# RESEARCH TERMINAL REPORT

**TITLE** : **Effects of Dakota Gold BPX™ Corn Distillers Dried Grains with Solubles at Various Levels on the Growth Performance and Carcass Yield of Broilers**

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# EFFECTS OF BPX DAKOTA GOLD PLUS® CORN DISTILLERS DRIED GRAINS WITH SOLUBLES AT VARIOUS LEVELS ON THE GROWTH PERFORMANCE AND CARCASS YIELD OF BROILERS

## INTRODUCTION

The rapid growth of the ethanol industry in the United States and other countries resulted in an increasing amount of ethanol co-products made available for animal feeds. Corn distillers dried grains with solubles (corn DDGS) is a co-product of the dry mill ethanol industry and is a source of protein/amino acids, energy, and available phosphorus for poultry (Creswell, 2006). Levels of 20-25% DDGS can be fed to meat type birds with no effect on gain or feed efficiency as long as the metabolizable energy (ME) and lysine are appropriate in the diet formula (Potter, 1966 and Waldroup *et al*, 1981). Parsons *et al* (1983) demonstrated that DDGS could replace up to 40% of soybean meal protein with no effect on chick body weight if the level of lysine was adjusted. In turkeys, Noli *et al* (2002) reported that toms fed DDGS derived from ethanol production at 12% of the diet in the starter period and 8% in later stages of growth did not result in detrimental growth performance or breast meat yield. Lumpkins *et al* (2003) reported that broilers could be fed 12% DDGS derived from ethanol production with no effect on production performance. In layers, Roberson *et al* (2005) demonstrated that there was no detrimental effect on egg production or quality of the egg or shell due to feeding of 15% corn DDGS in the diet.

Studies have shown that corn DDGS from different sources vary in nutrient contents and the quality of this feedstuff has a considerable impact on animal performance (Whitney *et al*., 1999). BPX Dakota Gold Plus® corn DDGS

was developed by Dakota Commodities Scotland, SD USA using the “BPX” processing technology that includes a more gentle drying process and the use of yeast and cocktail of digestive enzymes that releases more available nutrients than the conventional method (Dakota Gold Marketing Association). The corn DDGS product resulting from this process thus have a better nutrient profile in terms of higher crude fat, calculated available phosphorus and ME, lysine, methionine, and threonine levels necessary for animal growth than the traditional commodity traded DDGS (Spiehs *et al*, 2002 and Whitney *et al*, 2000, 2001).

The recent interest in this feedstuff among local poultry producers and animal nutritionists prompted us to evaluate the effects of BPX Dakota Gold Plus® corn DDGS at various levels on the growth performance and carcass yield of broilers. Specifically, this study was made to establish the levels of corn DDGS originating from the new generation ethanol plants in MN and SD that could be cost-effectively used in broiler diets.

## MATERIALS AND METHODS

### Test Product

The corn DDGS used in this trial came from an ethanol plant in Preston, MN and is marketed under the name of BPX Dakota Gold Plus® corn DDGS (Dakota Commodities, Scotland, SD 57059). This product is being marketed locally by AGRI-SPECIALISTS, INC. which provided the product used in this study. The corn DDGS used in this trial was reddish golden in color and appears to be highly flowable with sandy texture suggesting that the product was of high

nutrient quality. Ergul *et al* (2003) reported that color is a good predictor of lysine, cysteine, and threonine digestibilities of golden corn DDGS in poultry.

**Experimental Design**

A total of 320 straight run (equal number of sexes) Ross day old broiler chicks that were obtained from a commercial hatchery (Tyson, Inc). were used in this trial. All birds were raised in battery type brooder/grower cages with bamboo floors at the University poultry farm and received all the standard management and health procedures recommended for broilers (PCARRD, 1996) throughout the trial period. The birds received a common pretrial starter diet which is a corn-soybean meal based diet calculated to contain 23% CP and ME of 3200 kcal/kg for 7 days. After this period, the birds were weighed individually and sorted to result in equal starting weights across all treatments. There were 80 birds per treatment at 8 replicate cages per treatment and 10 birds per cage using a completely randomized design. Daily mortalities and dead bird weights were recorded. Feed efficiencies were corrected in these birds.

