

# Impact of Combination of Phytogetic Plant Sources on Growth Performance and Cost Evaluation of Broiler Finisher Birds

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## ABSTRACT

**Background and objective:** The interest in plant feed additives has grown over the last decade as their usage continues to increase across the nation. Some of the beneficial effects of these bioactive plant substances in animal nutrition may include the reduction of microbial threat and promotion of intestinal health, which is imperative for optimal performance and profitability. The impact of a combination of phytogetic plant sources on growth performance and cost evaluation of broiler finisher birds formed the root of the current research work. **Materials and Methods:** The 120, 4 weeks old broiler birds were used for the research work. The birds were randomly distributed into 5 treatment groups. Each treatment was replicated three times in a completely randomized design (CRD) with 8 birds per replicate. The 5 different diets were formulated such that treatment 1 served as the control, while treatments 2, 3, 4 and 5 contained lemon grass leaf meal and black plum leaf meal at the levels and ratios of 1:4, 2:3, 3:2 and 4:1, respectively. The chemical composition of the lemon grass leaf and black plum leaf meal was carried out. Feed and water were given *ad libitum* throughout the experimental period. **Results:** Birds in treatment 4 were superior ( $p < 0.05$ ) with values of 3018.98, 1572.19, 4246.85 g and 2.70 corresponding to final body weight, body weight gain, feed intake and feed conversion ratio. Dietary effect on cost evaluation revealed a higher net profit and better cost-benefit ratio of #1676.84 and 2.06 in treatment 4. In contrast, the least values for the same parameters of net profit and cost-benefit ratio were reported in treatment 1 with #987.20 and 3.30, respectively. **Conclusion:** It can be concluded that a combination of lemon grass and black plum leaf meal is viable with positive results in terms of performance and profit attainment, with the higher value obtained in treatment 4 specifically.

## KEYWORDS

Optimal performance, cost, broiler, leaf meal, finisher, phytogetic

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## INTRODUCTION

A major challenge of poultry production in Nigeria is the availability of quality feed ingredients which have over the years hampered production, especially at large scale<sup>1</sup>. Another critical factor is the incidence of disease outbreaks, of which the use of Antibiotic growth promoters has been the main stay<sup>2</sup>. Lately, antibiotic growth promotant usage in farm animals has been banned due to their various negative effects



among which are the development of microbial resistance in the animals and mutation effects which have resulted in high levels of morbidity and mortality in poultry birds and their potentially harmful effects on human health<sup>3</sup>.

With the present trend in the improvement of farm animal nutrition in Nigeria, phytogetic materials have found wide application without losing out on their nutritional value and standard. Several studies over the past years have revealed the nutritional benefits of dietary incorporation of phytogetic plant materials in poultry production. Such benefits may be attributed to the high contents of protein and bioactive compounds in the leaf meal<sup>4</sup>. However, the contents of fibre and anti-nutritional factors may suppress the nutrient utilization of leaf meal and thus growth performance of broilers. With considerable interest in plant-based materials as feed ingredients in poultry nutrition, several plants have been assessed with respect to their effects on performance and blood parameters in poultry production. Some notables one are *Napoleonaea imperialis*, *Ipomea asarifolia*, *Azadirachta indica*, *Moringa oleifera* etc<sup>5</sup>.

Lemon grass (*Cymbopogon citratus*) is a widely used herb in tropical countries especially in Southeast Asia and is cultivated in South and Central America, Africa and other tropical countries. They are characterized by tufted perennial grasses with numerous stiff stems arising from a short rhizomatous rootstock, as with citrus flavor and can be dried and powdered or used fresh<sup>6</sup>. It is also suitable for poultry, fish and seafood. Some of the reported phytoconstituents are essential oils that contain citral, citronellal, terpinolene and terpinolmethylheptone. Others include flavonoids and phenolic compounds, which consist of luteolin, isoorientin, quercetin, kaempferol and apiginin<sup>7</sup>.

