Effect of Diamond V\textsuperscript{xpc} (Direct Fed Microbial) on Broiler Performance and Health Status

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Abstract: The experiment was conducted to assess the effects of probiotics (Diamond V\textsuperscript{xpc}) enriched feed on the growth performance of Hyberflex broiler breed. The experiment which lasted for 8-weeks involved 300 Hyberflex broiler chickens which were randomly assigned to 5 dietary treatments using a Completely Randomized Design (CRD). Each treatment was replicated 3 times with 20 birds per pen. The Diamond V\textsuperscript{xpc} was incorporated into feed at varying levels up to 2% through feed. The treatments were designated T1, T2 and T3 with inclusion levels of 1.25, 1.5 and 2.0 kg/tonne respectively. A positive control (PC) which had the inclusion of 0.35kg/ton of Diamond V\textsuperscript{xpc} plus 0.35kg/ton of enerzyme and a negative control (NC) which contained zero (0%) Diamond V\textsuperscript{xpc} plus 0.35kg/ton of enerzyme. The parameters measured included; growth performance indices, carcass parameters and benefit cost analysis. Microbial data was also taken for total viable count and identification of bacteria in the small intestine of both the duodenum and ileum. The study revealed that adding Diamond V\textsuperscript{xpc} at 2% to the feed of broiler birds results in an efficient growth performance and a better weight gain. Also, adding Diamond V\textsuperscript{xpc} at 1.25 to 2% of the feed reduced feed intake and improved feed efficiency. It was more economical and efficient to raise broiler chickens at the inclusion level of 2% (T3) than any of the treatments in the study.

INTRODUCTION

Poultry production could be employed intensively as a short term solution for meeting the protein needs of people globally (Obi and Sonaiya, 1995). The local and intensive poultry producers are confronted by a number of challenges, pertinent among which are; high cost of feed, disease incidence, the extra cost incurred to solve these problems among others. Relatively paramount among these challenges is the incidence of diseases originating from viruses (Newcastle and Gumboro), bacteria (CRD) and protozoa (coccidiosis) (Appiah, 1993 and Koney, 1993). In an attempt to manage disease conditions, farmers often resort to administration of vaccines, antibiotics and coccidiostats to replenish the health status and increase the productive vigour of their birds (Aning, 2006).

Antibiotics, may lead to the evolution of resistant strains of microorganisms which become a lot more expensive and difficult to control (Dibner and Richards, 2005). Better alternatives adopted in recent times to the use of antibiotics have been the efforts to reduce veterinary drugs, improving biosecurity measures and feeding of probiotics (Simon, 2005).

Probiotics are live microbes which when dispensed in satisfactory amounts confer a health benefit on the host (FAO/WHO, 2009). \textit{Salmonella} microorganisms in chickens could competitively be excluded from the intestinal tract by the activities of probiotics (Wolfenden \textit{et al}., 2007). This can decrease the danger of diseases (Mounzouris \textit{et al}., 2009) and impact morphology and function of the digestion tract (Uscebrka \textit{et al}., 2005).
Effect of Diamond V\textsuperscript{XPC} (Direct Fed Microbial) on Broiler Performance and Health Status

and Yang et al., 2009). In poultry, probiotics boost body weight by increasing digestion, assimilation (Kim et al., 2003 and Salarmoini and Fooladi, 2011) and hinder the synthesis of cholesterol, with the goal that cholesterol levels drop and avoid arteriosclerosis and coronary heart disease (Kim et al., 2003).

Yeast probiotic improved body weight, feed intake and better feed conversion ratio in broiler chickens and also effectively inhibited the colonization of ceacal *Salmonella* and can replace antibiotics as growth promoters in commercial poultry farms (Olatoye et al., 2014).

Diamond V\textsuperscript{XPC} is a probiotic with *Saccharomyces cerevisiae* as its main constituent and media on which it was grown, consisting of roughage products, processed grain by-products and cane molasses.

The general objectives of the experiment were to analyse the effect of probiotics enriched feed on broiler growth and carcass safety. The specific objectives were

1. To examine the effect of various inclusion levels of Diamond V\textsuperscript{XPC} on the growth performance of broilers.
2. To analyse the effect of Diamond V\textsuperscript{XPC} on internal viscera components of broiler birds and
3. To determine the effect of Diamond V\textsuperscript{XPC} on microbial status of the small intestine.