Experimental diets were corn-soybean meal based and were formulated to contain corn DDGS at inclusion levels of 0, 5, 10, and 15% of the starter and grower diets, respectively. All diets were least cost formulated to meet the nutrient requirements of broilers (Philsan, 2003). The amino acid specifications were formulated in a total amino acid basis. The nutrient values used for the new generation corn DDGS as provided for by the Dakota Gold Marketing, Scotland, SD, USA is shown in Table 1. The composition and calculated nutrient analysis

of starter and grower diets are shown in Tables 2 and 3. Kjeldahl analysis of the mixed feeds were in agreement with the calculated values. The starter feed was fed from d 8 to 21 and the grower from d 22 to 42 of age. Feeds were in mash form and fed *ad libitum* to the birds. Clean drinking water was made available at all times.

**Parameters Measured**

Group body weights were taken in each pen at 8, 21, and 42 days of age. Feed consumption was taken at the same intervals to calculate feed:gain ratio. The weight gain, feed efficiencies, and livability rates were calculated at the end of each growing period. As an economic indicator, the average feed cost per gain was computed per treatment based on the prevailing prices of feed ingredients used at the time of study. At the end of 42 days, 16 representative samples of birds were randomly taken from each treatment group to determine dressing percentage and breast meat yield.

**Statistical Analysis**

The data were analyzed using the analysis of variance with significant differences between treatment means determined by the multiple range test. The General Linear Models procedure of SAS (SAS Institute, 1989) was used to analyze the data.

## RESULTS AND DISCUSSION

### Growth Performance

In general, no significant differences were noted in the overall growth performance and carcass yield of broilers fed corn-soybean meal based diets with different inclusion levels of BPX Dakota Gold Plus® corn DDGS during the 8 to 42-d growing period (Table 4).

In the starter period, 8 to 21-d, no significant differences were noted in body weight gain and feed efficiency of broilers fed diets with and without corn DDGS (Table 4). However, birds fed the diet with 15% corn DDGS showed significantly low feed intake compared to birds fed 0, 5 and 10% levels of the feedstuff. A similar observation was reported by Roberson *et al* (2005) in layers and Thaler (2006) in swine. Both workers suggested that corn DDGS may need to be included at a lower level at the starting period to introduce the new feedstuff to the animal to avoid drop in feed consumption. The drop in feed consumption observed in broilers fed diet with 15% corn DDGS, in this trial, did not significantly influence the gain and the feed:gain ratio of the birds. However, broilers fed with 5 and 10% corn DDGS in the diet tended to have a slightly better weight gain and feed:gain ratio compared with birds fed the control diet without corn DDGS.

In the grower period, 22-42-d, the same trend was observed where no significant differences were observed in the growth, feed intake, and feed efficiency in broilers fed diets with and without corn DDGS (Table 4). Although, it can be observed that birds fed corn-soybean meal based diets with 15% corn

DDGS inclusion tended to demonstrate slightly higher weight gain and better feed efficiency compared to those fed diets with 0, 5, and 10% corn DDGS.

Results of this study suggest that the corn DDGS used in this study proved to be an acceptable amino acid, energy, and phosphorus sources for broilers. Cromwell *et al* (1993) indicated that the odor and color of DDGS seem to correlate well with the nutrient value of the feedstuff.

Feed cost per gain was slightly lower (P>0.05) in corn-soy bean meal-based diets with 5 and 10% corn DDGS than those diets with 0 and 15% DDGS (Table 4). In this particular trial, a savings of 22 to 23 centavos per kg feed was realized if 5 and 10% corn DDGS was included in the diet. However, the cost of the corn-soybean meal diet with 15% DDGS was higher (P>0.05) by Php1.28 compared to the cost of the control diet, and PhP1.50 higher compared with the cost of diet with 5 and 10% corn DDGS. The high oil content of the diet with 15% DDGS brought about the increased in cost of this feed. Therefore, in this study the use of 15% corn DDGS in the broiler diet tended to be uneconomic based on the prevailing prices of feed ingredients used at the time of study, compared with the use of the lower levels of the feedstuff.

**Carcass Yield**

No significant differences were noted in the dressing percentage and breast meat yield of broilers fed corn-soybean meal based diets with and without corn DDGS inclusion (Table 4). This observation would imply that the corn DDGS used in this trial had a high nutrient profile and good amino acid digestibility. A

similar observation was reported by Lumpkins *et al* (2003) where he reported that broilers could be fed 12% DDGS derived from ethanol production with no effect on growth or carcass yield.