On the other hand, black plum also known as *Vitex doniana* is a deciduous flowering tree growing up to 20 m in height in tropical Africa. It has a heavy rounded crown. Black plum (*Vitex doniana*) is among plant leaves with the potential for improving performance in livestock and poultry nutrition<sup>8</sup>. It is an indigenous tropical plant distributed across tropical sub-saharan, Africa's coastal savannas and savanna woodland. The proximate composition of raw *Vitex doniana* showed that it has an ash content of 1.63%, fat and fiber content of 2.92 and 2.75%, crude protein content of 8.10% and a carbohydrate value of 7.57%, respectively<sup>5</sup>. Vitamin analysis of *Vitex doniana* young leaf confirmed the presence of vitamins, A, B1, B2, B3, C, D, E and K. It was reported from literature that the value of Vitamin C is highest in black plum leaf, while that of vitamin K is the least. The nutrient analysis of *Vitex doniana* showed that the nutrient content of the young leaves is similar to those of edible vegetables<sup>8</sup>. The study therefore seeks to determine the impact of combination of phytogetic plant sources on growth performance and cost evaluation of broiler finisher birds.

## MATERIALS AND METHODS

**Experimental site:** This experimental work was carried out at the Poultry section of the Federal College of Agriculture, Ishiagu, Ivo Local Government Area of Ebonyi State from July to August, 2022.

**Source and processing of black plum leaf:** The black plum leaves and lemon grass leaves (7.5 kg each) that were used for the experiment were sourced from Afikpo and Ishiagu, respectively, both in Ebonyi State. The black plum leaves and lemon grass leaves were obtained fresh and washed. The leaves were then sun-dried and later ground into a meal.

**Experimental design and management of birds:** The 120, 4 weeks old broiler birds were used for the research work. The birds were randomly distributed into five treatment groups. Each treatment was replicated three times in a completely randomized design (CRD) with 8 birds per replicate. The birds were purchased from 'Cosin farm' in Enugu, Enugu state. The birds were rear on a cemented floor covered with wood shavings as a source of litter. The pens were divided into partitions such that each partition accommodated 8 birds. Feed and water were given *ad-libitum* and other necessary management practices such as routine medication and sanitation were properly observed to prevent disease outbreaks.

Table 1: Composition of experimental birds

Ingredients	Treatment				
	T1	T2	T3	T4	T5
Maize	58.00	58.00	58.00	58.00	58.00
Wheat offal	6.90	3.90	3.90	3.90	3.90
Fullfat soya	5.00	5.00	5.00	5.00	5.00
Groundnut cake	14.00	14.00	14.00	14.00	14.00
Fish meal (72%)	1.50	1.50	1.50	1.50	1.50
Blood meal	3.50	3.50	3.50	3.50	3.50
Palm kernel cake	6.00	4.00	4.00	4.00	4.00
Lemon grass L.M	0.00	1.00	2.00	3.00	4.00
Black plum L.M	0.00	4.00	3.00	2.00	1.00
Limestone	1.50	1.50	1.50	1.50	1.50
Bonemeal	2.50	2.50	2.50	2.50	2.50
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20	0.20
Finisher premix	0.35	0.35	0.35	0.35	0.35
Salt	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated value					
Crude protein (CP)	19.75	19.37	19.32	19.36	19.38
MEnergy (kcal/kg)	2950.67	2910.34	2895.80	2895.92	2910.45

MEnergy: Metabolizable energy and L.M: Leaf meal

Table 2: Proximate composition of Lemon grass leaf meal and black plum leaf meal

Components	Lemon grass leaf meal	Black plum leaf meal
Dry matter	90.42	89.06
Ash	10.44	9.38
Ether extract	2.23	2.60
Crude fibre	7.24	7.37
Crude protein	10.91	11.27
Nitrogen free extract	59.60	58.44
Metabolizable energy (kcal/kg)	2,657.40	2,660.85

The five experimental diets (Table 1) were compounded with diet 1 containing 0% lemon grass leaf meal and black plum leaf meal, which served as the control. Diets 2, 3, 4 and 5 contained lemon grass leaf meal and black plum leaf meal at the levels and ratios of 1:4, 2:3, 3:2 and 4:1, respectively. Proximate analysis of black plum leaf meal and lemon grass leaf meal were also carried out (Table 2).