**MATERIALS AND METHODS**

Experimental Location

The experiment was conducted at the Poultry Section of the Department of Animal Science, College of Agriculture and Natural Resources (CANR) of the Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana. The area exists in the semi-deciduous backwoods zone of Ghana. The poultry area is situated within latitude 06° 41’N and longitude 01°33’W. The highest temperature, least temperature and mean precipitation for the period were 31.5°C, 20.6°C and 14.0mm respectively.

The experiment lasted for eight weeks (56 days) and started in early October, 2017 and was terminated in December, 2017. Because of the non-existence of Animal Care Committee at the Kwame Nkrumah University of Science and Technology at the time of this experiment, the research was led and managed by the group leader following the experimental procedures affirmed by the University of Alberta Animal Care and Use Committee in accordance with the Canadian Council on Animal Care (2009) rules.

Experimental Animals and Experimental Design

Three hundred (300) day old hyperflex broiler chicks were used for the experiment. The day old chicks (DOCs) were acquired from Chicks and Chickens Hatchery, a local hatchery located at Entesery in the Ashanti Region of Ghana. There were five treatments and each treatment was replicated four times with fifteen (15) birds allocated to each replicate in a completely randomized design (CRD).

The birds were raised in twenty deep litter pens in an all-in-all-out system. The pens were used as brooding houses and heat supply was by incandescent bulbs (100 watts). Brooding temperatures were from 39-30°C. Each pen measured 1.14m x 1.09m which gives a total floor space of 12.42m\textsuperscript{2} with 15 birds per pen.

The birds were given unrestricted access to water and feed throughout the experimental period. Vaccine and medication were administered through the drinking water. The drinkers were cleaned each day and refilled whenever it dropped in level. The medication and vaccination programme used in the experiment is presented in Table 6.1.
Table 6.1. Vaccination and water program

| Day | Activity                                      |
|-----|----------------------------------------------|
| 1-4 | Vitamins and Antibiotics and coccidiostats. |
| 5-6 | Pure water                                   |
| 7   | First Gumboro                                |
| 8-10| Pure water                                   |
| 11  | Vitamins and Antibiotics and Coccidiostats   |
| 12-13| Pure water                                  |
| 14  | First Newcastle vaccine                      |
| 15  | Pure water                                   |
| 16-18| Vitamins and Antibiotics and Coccidiostats  |
| 19-20| Pure water                                  |
| 21  | Second Gumboro                               |
| 22  | Pure                                         |
| 23-25| Vitamins and Antibiotics and Coccidiostats  |
| 26-27| Pure water                                  |
| 28  | Second Newcastle vaccine                      |
| 29  | Pure water                                   |
| 30-32| Vitamins Antibiotics and Newcastle           |
| 33-41| Pure                                         |
| 42-46| Antibiotics                                 |
| 47-52| Pure water                                  |
| 53-57| Vitamins and Antibiotics and Coccidiostats  |

Dietary Treatments and Feeding

The birds were allotted to five dietary treatment diets, namely; positive control (PC), negative control (NC), treatment one (T1), treatment two (T2) and treatment three (T3). The NC diet had zero Diamond V<sup>XPC</sup> and birds treated with antibiotics. PC had 0.35kg/ton of Diamond V<sup>XPC</sup> and birds treated with antibiotics. T1 had 1.25kg/ton of Diamond V<sup>XPC</sup> added to it (as the recommended level by the manufacturers). T2 had 1.50kg/ton of Diamond V<sup>XPC</sup> added to it whilst T3 had 2.0kg/ton of Diamond V<sup>XPC</sup> added to it. Apart from the PC, all the Diamond V<sup>XPC</sup> treated birds received no antibiotics treatment.

The birds were placed under two different dietary phases. The starter phase (day 1 to day 28) and the finisher phase (day 29 to day 56). Experimental diets were formulated to be isonitrogenous and isocaloric under both phases (Table 6.2 and Table 6.3) and meeting the nutritional requirements of Hyberflex broiler birds. The starter phase had 22.5% CP and 2891.80 kcal/kg of energy and 19% CP and 2,900 kcal/kg of energy for the finisher stage.

