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Technical Note

# Effects of Varying Levels of Distillers Dried Grains with Solubles on Growth Performance of Broiler Chicks[1]

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## ABSTRACT

There is no formal recommendation, regarding dietary concentration, when it comes to feeding distillers dried grains with solubles (DDGS) to young broilers. This study evaluated the effects of varying levels of DDGS in a diet to young broilers from 0 to 14d of age. Diets ranged from 0 to 32% DDGS concentration, with 8% increments. Increasing inclusion rate of DDGS led to decreased body weight gain (BWG), whereas mortality seemed to be linearly increased. However, there was an increase seen in feed conversion (FCR) in conjunction with the increase in DDGS in the diet. An inclusion level of 8% DDGS or less is recommended for starter diets for broiler chicks.

## INTRODUCTION

When corn is fermented to be used in the production of ethanol, the bulk of the starch component of the grain is what is actually fermented off to make the biofuel, while the rest may become a by-product commonly known as distillers dried grains with solubles (DDGS). There has been a dramatic increase in the amount of this primary by-product of corn fermentation over the last several years (Renewable Fuels Association, 2008). DDGS can be a feasible and economical choice for inclusion in broiler diets, especially through periods of economic hardship. However, there are problems that have been noted with the product, ranging from the areas of transport, to milling, to nutrition. In the study presented herein, we focused on the nutritional aspect of the product. More specifically, the researchers wished to evaluate the effects that different levels of DDGS would have on broiler chicks during the first two weeks posthatch. Other research has pointed out that the low energy density of DDGS diets may be the limiting factor in meeting the energy needs of young broilers (Wang *et al.*, 2008).

Research evaluating inclusion levels of DDGS in the diet of young broilers are sparse and some have suggested that up to 25% DDGS may be included in the diet with no negative effects on body weight gain (BWG), feed conversion (FCR) or feed intake (Min *et al.*, 2009). The objective of the work presented herein was to further investigate the maximum limits of DDGS inclusion for broiler chicks during a starter phase that ranged from 0 to 14d of age.

## MATERIALS AND METHODS

This study encompassed the period between 0 to 14 d of age using Ross × Ross 308 males and females obtained from a commercial hatchery. Day-old chicks were randomly placed in a sex-separate manner, across 80 floor pens (15 birds/pen; 1200 birds total) at a density of 0.07 $m^2$/bird. The house used was close-sided, with thermostatically controlled heating, cool cells and cross ventilation. Each pen had built-up litter, a hanging feeder (22.5 kg capacity) and a water line (3 nipples/pen). The lighting program was 23 hr light and 1 hr dark and ventilation was accomplished by negative air pressure. Chicks were vaccinated for Marek's disease (via *in ovo* administration at d 18), Newcastle disease and infectious bronchitis (via coarse spray at hatch).

There were 5 different DDGS dietary levels evaluated, and both sexes, for a total of 10 treatments with 8 replicates each during study one. Treatments were blocked according to location within the house. A conventional corn-soybean meal based diet served as the control. Subsequent treatments contained 8, 16, 24 or 32% DDGS in the diet. All diets were formulated to be isocaloric and similar in Ca, P and all limiting amino acids, and were fed in crumble form. Diets were formulated to meet or exceed nutrient recommendations (NRC, 1994). Table one displays the control (0% DDGS) and 32% DDGS diets, as the 8, 16 and 24% diets were the result of blending the control and the 32% diet. Feed and water were provided *ad libitum*.

All birds in each pen were weighed at the beginning and at the end of the study. Feed consumption and mortality were monitored throughout the studies and feed conversion was corrected for the weight of mortality, and represents: (g of feed consumed by all birds in a pen) / (g of BW per pen + g of weight of dead birds).

Data in these experiments were evaluated using analysis of variance in a randomized complete block design with the pen representing this experimental unit. Percentage data for mortality were transformed to arcsine % for analysis. Two-way interactive effects of DDGS × gender were tested and subsequently main effects. All data were analyzed by the GLM procedure of SAS (2004) and treatment effects ($p \leq 0.05$) were separated using Fisher's Least Significant Difference test option of SAS (2004) using an $\alpha$ of 0.05.

**Table 1 -** Composition of experimental diets.

| Ingredient (% as-is) | Control (0% DDGS) | 32% DDGS |
|---|---|---|
| Corn | 58.036 | 39.043 |
| Soybean meal | 35.099 | 20.648 |
| DDGS | - | 32.00 |
| Pro-Plus[1] | 1.50 | 1.50 |
| Poultry oil | 2.989 | 4.27 |
| Deflourinated phosphate | 1.517 | 1.067 |
| Calcium carbonate | 0.042 | 0.687 |
| Sodium chloride | 0.242 | 0.154 |
| Premix[2] | 0.25 | 0.25 |
| DL-Methionine | 0.213 | 0.05 |
| L-Lysine | 0.061 | 0.28 |
| Coccidiostat[3] | 0.05 | 0.05 |
| **Calculated composition** | | |
| CP (%) | 23.2 | 23.2 |
| AME (kcal/kg) | 3,125 | 3,125 |
| Ca (%) | 0.90 | 0.90 |
| Available P (%) | 0.45 | 0.45 |
| Na (%) | 0.20 | 0.20 |
| Choline (mg/kg) | 1,638.727 | 2,105.936 |
| Digestible TSAA | 0.90 | 0.90 |
| Digestible Lys | 1.25 | 1.25 |
| Digestible Thr | 0.84 | 0.88 |
| Choline, mg/kg | 1,817 | 1,688 |