**Statistical analysis:** Data obtained from the research work was subjected to Analysis of Variance (ANOVA) and significant means were compared using the Duncan’s Multiple Range Test at 5% significant level.

**Ethical consideration:** There was no risk involved in the research work to the birds and there was no incidence of transfer of disease to the end user as it was considered safe and sound for consumption.

## RESULTS AND DISCUSSION

Data obtained for growth performance in the present study is displayed in Table 3. Dietary effect showed that a superior ( $p < 0.05$ ) value of 3018.98 g was obtained in treatment 4, which did not differ from the values of 2905.41, 2821.53 and 2846.40 g obtained in treatments 1, 2 and 3, respectively. The least value of 2496.48 g was seen in treatment 5. The similarity reported in the high values obtained in treatments fortified with the test ingredients showed the ability of the birds in those treatments to access the nutrients in the diets. The highest final body weight obtained in treatment 4 could be due to the ability of the birds to ‘milk out’ the advantages of the combination of the active ingredients and bioactive factors in the lemon grass leaf meal and black plum leaf meal at that ratio.

Table 3: Growth performance characteristics and cost analysis of finisher broiler birds

Parameters	Treatment					SEM
	T1	T2	T3	T4	T5	
Initial body weight (g)	1431.43	1448.75	1430.83	1446.79	1439.58	-
Final body weight (g)	2905.41 <sup>a</sup>	2821.53 <sup>a</sup>	2846.40 <sup>a</sup>	3018.98 <sup>a</sup>	2496.48 <sup>b</sup>	58.21
Body weight gain (g)	1473.98 <sup>a</sup>	1372.78 <sup>b</sup>	1415.57 <sup>b</sup>	1572.19 <sup>a</sup>	1056.90 <sup>c</sup>	39.44
Feed intake (g)	4151.30 <sup>a</sup>	4009.55 <sup>a</sup>	4075.28 <sup>a</sup>	4246.85 <sup>a</sup>	3618.11 <sup>b</sup>	91.17
Daily body weight gain (g)	70.19 <sup>a</sup>	65.37 <sup>a</sup>	67.41 <sup>a</sup>	74.87 <sup>a</sup>	50.33 <sup>b</sup>	3.49
Daily feed intake (g)	197.68 <sup>a</sup>	190.93 <sup>a</sup>	194.06 <sup>a</sup>	202.23 <sup>a</sup>	172.29 <sup>b</sup>	5.09
Feed conversion ratio	2.82 <sup>b</sup>	2.92 <sup>b</sup>	2.88 <sup>b</sup>	2.70 <sup>b</sup>	3.42 <sup>a</sup>	0.10
Cost of birds at 4 weeks old (₦)	1800.00	1800.00	1800.00	1800.00	1800.00	-
Cost of kg of feed (₦)	318.00	305.50	303.00	301.50	299.00	5.49
Cost of feed consumed (₦)	1320.11 <sup>a</sup>	1224.92 <sup>a</sup>	1234.81 <sup>a</sup>	1280.43 <sup>a</sup>	1081.82 <sup>b</sup>	21.88
Other cost (expenses) (₦)	375.00	375.00	375.00	375.00	375.00	-
Total cost of production (₦)	3495.11	3399.92	3409.81	3455.43	3256.82	31.43
Revenue (₦)	4939.20 <sup>a</sup>	4796.60 <sup>b</sup>	4838.88 <sup>b</sup>	5132.27 <sup>a</sup>	4244.02 <sup>c</sup>	80.54
Net profit (₦)	1444.09 <sup>b</sup>	1396.68 <sup>b</sup>	1429.07 <sup>b</sup>	1676.84 <sup>a</sup>	987.20 <sup>c</sup>	55.76
Cost benefit ratio	2.42 <sup>b</sup>	2.43 <sup>b</sup>	2.39 <sup>b</sup>	2.06 <sup>c</sup>	3.30 <sup>a</sup>	0.14