Table 6.2. Percentage composition of the experimental diets at starter phase

| Ingredients (kg) | NC     | PC     | T1     | T2     | T3     |
|------------------|--------|--------|--------|--------|--------|
| Maize            | 570.15 | 570    | 569.45 | 569.2  | 568.7  |
| Fishmeal         | 40     | 40     | 40     | 40     | 40     |
Effect of Diamond V<sup>xpc</sup> (Direct Fed Microbial) on Broiler Performance and Health Status

| Ingredient                  | NC  | PC  | T1  | T2  | T3  |
|-----------------------------|-----|-----|-----|-----|-----|
| Soybean meal                | 315 | 315 | 315 | 315 | 315 |
| Wheat bran                  | 30  | 30  | 30  | 30  | 30  |
| Oyster shell                | 24  | 24  | 24  | 24  | 24  |
| Bone meal                   | 11  | 11  | 11  | 11  | 11  |
| Salt                        | 3   | 3   | 3   | 3   | 3   |
| Vit. trace mineral premix   | 3   | 3   | 3   | 3   | 3   |
| Lysine                      | 1.93|       | 1.8 | 1.8 | 1.8 |
| Methionine                  | 1.57|       | 1.5 | 1.5 | 1.5 |
| Enerzyme-select             | 0.35| 0.35 | -   | -   | -   |
| Diamond V                   | -   | 0.35 | 1.25| 1.5 | 2   |
| TOTAL                       | 1000| 1000 | 1000| 1000| 1000|

Nutrient composition (calculated)

| Nutrient                  | NC       | PC       | T1       | T2       | T3       |
|---------------------------|----------|----------|----------|----------|----------|
| Crude protein, %          | 22.55    | 22.53    | 22.54    | 22.54    | 22.55    |
| Ether Extract, %          | 3.58     | 3.58     | 3.58     | 3.58     | 3.58     |
| Crude fibre, %            | 2.81     | 2.82     | 2.84     | 2.85     | 2.86     |
| Calcium, %                | 1.30     | 1.30     | 1.30     | 1.30     | 1.30     |
| Phosphorus, %             | 0.43     | 0.43     | 0.43     | 0.43     | 0.43     |
| Lysine, %                 | 1.29     | 1.29     | 1.29     | 1.29     | 1.29     |
| Methionine, %             | 0.52     | 0.51     | 0.51     | 0.51     | 0.51     |
| M.E (kcal/kg)             | 2897.34  | 2896.18  | 2894.31  | 2893.46  | 2891.80  |

*Vitamin mineral premix per kg of diet: Fe 100 mg, Mn 110 mg, Cu 20 mg, Zn 100 mg, I 2 mg, Se 0.2 mg, Co 0.6 mg, sanoquin 0.6 mg, retinal 2000 mg, cholecalciferol 25 mg, α-tocopherol 23000 mg, menadione 1.33 mg, cobalamin 0.03 mg, thiamin 0.03 mg, riboflavin 2 mg, folic acid 0.33 mg, biotin 0.03 mg, pantothenic acid 3.75 mg, niacin 23.3 mg and pyridoxine 1.33 mg.

1 NC- Negative control (0kg Diamond V<sup>xpc</sup>/tone), PC- Positive control (0.35kg Diamond V<sup>xpc</sup>/tone and 0.35kg Enerzyme/tone), T1- Treatment 1 (1.25kg Diamond V<sup>xpc</sup>/tone), T2- Treatment 2 (1.5kg Diamond V<sup>xpc</sup>/tone), T3-Treatment 3 (2.0kg Diamond V<sup>xpc</sup>/tone) of feed.

ME: Metabolizable energy

Table6.3. Percentage composition of the experimental diets at finisher phase

| Ingredients (kgs) | FINISHER PHASE TREATMENTS<sup>1</sup> |
|-------------------|-------------------------------------|
|                   | NC       | PC       | T1       | T2       | T3       |
| Maize             | 510.15   | 510      | 509.1    | 509      | 508.5    |
| Fishmeal          | 40       | 40       | 40       | 40       | 40       |
| Soybean meal      | 150      | 150      | 150      | 150      | 150      |
| BSM               | 200      | 200      | 200      | 200      | 200      |
| Wheat bran        | 50.6     | 50.6     | 50.6     | 50.6     | 50.6     |
| Oyster shell      | 18.5     | 18.5     | 18.5     | 18.5     | 18.5     |
| Bone meal         | 20       | 20       | 20       | 20       | 20       |
| Salt              | 3        | 3        | 3        | 3        | 3        |
| Vit. trace mineral premix | 3 | 3 | 3 | 3 | 3 |
Effect of Diamond V<sup>xpc</sup> (Direct Fed Microbial) on Broiler Performance and Health Status

| Nutrient composition (calculated) |  |  |  |  |  |
|----------------------------------|---|---|---|---|---|
| Lysine                           | 2.60 | 2.6 | 2.6 | 2.6 | 2.6 |
| Methionine                       | 1.80 | 1.6 | 1.8 | 1.8 | 1.8 |
| Enerzyme-select                  | 0.35 | 0.35 | - | - | - |
| Diamond V                        | - | 0.35 | 1.25 | 1.5 | 2.0 |
| TOTAL                            | 1000.0 | 1000.0 | 1000.0 | 1000.0 | 1000.0 |