## SUMMARY AND CONCLUSION

In general, the overall results of this study are in agreement with those reported by Runnels (1966), Waldroup *et al* (1981), and Lumpkins *et al (*2003) that high quality corn DDGS can be fed to broilers without negative impact on growth performance. This study demonstrated that BPX Dakota Gold Plus® corn DDGS is a good quality feedstuff that can be included in the broiler diet up to a level of 15% (which is 5% higher than the maximum inclusion rate for broilers recommended by Dakota Gold Marketing Association) without adverse effect on overall growth performance and carcass yield. However, the economic benefit of feeding corn DDGS to broilers will depend on prices of other feedstuffs like corn, soybean meal, and oil and which complete diet is less expensive.

**Table 1. Nutrient analysis of BPX Dakota Gold Plus® Corn DDGS (As fed basis)**

| NUTRIENTS | Per Cent | |
|---|---|---|
| Dry Matter | 90 | |
| Crude protein | 25.5 | |
| Amino Acids (%) | Total | Digestible |
| Lysine | 0.95 | 0.72 |
| Methionine | 0.45 | 0.34 |
| Cystine | 0.40 | 0.35 |
| Threonine | 0.72 | 0.61 |
| Tryptophan | 0.19 | 0.16 |
| Arginine | 1.00 | 0.85 |
| Leucine | 2.97 | 2.52 |
| Isoleucine | 0.81 | 0.69 |
| Phenylalanine | 1.17 | 1.00 |
| Histidine | 0.63 | 0.54 |
| Crude fat | 10.00 | |
| Crude fiber | 6.30 | |
| Ash | 4.50 | |
| Calcium | 0.03 | |
| Phosphorus, Avail. P (Poultry) | 0.61 | |
| Na | 0.17 | |
| K | 0.78 | |
| Cl | 0.07 | |
| Xanthophyll, ppm | 31.00 | |
| ME Poultry, kcal/kg | 2750 | |

Source: Dakota Gold Research Association (Dakota Gold Marketing, Scotland, SD770)

**Table 2. Composition and calculated nutrient analysis of starter diets (as fed basis)**

| INGREDIENTS | STARTER DIETS | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| | AS PERCENT OF DIET | | | |
| Yellow corn | 51.547 | 48.867 | 46.187 | 35.617 |
| US soybean meal 47 | 40.300 | 37.950 | 35.610 | 35.290 |
| Crude coco oil | 4.410 | 4.500 | 4.580 | 10.240 |
| Monodicalcium PO4 | 1.680 | 1.560 | 1.430 | 1.310 |
| Limestone | 1.120 | 1.200 | 1.290 | 1.640 |
| Salt | 0.390 | 0.370 | 0.350 | 0.350 |
| Vitamin premix* | 0.150 | 0.150 | 0.150 | 0.150 |
| Mineral premix** | 0.100 | 0.100 | 0.100 | 0.100 |
| DL-methionine | 0.110 | 0.110 | 0.110 | 0.110 |
| Choline chloride 50% | 0.080 | 0.080 | 0.080 | 0.080 |
| Toxin binder | 0.050 | 0.050 | 0.050 | 0.050 |
| Mold inhibitor | 0.050 | 0.050 | 0.050 | 0.050 |
| Antioxidant | 0.013 | 0.013 | 0.013 | 0.013 |
| Dakota Gold DDGS | 0.000 | 5.000 | 10.000 | 15.000 |
| **Total** | **100.000** | **100.000** | **100.000** | **100.000** |
| CALCULATED ANALYSIS | | | | |
| ME, kcal/kg | 3050 | 3050 | 3050 | 3317 |
| Crude protein, % | 22.87 | 22.84 | 22.81 | 23.12 |
| Calcium, % | 0.90 | 0.90 | 0.90 | 1.00 |
| Avail. Phosphorus, % | 0.46 | 0.46 | 0.46 | 0.46 |
| Lysine, % | 1.33 | 1.30 | 1.27 | 1.28 |
| Met + Cys, % | 0.75 | 0.75 | 0.75 | 0.75 |
| Tryptophan, % | 0.29 | 0.28 | 0.28 | 0.28 |
| Threonine, % | 0.88 | 0.86 | 0.85 | 0.85 |

*Analysis per 2 kg: Vit. A-10,000,000 IU; Vit. D3- 2,500,000 IU; Vit. E-25,000 mg; Vit K3-2,500 mg; Vit. B1-2000 mg; Vit. B2-5,000 mg; Vit. B6-3,000 mg; Vit. B12-20 mg; Niacin, 30,000 mg; Calpan, 12,000 mg; Folic acid, 1,000 mg; Biotin-150 mg; Ethoxyquin-5,000 mg.

**Analysis per 1 kg: Manganese-60,000 mg; Zinc-44,000 mg; Iron-80,000 mg; Copper-8,000 mg; Iodine-350 mg; Selenium-150 mg.