<sup>abc</sup>Means on the same row with different superscripts are significantly ( $p < 0.05$ ) different and SEM: Standard error of mean

This result disagreed with the work carried out by Olabode *et al.*<sup>5</sup> where they obtained higher final body weight in broiler birds fed a combination of moringa leaf meal and black plum leaf meal. This result agreed with those reported by Onyimonyi *et al.*<sup>9</sup>, where they observed increased final body weight in broiler birds fed a diet fortified with *Moringa oleifera* leaf meal. Values obtained for feed intake were superior ( $p < 0.05$ ) in treatment 4 (4246.85 g), which did not differ ( $p > 0.05$ ) from those in treatments 1, 2 and 3 with 4151.30, 4009.55 and 4075.28 g, respectively, while the least value of 3618.11 g was observed in treatment 5. The high level of feed intake could be due to the positive taste and aroma in the lemon grass which possibly enhanced the consumption of feed at the level of inclusion. This result agreed with the report of Olabode *et al.*<sup>1</sup>, where they observed increased feed intake in diets fortified with a combination of moringa and black plum leaf meal at the finisher stage in broilers. Also, El-Tazi<sup>10</sup> observed a significant difference in feed intake of broiler birds. A superior value for feed conversion ratio was observed in treatment 4 with a value of 2.70 which was significantly ( $p < 0.05$ ) different from the rest of the treatments observed. This was similar to the report of previous studies<sup>1,8</sup>, who observed better feed utilization by the birds in moringa leaf meal-fortified diets.

A higher and better net profit value of ₦1676.84 was obtained in treatment 4, which was significantly ( $p < 0.05$ ) different from the value of ₦987.20 obtained for benefit in treatment 5, being the least value for net profit. Values of ₦1444.09, ₦1396.68 and ₦1429.07 were obtained for benefit in treatments 1, 2 and 3 which were similar to each other statistically. This was in agreement with the report of previous studies<sup>1,5</sup>, where they observed better profit in leaf meal-fortified diets.

This result showed that the combination of lemongrass and black plum leaf meal is possible at the finishing phase with positive and enhanced performance, especially at the desired ratio and level of inclusion.

Based on results obtained in this study, it is recommended that leaf materials be combined to maximize the phytonutrients and nutrients in them, especially those that have been tried over a period of time. This will also lead to a dive into the combined advantage of bioactive substances found in both leafy materials when properly processed. It is also recommended the use of these plant materials at different stages of growth.

The main limitation of this study is the drying process which required good weather to avoid the leafy material getting mouldy, thus intruding the incidence of fungal infection in the flock of birds.

### CONCLUSION

The study concluded that it can be inferred that lemon grass and black plum leaf meal can be combined as a feed additive/supplement in broiler finisher diet. The best possible combination is at the level and ratio of 3 parts lemon grass leaf meal and 2 parts black plum leaf meal for finisher stage. Better profit can be attained at the combination level and ratio of 3:2 lemon grass leaf meal and black plum leaf meal in broiler finisher birds.

### SIGNIFICANCE STATEMENT

The purpose of the study focuses on attaining a better weight and less cost in producing finisher broiler birds using a combination of two plant sources, namely lemon grass and black plum leaf meal. The study revealed the possibility of combining both lemon grass and black plum leaf meals in the feeding of broiler birds, especially at the finisher stage with an enhanced performance in terms of growth and cost-benefit implications. The study also showed that the birds were able to make use to a larger extent of the phytonutrients embedded in the leaf meals despite the anti-nutritional factors in the leaf meals.

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