*vitamin mineral premix/kg diet: Fe 100mg, Mn 110mg, Cu 20mg, Zn 100mg, I 2mg, Se 0.2mg, Co 0.6mg, Sanoquin 0.6mg, retinal 2000mg, cholecalciferol 25mg, α-tocopherol 2300mg, menadione 1.33mg, cobalamin 0.03mg, thiamin 0.83mg, riboflavin 2mg, folic acid 0.33mg, biotin 0.03mg, pantothenic acid 3.75mg, niacin 23.3mg and pyridoxine 1.33mg

NC- Negative control (0kg Diamond V<sup>xpc</sup>/tone), PC- Positive control (0.35kg Diamond V<sup>xpc</sup>/tone and 0.35kg Enerzyme/tone), T1- Treatment 1 (1.25kg Diamond V<sup>xpc</sup>/tone), T2- Treatment 2 (1.5kg Diamond V<sup>xpc</sup>/tone), T3-Treatment 3 (2.0kg Diamond V<sup>xpc</sup>/tone) of feed.

Growth and Carcass Parameters

Data on parameters required for the assessment of growth performance of the birds were taken on weekly basis from week one to the eighth week. The parameters measured included; feed intake, body weight and body weight gain, feed conversion ratio (FCR) and economics of production.

Feed consumption of birds was measured weekly. Feed consumed per birds per pen was measured by subtracting feed left over in trough from total feed supplied for a week using a digital electronic scale (Jadever, JPS-1050). It was then divided by the number of birds in a replicate and number of days to obtain mean feed intake per bird per day.

Live weight and live weight gain were measured by weighing the birds in each pen at the beginning of the trial and subsequently at the end of every week. Birds were batch weighed and the weight divided by the number of birds in each batch to obtain the mean live weight per bird. The initial average live weight per bird was subtracted from the weekly average live weight to obtain the live weight gain per week.

Feed Conversion Ratio (FCR) was calculated as feed/gain ratio. Mean weekly feed conversion was calculated by dividing the feed consumed by the live weight gain during the same period.

Carcass evaluation was carried out at the end of the trial. Four birds per replicate were randomly selected, fasted overnight and slaughtered by severing the jugular vein. Bled weight, defeathered weight and dressed weight of the birds were taken. The internal organs such as heart, kidney, gizzard, kidney, liver, were all weighed separately and recorded using electric micrometer 3000g weighing gauge as described by Jahanian <i>et al.</i> (2008).
Effect of Diamond V®pc (Direct Fed Microbial) on Broiler Performance and Health Status

**Storage and Origin of DFM (Diamond V®pc)**

The direct fed microbial (Diamond V®pc) used in the experiment was a single strain product produced by the Diamond V company, a leading global animal health company in the USA. It appears to be tan to brown granular powder with a fermented, yeasty aroma. Diamond V®pc is a probiotic with *Saccharomyces cerevisiae* as its main constituent and media on which it was grown, consisting of roughage products, processed grain by-products and cane molasses. It was stored in a cool dry environment.

**Statistical Analysis**

Growth performance and carcass data were subjected to the GLM procedure of Statistical Analytical System, SAS (2014) at 5% level of probability to assess significant differences. Treatment means were separated using Waller Duncan's K-ratio t-test in SAS.

**Results and Discussion**

**Growth Performance**

Feed intake did not differ significantly (P>0.05) among birds which fed on Diamond V®pc dietary treatments (T1, T2 and T3). However, PC and NC were numerically higher than the other Diamond V®pc treated diets (Table 6.4). Feed intake for birds on the negative control (NC) recorded about 19% more than the feed intake for birds on T2 and T3.