1 - Animal protein blend with a CP value of 60% (H.J. Baker & Bro., Inc.; Little Rock, AR). 2 - The vitamin and mineral premix contained per kg of diet: retinyl acetate, 2,654 µg; cholecalciferol, 110 µg; dl--tocopherol acetate, 9.9 mg; menadione, 0.9 mg; B12, 0.01 mg; folic acid, 0.6 µg; choline, 379 mg; d-pantothenic acid, 8.8 mg; riboflavin, 5.0 mg; niacin , 33 mg; thiamin, 1.0 mg; d-biotin, 0.1 mg; pyridoxine, 0.9 mg; ethoxiquin, 28 mg; manganese, 55 mg; zinc, 50 mg; iron, 28 mg; copper, 4 mg; iodine, 0.5 mg; selenium, 0.3 mg. 3 - Dietary inclusion of coccidiostat provides 60 g salinomycin sodium per 907.2 kg of feed.

## RESULTS AND DISCUSSION

Results from the study are shown in Table 2. The 24 and 32% DDGS treatments exhibited significantly lower BWG values compared to all other dietary treatments. This agrees with the results of previous research, showing that DDGS in the diet did not affect BWG at levels of up to 20% of the diet (Wang *et al*. 2008). A quadratic response was observed and the slope ratio from this regression calculated an 8% maximum DDGS inclusion level for BWG (Table 2). Feed intake exhibited an interaction, which resulted from the females consuming significantly more than the males at the 16% DDGS level. Males and females did not consume significantly different amounts for any other treatment. Also, a quadratic trend was observed for feed consumption, which by regression analysis resulted in a 14% recommendation of DDGS inclusion. These results do not agree with those of previous research that showed no differences in feed intake when feeding levels of 0, 6, 12, and 18% DDGS during a starter phase (Lumpkins *et al*., 2004). They are also in disagreement with those reported by Wang *et al*. (2008) that showed a tendency for consumption to increase as DDGS content of the diet increased during the starter phase. Results for FCR showed the 32% DDGS treatment resulted in the poorest performance. The control treatment had the lowest FCR value, but was not significantly different from that of the 8% treatment. The data showed a linear increase of FCR as DDGS content of the diet increased, and this effect is in agreement with the results by Wang *et al*. (2008). The incidence of mortality was unexpectedly high, and seemed to be linearly increased (p=0.03) as DDGS in the diet was increased.

**Table 2** - Performance of broiler chicks fed graded levels of DDGS from 0 to 14 d of age.

| Treatment | BW gain[1] | Feed intake[2] | CFCR[3] | Mortality[4] |
|---|---|---|---|---|
| 0% DDGS | 384 a | 495 ab | 1.29 d | 0.4 |
| 8% DDGS | 385 a | 502 a | 1.30 cd | 3.3 |
| 16% DDGS | 387 a | 512 a | 1.32 c | 1.7 |
| 24% DDGS | 367 b | 497 ab | 1.35 b | 5.8 |
| 32% DDGS | 355 b | 483 b | 1.41 a | 4.9 |
| Males | 379 a | 500 | 1.32 b | 2.6 |
| Females | 372 b | 496 | 1.34 a | 3.8 |
| SEM | 4.6 | 6.0 | 0.006 | 1.59 |
| **ANOVA P-Value** | | | | |
| DDGS | 0.0001 | 0.02 | 0.0001 | 0.13 |
| Sex | 0.045 | 0.38 | 0.0002 | 0.38 |
| DDGS × Sex | 0.13 | 0.044 | 0.92 | 0.36 |
| DDGS Linear | <0.0001 | 0.16 | <0.0001 | 0.03 |
| DDGS Quadratic | 0.009 | 0.006 | 0.23 | 0.77 |

1 - Values represent the BW gained expressed as grams/bird. The quadratic response observed was defined with the following equation: $y = 383.397 + 0.818x – 0.054x^2$. 2 - Values represent the feed consumption expressed as grams/bird. The quadratic response observed was defined with the following equation: $y = 494.04 + 2.011x – 0.074x^2$. 3 - Values represent the feed conversion after being corrected for mortality weight. 4 - Values represent the incidence of mortality expressed as a percentage of the population. a,b - Means in the same column followed by different letters are significantly different by the Fisher's Least Significant Difference test at 5%.

Due in large part to the unexpected drop in feed consumption exhibited by the birds, the diets and a sample of DDGS used in this study were analyzed for possible contamination of common mycotoxins. The results of these analyses were a negative presence of these metabolites in the DDGS source as well as the actual diets fed.

Based on the present results, these agree with those responses reported by Wang *et al*. (2008). It could be concluded that DDGS can be included in a diet to chicks from 0 to 14 d of age at levels of up to 8% without any detrimental effects on BWG, FCR or feed intake.

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