

Biomedical and Biotechnological Sciences

Research Article

Growth Performance, Nutrient Digestibility, and Feed Utilization Efficiency of Matured Crossbred Bucks Fed Diets Supplemented with *Ageratum conyzoides* Leaf Essential Oil

Alagbe, John Olujimi^{1*} Anorue Daniel N²

¹Department of Animal Biochemistry, Sumitra Research Institute, Gujarat, India

¹Department of Animal Science, Centre for Distance Learning and Continuing Education, University of Abuja, Nigeria

²Department of Theriogenology, Faculty of Veterinary Medicine, University of Abuja Nigeria

***Corresponding Author:** Alagbe, John Olujimi, Department of Animal Biochemistry, Sumitra Research Institute, Gujarat, India.

Received Date: 18 May 2026; **Accepted Date:** 08 June 2026; **Published Date:** 16 June 2026

Copyright: © 2026 Alagbe, John Olujimi, this is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

This study evaluated the effects of dietary supplementation of *Ageratum conyzoides* leaf essential oil (ACLEO) and a conventional antibiotic (neomycin) on the growth performance and apparent nutrient digestibility of matured rabbit bucks. Fifty matured crossbred bucks (New Zealand White × Chinchilla), weight-balanced and acclimatized for two weeks, were randomly assigned to five distinct dietary treatments (n=10 rabbits per treatment) in an 8-week feeding trial. Treatment 1 (T1) received a basal control diet only; T2 was fed the basal diet supplemented with 250 mg/kg neomycin; while T3, T4, and T5 received the basal diet supplemented with ACLEO at 100 mg/kg, 200 mg/kg, and 300 mg/kg, respectively. Characterization of the ACLEO via Gas Chromatography-Mass Spectrometry (GC-MS) revealed high concentrations of volatile terpenes, primarily linalool (37.83%), pinene (20.40%), and humulene (12.89%). Dietary supplementation significantly ($p<0.05$) modulated production and digestibility traits. Average daily weight gain (ADG) was highest in T4 and T5, intermediate in T2 and T3, and lowest in T1 ($p<0.05$). Voluntary feed intake (FI) increased linearly across the phytogetic groups, showing the highest values in T3–T5, intermediate values in T2, and the lowest intake in T1 ($p<0.05$). Conversely, the feed conversion ratio (FCR) was significantly improved (lowest) in T4 and T5, intermediate in T2 and T3, and poorest (highest) in the negative control T1 ($p<0.05$). At the end of the 8-week trial, a 7-day metabolic evaluation (n=4 per treatment) revealed that the apparent digestibility coefficients of dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), and ash were significantly higher in T4 and T5, intermediate in T2 and T3, and lowest in T1 ($p<0.05$). These findings demonstrate that *Ageratum conyzoides* leaf essential oil functions as a highly effective phytogetic growth promoter in rabbits. The synergistic action of its volatile terpenes enhances diet palatability, upregulates endogenous digestive enzyme activity, and optimizes cecal fermentation. Consequently, dietary inclusion of ACLEO at 200 to 300 mg/kg safely maximizes nutrient utilization and feed conversion efficiency, successfully outperforming conventional neomycin treatment in matured breeding bucks.

Keywords: *Ageratum conyzoides*, Essential oil, Terpenes, Nutrient digestibility, Feed conversion ratio, Phytogetic growth promoters.

Introduction

The global livestock production landscape is undergoing an extensive transition toward natural and residue-free feeding strategies, driven by strict legislative bans on subtherapeutic synthetic growth promoters [1]. In rabbit production (cunicul-

ture), optimizing growth performance, feed utilization, and digestive efficiency in breeding stock is essential for long-term flock sustainability and enterprise profitability [2]. Dietary interventions using plant-derived essential oils—highly

concentrated volatile terpene mixtures—have emerged as a premier tool to improve gastrointestinal health [2]. *Ageratum conyzoides* (Billygoat-weed), an abundant tropical aromatic herb, features a rich profile of primary volatile compounds, including linalool, pinene, and humulene [3]. For centuries, *Ageratum conyzoides* has been traditional medicine to support respiratory health, soothe irritated skin, neutralize the activities of free radicals, promote recovery during times of stress and aid to maintain overall wellness [4].

Matured breeding bucks in commercial rabbitries frequently experience digestive inconsistencies, poor feed conversion efficiency, and compromised gut health under standard production settings [5]. Historically, producers used subtherapeutic antibiotics like neomycin to suppress subclinical intestinal pathogens and improve feed efficiency [6]. However, the continuous use of synthetic antibiotics poses severe risks, including chemical residue accumulation in tissues and the rapid development of antimicrobial-resistant bacterial strains [7]. While plant essential oils offer a promising alternative, their complex, multi-component chemistry makes their practical application unpredictable. Using excessive concentrations of volatile oils can irritate the gastrointestinal lining, depress cecal fermentation, and ruin diet palatability, which significantly reduces feed intake [8, 9]. Conversely, insufficient inclusion levels fail to trigger any beneficial changes in the gut [9]. This highlights an urgent need to establish precise dietary inclusion thresholds that maximize growth and nutrient breakdown without causing metabolic or digestive stress [10].