**Table 3. Composition and calculated nutrient analysis of grower diets (as fed basis)**

| INGREDIENTS | GROWER DIETS | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| | AS PERCENT OF DIET | | | |
| Yellow corn | 58.657 | 55.977 | 53.297 | 47.407 |
| US soybean meal 47 | 33.470 | 31.120 | 28.780 | 27.710 |
| Crude coco oil | 4.170 | 4.250 | 4.340 | 6.000 |
| Monodicalcium PO4 | 1.530 | 1.410 | 1.280 | 1.300 |
| Limestone | 1.260 | 1.350 | 1.430 | 1.730 |
| Salt | 0.400 | 0.380 | 0.360 | 0.340 |
| Vitamin premix* | 0.150 | 0.150 | 0.150 | 0.150 |
| Mineral premix** | 0.100 | 0.100 | 0.100 | 0.100 |
| DL-methionine | 0.070 | 0.070 | 0.070 | 0.070 |
| Choline chloride 50% | 0.080 | 0.080 | 0.080 | 0.080 |
| Toxin binder | 0.050 | 0.050 | 0.050 | 0.050 |
| Mold inhibitor | 0.050 | 0.050 | 0.050 | 0.050 |
| Anti-oxidant | 0.013 | 0.013 | 0.013 | 0.013 |
| Dakota Gold DDGS | 0.000 | 5.000 | 10.000 | 15.000 |
| **Total** | **100.000** | **100.000** | **100.000** | **100.000** |
| CALCULATED ANALYSIS | | | | |
| ME, kcal/kg | 3100 | 3100 | 3100 | 3101 |
| Crude protein, % | 20.22 | 20.19 | 20.17 | 20.35 |
| Calcium, % | 0.90 | 0.90 | 0.90 | 1.00 |
| Avail. Phosphorus, % | 0.42 | 0.42 | 0.42 | 0.45 |
| Lysine, % | 1.14 | 1.11 | 1.09 | 1.08 |
| Met + Cys, % | 0.68 | 0.68 | 0.68 | 0.68 |
| Tryptophan, % | 0.25 | 0.24 | 0.24 | 0.24 |
| Threonine, % | 0.77 | 0.76 | 0.75 | 0.74 |

*Analysis per 2 kg: Vit. A-10,000,000 IU; Vit. D3- 2,500,000 IU; Vit. E-25,000 mg; Vit K3-2,500 mg; Vit. B1-2000 mg; Vit. B2-5,000 mg; Vit. B6-3,000 mg; Vit. B12-20 mg; Niacin, 30,000 mg; Calpan, 12,000 mg; Folic acid, 1,000 mg; Biotin-150 mg; Ethoxyquin-5,000 mg.

**Analysis per 1 kg: Manganese-60,000 mg; Zinc-44,000 mg; Iron-80,000 mg; Copper-8,000 mg; Iodine-350 mg; Selenium-150 mg.

Table 4. Effects of inclusion of BPX Dakota Gold Plus® corn distiller's dried grains with solubles (DDGS) on growth performance and carcass yield of broilers

| DDGS % | 8-d Body Weight (g) | 8 to 21-d | | | 22 to 42-d | | | 8 to 42-d | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Body weight gain (g) | Feed Consump-tion (g) | Feed:Gain (g:g) | Body weight gain (kg) | Feed Consump-tion (kg) | Feed:Gain (kg:kg) | Body weight gain (kg) | Feed Consump-tion (kg) | Feed:Gain (kg:kg) | Feed cost/ Gain (Php)* | Livabi-lity (%) | Dressing (%) | Breast Meat Yield (%) |
| 0 | 161 | 637 | 714[a] | 1.51 | 1.18 | 2.59 | 2.20 | 1.68 | 3.34 | 1.99 | 30.89 | 96 | 68[ab] | 26 |
| 5 | 161 | 642 | 712[a] | 1.49 | 1.18 | 2.57 | 2.20 | 1.68 | 3.32 | 1.98 | 30.68 | 96 | 67[b] | 25 |
| 10 | 162 | 670 | 725[a] | 1.43 | 1.15 | 2.56 | 2.19 | 1.67 | 3.26 | 1.95 | 30.67 | 99 | 71[a] | 25 |
| 15 | 163 | 630 | 691[b] | 1.49 | 1.21 | 2.59 | 2.14 | 1.70 | 3.32 | 1.96 | 32.18 | 96 | 68[ab] | 25 |
| F-value | 1.04[ns] | 1.26[ns] | 4.63[s] | 0.66[ns] | 1.13[ns] | 0.18[ns] | 1.17[ns] | 0.21[ns] | 0.29[ns] | 0.17[ns] | 1.30[ns] | 0.51[ns] | 3.35[s] | 1.36[ns] |
| CV, % | 1.81 | 6.82 | 2.64 | 8.08 | 4.15 | 4.90 | 8.04 | 4.51 | 5.34 | 6.86 | 5.77 | 5.09 | 3.72 | 5.58 |

[a,b]Means (8 replicate cages of 10 birds per cage) within columns with different superscripts are different (P<0.05).