This finding is in concord with the research by Kabir et al. (2004) and that of Habibi et al. (2013) when probiotics were fed to broiler chickens. Arslan and Saatci (2002) also observed an increase in feed intake for the control group as compared to quails on the DFM diets. The lower feed consumption recorded for all the probiotic treated birds (PC, T1, T2 and T3) could be attributed to the fact that the probiotics provided a well-balanced microbial ecosystem in the GIT. A well-balanced microbial ecosystem means microorganism present in probiotics possibly secreted amylase, protease, and lipase (Rolfe, 2000) that accelerate nutrient digestibility (Apata, 2008 and Li et al., 2008). In these circumstances birds do not have to consume much for growth and body weight and that could explain for the low feed intake recorded for birds on the probiotic diets. Moreover, bacteria like *Clostridium perfringens* causes damage to the intestinal mucosa and this decreases digestion and absorption and increases feed conversion ratio (Kaldhusdal et al., 2001 and Hofacre et al., 2003). When there is a balance microbial ecosystem, the effect of these pathogens is surmounted and thereby increasing the rate of digestion and absorption as feed conversion ratio decreases.

The performance results at the end of the experimental period showed insignificant differences in the final body weights (P=0.48) and the feed conversion ratio (P=0.09). Al-Sagan and Abudabos (2017) also reported a non-statistical difference for body weight and feed conversion ratio when the effect of a prebiotic, probiotic and symbiotic on performance of broilers under *Clostridium perfringens* challenge were studied. Kwakernaak et al. (2007) reported that *B. subtilis* spores supplementation in a wheat-SB based diet did not significantly affect the overall body weight gain and feed conversion ratio at 36 days. The findings of this study again confirms those reported by Mountzouris et al. (2007), when cumulative FCR of probiotic birds did not significantly differ from that of the antibiotic treatment. It was however observed that all the DFM supplemented diets had a better FCR with the exception of the positive control.

**Carcass Parameters**

Generally, the treatments had no significant difference (P > 0.05) on the internal organs weighed, except the full intestine weight which was significant (P < 0.05) (Table 6.5). Ozcan Cengiz et al. (2015) experimented the effect of dietary probiotic and high stocking density on the performance, carcass yield, gut microflora, and stress.
Effect of Diamond V<sup>xpc</sup> (Direct Fed Microbial) on Broiler Performance and Health Status

indicators of broilers and no treatment effects on the overall relative carcass yield and weights of lymphoid organs were observed. Other researchers (Pelicano <i>et al.</i>, 2003, 2005; Karaoglu and Durdag, 2005) also reported no dietary treatment effects on carcass yield of broilers when probiotics were fed.

**Table 6.4. Effect of Diamond VXPC on growth performance of broiler chickens**

| Parameters                  | PC   | NC   | T1   | T2   | T3   | SEM | P-value |
|-----------------------------|------|------|------|------|------|------|---------|
| Initial weight/bird/g       | 39.12| 38.80| 39.15| 38.95| 39.38| 2.72 | 0.60    |
| Final weight/bird/g         | 3115.00| 3538.00| 3125.00| 2950.00| 3212.00| 680.90| 0.48    |
| Total weight gain/bird/g    | 3076.00| 3500.00| 3086.00| 2915.00| 3173.00| 679.80| 0.48    |
| Daily weight gain/bird/g    | 54.93 | 62.50| 55.10| 52.05| 56.66| 12.14| 0.48    |
| Total feed intake/bird/g    | 8408.79| 9087.73| 7465.19| 7355.82| 7387.48| 1332.5| 0.05    |
| Daily feed intake/bird/g    | 150.16| 162.28| 133.31| 131.35| 131.92| 23.80| 0.05    |
| FCR                         | 2.74 | 2.61 | 2.44 | 2.53 | 2.35 | 0.28 | 0.09    |
| Feed cost/kg@ starter phase | 1.77 | 1.79 | 1.85 | 1.87 | 1.90 | -    | -       |
| Feed cost/kg@ finisher phase| 1.72 | 1.74 | 1.80 | 1.82 | 1.85 | -    | -       |
| Feed cost/gain @ starter phase| 4.85 | 4.68 | 4.52 | 4.73 | 4.47 | 0.53 | 0.56    |
| Feed cost/gain @ finisher phase| 4.72 | 4.55 | 4.40 | 4.61 | 4.36 | 0.51 | 0.57    |

1 NC - Negative control (0kg Diamond V<sup>xpc</sup>/tone), PC - Positive control (0.35kg Diamond V<sup>xpc</sup>/tone and 0.35kg Enerzyme/tone), T1 - Treatment 1 (1.25kg Diamond V<sup>xpc</sup>/tone), T2 - Treatment 2 (1.5kg Diamond V<sup>xpc</sup>/tone), T3 - Treatment 3 (2.0kg Diamond V<sup>xpc</sup>/tone) of feed.