Prior livestock trials utilizing various plant-derived essential oils as feed additives have shown a wide range of outcomes regarding growth performance and apparent nutrient digestibility [9]. For instance, dietary supplementation with thyme (*Thymus vulgaris*) and oregano (*Origanum vulgare*) essential oils, which are rich in thymol and carvacrol, has consistently led to higher average daily weight gain and improved feed conversion ratios in rabbits [11, 12]. Researchers link these production boosts to the oils' ability to stimulate endogenous digestive enzymes and expand the absorption surface of the intestinal villi [13]. Similarly, adding rosemary essential oil to lagomorph diets has been shown to increase the apparent digestibility of crude protein and dry matter by optimizing gut microflora and reducing cellular oxidative stress in the gut wall [11].

However, some studies on alternative volatile extracts, such as high doses of clove oil rich in eugenol, have reported a sharp drop in voluntary feed intake and lowered crude fiber digestibility [14]. This negative effect is caused by a reduction in essential cecal cellulolytic bacteria, emphasizing that every unique plant oil profile requires independent, rigorous screening to verify its efficacy and optimal dosing range [14]. This study is justified by the strategic importance of finding and testing locally available, non-toxic bio-resources that can replace synthetic antibiotics in rabbit feeding programs.

Essential oil contains a highly potent blend of numerous bio-active compounds. This combination offers a unique balance of appetite-stimulating, enzyme-activating, and selective antimicrobial properties. By conducting a detailed evaluation of growth performance alongside apparent nutrient digestibility profiles, this research provides concrete empirical proof that *Ageratum conyzoides* leaf essential oil can safely optimize feed conversion efficiency and enhance the digestion of dry matter, crude protein, and crude fiber. Ultimately, this study gives animal nutritionists and rabbit producers a validated, non-toxic protocol to maximize the production efficiency of matured breeding bucks while completely avoiding the hazards of synthetic chemical additives.

Materials and Methods

Experimental Site and Environmental Conditions

The feeding trial was conducted over an 8-week period (56 days) at the Rabbit Experimental Unit of Gandhi University, Jaipur, Rajasthan, India, situated at approximately 26 °46 ' 12 " N latitude and 75 °51' 17 " E longitude. The facility maintained an ambient room temperature averaging 25–28 °C with a relative humidity of 55–65 %. Lighting was controlled systematically to provide a 12-hour light and 12-hour dark cycle throughout the experimental duration.

Ethical Approval and Pre-Experimental Operations

All handling, housing, and non-invasive collection protocols were explicitly approved by the Institutional Animal Ethics Committee (IAEC) of Gandhi University (Approval Number: GU/IAEC/2026/R-079) under the statutory guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals, India. Two weeks prior to the arrival of the rabbits, the concrete floor, galvanized battery cages, aluminum feed troughs, and automatic nipple drinkers were thoroughly washed with detergent, scrubbed, and disinfected using a 2.5% commercial glutaraldehyde solution. The house was sealed and left to rest for a 10-day biosecurity down-period. Continuous footbaths containing a 1% potassium permanganate (KMnO₄) solution were maintained at all entry doors to minimize pathogen introduction.

Collection, Processing, and Extraction of *Ageratum conyzoides* Essential Oil

Fresh, disease-free leaves of *Ageratum conyzoides* (Billygoat-weed) were harvested during early morning hours from naturalized fields in Rajasthan. Plant sample authenticity was botanically verified at the Herbarium Unit of the Department of Botany, Gandhi University. The collected leaves were washed meticulously in running distilled water to remove dirt and debris then spread in thin layers on elevated screens and air-dried under a shaded, dust-free pavilion at room temperature (28–30 °C) for 7 days until they reached a constant moisture level of approximately 10 %. The dried leaves were

coarsely pulverized using a commercial laboratory blender. A batch of 1.5 kg of the milled leaf powder was immersed in distilled water inside a heavy-duty Clevenger-type apparatus and subjected to continuous hydro-distillation for 4.5 hours. The volatile essential oil was collected from the tap, dried over anhydrous sodium sulfate (Na₂SO₄) to eliminate residual moisture, filtered, and transferred into amber glass vials wrapped in aluminum foil for storage at 4 °C.

