.2 | 0.19 | 0.19 | 62.3 | 62.2 | 62.4 | 0.2 | 0.81 | 0.59 |
| LM Area, $in^2$ | 13.7 | 14.0 | 13.8 | 0.2 | 0.43 | 0.24 | 13.8 | 13.8 | 13.9 | 0.2 | 0.74 | 0.63 |
| $12^{th}$ Rib Fat, in | 0.50 | 0.52 | 0.56 | 0.02 | <0.01 | 0.84 | 0.53 | 0.52 | 0.52 | 0.02 | 0.75 | 0.89 |
| Marbling | 447 | 456 | 440 | 7 | 0.45 | 0.12 | 447 | 448 | 449 | 7 | 0.82 | 0.97 |
| USDA Yield Grade | 2.9 | 2.9 | 3.1 | 0.1 | 0.14 | 0.39 | 3.0 | 3.0 | 3.0 | 0.1 | 0.99 | 0.52 |
| PUN mg/100mL[1] | 18.57 | 20.03 | 22.72 | 0.53 | <0.01 | 0.33 | 17.81 | 20.31 | 23.20 | 0.50 | <0.01 | 0.73 |

[1] PUN = Plasma Urea Nitrogen