*Php - Philippine peso

## REFERENCES


1. Creswell, D. C. DDGS: Benefits and Limitations. 2006. Asian Poultry Magazine. pp. 22-24. Jan/Feb., 2006.

2. Cromwell, G. L., K. L. Herkelmann, and T. S. Stahly. 1993. Physical, chemical and nutritional characteristics of distillers dried grains with solubles for chicken and pigs. J. Anim. Sci. 71:679-686.

3. Ergul, T., C. Martinez Amezcua, C. M. Parsons, B. Walters, J. Brannon and S. L. Noll. 2003. Amino acid digestibility in corn distillers dried grains with solubles. Poult. Sci. 82 (Supplement 1):70 (Abstract).

4. Lumpkins, B. L., A. B. Batal and N. M. Dale. 2003. Evaluation of distiller's grains with solubles as a feed ingredient for broilers. Poult. Sci. 82 (Suppl.):115 (Abstr.).

5. Noll, S., V. Stangeland, G. Speers, C. Parsons and J. Brannon. 2002. Utilization of canola meal and distillers grains with solubles in market turkey diets. Poult. Sci. 81 (Suppl.)1:92.

6. Parsons, C. M., D. H. Baker and J. M. Harter. 1983. Distillers dried grains with solubles as a protein source for the chick. Poult. Sci. 62:2445-2451.

7. PCARRD. 1996. Philippine Recommends for Broiler Production, Los Baños, Laguna. Philippine Council for Agriculture Forestry and Natural Resources Research Development. 91 p.

8. PHILSAN (Philippine Society of Animal Nutritionists) Feed Reference Standards. 2003. 3rd ed. Published by the Philippine Society of Animal Nutritionist, 351 p.

9. Potter, L. M. 1966. Studies with distillers feeds in turkey rations. In "Proceedings Distillers Feed Resources Council Conference". pp. 47-51.

10. Roberson, K. D., J. L. Kalbfluisch, W. Pan and R. A. Charbeneau. 2005. Effect of Corn Distiller’s Dried Grains with Solubles at Various Levels on Performance of Laying Hens and Egg Yolk Color. Int’l. J. of Poul. Sci. 4(2) 44-51.

11. Runnels, T.D. 1966. The biological nutrient availability of corn distillers dried grains of solubles in broiler feeds. Proc. Dist. Feed Res. Corn. 21:11-15.

12. SAS Institute. 1989. SAS® User's Guide: Statistics. Version 6.1. SAS Institute Inc., Carey, NC.

13. Spiehs, M.J., M. H. Whitney and G. C. Shurson. 2002. Nutrient database for distillers dried grains with solubles produced from ethanol plants in Minnesota and South Dakota. J. Anim. Sci., 80:2639-2645.

14. Thaler, R. C. 2006. Benefits and Limitation of DDGS for Swine. American Soybean Association International Marketing Technical Report Series-Swine Nutrition and Management, pp. 13-17.

15. Waldroup, P. W., J.A. Owen, B. E. Ramsey and D. L. Whelcel, 1981. The use of high levels of distillers dried grains plus solubles in broiler diets. Poult. Sci. 60:1479-1484.

16. Whitney, M. H., M. J. Spiehs, and G. C. Shurson. 1999. A nutrient database for distiller's dried grains with solubles produced from new ethanol plants in Minnesota and South Dakota. J. Anim. Sci. 77:188 (Suppl.).

17. Whitney, M. H., M. J. Spiehs, and G. C. Shurson. 2001. Availability of phosphorus in distiller's dried grains with solubles for growing swine. J. Anim. Sci. 79 (Suppl.):108 (Abstr.).

18. Whitney, M. H., M. J. Spiehs, G. C. Shurson and S. K. Baidoo. 2000. Amino acid digestibilities of corn distiller's dried grains with soluble produced from new ethanol plants in Minnesota and South Dakota. J. Anim. Sci. 78:185 (Suppl.1).