SEM: standard error of means, P-value: Probability value

**Table 6.5. Effect of Diamond VXPC on carcass traits of broiler chickens**

| Parameters           | PC   | NC   | T1   | T2   | T3   | SEM | P-value |
|----------------------|------|------|------|------|------|------|---------|
| Bled weight/bird     | 2880 | 3360 | 3040 | 2850 | 3090 | 0.75 | 0.61    |
| Defeathered weight/bird | 2710 | 3210 | 2880 | 2740 | 2920 | 0.71 | 0.59    |
| Dressed weight/bird  | 2325 | 2812 | 2525 | 2300 | 2538 | 0.61 | 0.42    |
| Viscera weight/bird  | 33.8 | 32.5 | 36.2 | 27.5 | 30.0 | 0.09 | 0.32    |
| Head weight/bird     | 66.3 | 63.5 | 60.2 | 61.5 | 58.5 | 0.01 | 0.75    |
| Heart weight/bird    | 13.3 | 14.0 | 12.0 | 11.5 | 14.8 | 0.01 | 0.60    |
| Liver weight/bird    | 60.7 | 59.7 | 63.0 | 60.5 | 54.2 | 0.01 | 0.52    |
| Full Gizzard weight/bird | 73.5 | 87.0 | 84.5 | 73.5 | 83.7 | 0.02 | 0.35    |
| Empty Gizzard weight/bird | 45.0 | 56.0 | 58.7 | 46.5 | 59.0 | 0.02 | 0.23    |
| Full intestine weight/bird | 136.5 | 137.8 | 172.5 | 121.3 | 120.5 | 0.03 | 0.01    |
| Empty intestine weight/bird | 72.20 | 72.20 | 68.30 | 56.50 | 68.80 | 0.02 | 0.43    |

1 NC - Negative control (0kg Diamond V<sup>xpc</sup>/tone), PC - Positive control (0.35kg Diamond V<sup>xpc</sup>/tone and 0.35kg Enerzyme/tone), T1 - Treatment 1 (1.25kg Diamond V<sup>xpc</sup>/tone), T2 - Treatment 2 (1.5kg Diamond V<sup>xpc</sup>/tone), T3 - Treatment 3 (2.0kg Diamond V<sup>xpc</sup>/tone) of feed.

SEM: standard error of means, P-value: Probability value
Effect of Diamond V<sup>xpc</sup> (Direct Fed Microbial) on Broiler Performance and Health Status

ECONOMICS OF PRODUCTION

From Table 6.4, feed cost per kilogram at the starter and finisher phases increased when the Diamond V<sup>xpc</sup> was added from NC (no Diamond V<sup>xpc</sup>) to T3 (2.0% Diamond V<sup>xpc</sup>). The higher price in the Diamond V<sup>xpc</sup> diets is the additional cost from the Diamond V<sup>xpc</sup>. However, a different trend was observed at feed cost per gain where T3 (2.0% Diamond V<sup>xpc</sup>) which recorded the highest feed cost per kg now has the lowest feed cost/gain (Table 6.4) at both the starter and the finisher phases. This could be attributed to the fact that birds on the T3 were more efficient and utilized less feed to gain more weight; hence the lesser cost on the feed cost/gain (Table 6.4) compared to the controls (i.e. PC and NC). The farmer stands the chance of making additional 7.84% and 7.63% profit of using Diamond V<sup>xpc</sup> at 2% than not using it as in the case of NC at starter and finisher phases respectively.

CONCLUSION AND RECOMMENDATION

The study revealed that adding Diamond V<sup>xpc</sup> at 2% to the feed of broiler birds resulted in an efficient growth performance and a better feed cost/weight gain. The study also showed that, adding Diamond V<sup>xpc</sup> at 1.25 to 2% to the feed reduced feed intake and gave an improved feed efficiency. It can be deduced that it is more economical and efficient to raise broiler chickens on treatment 3 (T3) than any of the treatments in the study. It is recommended that producers and farmers can add Diamond V<sup>xpc</sup> to the diets of their birds up to 2% inclusion without any detrimental effect on the birds.

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Effect of Diamond V<sup>D</sup> (Direct Fed Microbial) on Broiler Performance and Health Status

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Effect of Diamond V<sup>xpc</sup> (Direct Fed Microbial) on Broiler Performance and Health Status

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