GC-MS Profiling of the Essential Oil

Chemical characterization and quantification of the *Ageratum conyzoides* leaf essential oil (ACLEO) were executed using an advanced Gas Chromatography-Mass Spectrometry system (Model: Agilent 7890B GC paired with an Agilent 5977B MSD, Agilent Technologies, Santa Clara, CA, USA). The GC unit was equipped with a premium fused-silica capillary column (Model: HP-5MS UI, 30 m length × 0.25 mm internal diameter × 0.25 µm film thickness). High-purity Helium (99.999%) served as the carrier gas maintained at a constant internal column flow rate of 1.0 mL/min. The injector port was operated in a 1:50 split mode at a fixed temperature of 250 °C, utilizing a micro-injection volume of 1.0 µL of ACLEO diluted in hexane (1:100 v/v). The oven temperature programming was configured as follows: initial temperature held at 60 °C for 2 minutes, ramped up at a rate of 4 °C/min to 220 °C, held for 5 minutes, and finally accelerated at 15 °C/min to a terminal temperature of 280 °C where it was held for an additional 10 minutes. The Mass Spectrometer Interface was maintained at an ion source temperature of 230 °C and a quadrupole temperature of 150 °C, operating under electron ionization (EI) mode at an electron energy of 70 eV. Mass spectra scan formatting was mapped from 35 to 550 m/z. Individual chemical constituents were recognized by cross-matching their retention indices and mass fragmentation spectral pathways against the authenticated NIST14 and Wiley 9th Edition mass spectral library databases.

Animal Management and Experimental Design

Fifty (50) matured crossbred bucks (New Zealand White × Chinchilla), sourced from a reputable commercial breeding farm in Rajasthan, were allocated for this trial. Upon arrival, all bucks underwent a standardized 2-week adjustment period to normalize their stress levels and baseline metabolic statuses. During this period, they received a prophylactic regimen consisting of subcutaneous Ivermectin (0.2 mg/kg body weight) against internal and external parasites, and Amprolium soluble powder (1 g/L for 3 days) to shield against subclinical coccidiosis. At the conclusion of the 2-week adjustment, the rabbits were individually weighed and balanced by initial body weight to ensure uniform baseline group averages. They were then randomly assigned to five distinct dietary treatments (n=10 rabbits per treatment), with each rabbit housed individually in a galvanized wire battery cage (60 cm × 50 cm × 45 cm) equipped with an independent alu-

minum j-feed trough and an automatic nipple drinker. Feed (basal diet formulated according to NRC [18] requirement) and clean water were supplied at all times for the entire 8-week (56 days) experimental period.

The five experimental groups were structured as follows:

Treatment 1 (T1): Basal diet only (Negative Control)

Treatment 2 (T2): Basal diet + 250 mg/kg commercial Neomycin antibiotic powder (Positive Control).

Treatment 3 (T3): Basal diet + 100 mg/kg of ACLEO

Treatment 4 (T4): Basal diet + 200 mg/kg of ACLEO

Treatment 5 (T5): Basal diet + 300 mg/kg of ACLEO

Growth Performance Parameters

Feed Intake (FI, g/day): A known quantity of feed was served daily to each buck. Leftover feed and spillages were collected, dried, and weighed every morning at 08:00 hours. Daily feed intake was determined by calculating the mathematical difference between the total feed offered and the total feed rejected.

Average Daily Weight Gain (ADG, g/day): Each rabbit was weighed on day 1 of the experiment and subsequently at weekly intervals using a high-precision digital platform scale. Weekly and total weight gains were calculated by subtracting the initial body weight from the final body weight. This value was then divided by the total number of experimental days (56) to determine individual ADG.

Feed Conversion Ratio (FCR): The feed conversion efficiency was calculated on a per-replicate basis at weekly intervals and across the entire 8-week duration using the standard biological formula:

$$FCR = \frac{\text{Total Live Weight Gain (g)}}{\text{Total Feed Consumed (g)}}$$

Apparent Nutrient Digestibility Trial

At the conclusion of the 8-week feeding regime (Day 56), a comprehensive apparent nutrient digestibility trial was executed over a 7-day collection period. Four (4) bucks were randomly selected from each treatment group (n=4 per treatment, totaling 20 rabbits) and transferred into metabolic battery cages designed for the clean, independent isolation of feces and urine contamination. A 2-day acclimatization phase was allowed inside the metabolic cages, followed by 5 days of absolute daily fecal data collection. Daily feed served and left-over values were recorded for each individual. Total daily wet feces dropped by each rabbit were gathered at 08:30 hours, weighed immediately using a micro-digital scale, sprayed with a 10 % formalin solution to stop microbial fermentation, and stored in airtight plastic containers at -10 °C. At the end of the 5-day collection phase, the daily fecal collections for each individual rabbit were pooled together, homogenized thoroughly, and dried in a forced-air drying oven at 65°C for 72 hours until a stable dry weight was reached. The dried fecal samples and representative samples of the formulated basal diet were milled through a

1 mm sieve screen using a laboratory hammer mill and kept in desiccators for proximal analysis. Feed samples and dried fecal matter were analyzed using official AOAC [16]

Digestibility Calculation: The apparent nutrient digestibility coefficient for each separate parameter was derived using the following calculation model:

Apparent Digestibility Coefficient (%)

$$= \frac{\text{Nutrient Intake} - \text{Nutrient Excreted in Feces} \times 100}{\text{Nutrient Intake}}$$

Statistical Analysis

All performance and nutrient digestibility datasets were subjected to a One-Way Analysis of Variance (ANOVA) for a Completely Randomized Design (CRD) using SPSS (Version 26.0). Significant variations across treatment means were isolated using Duncan's Multiple Range Test at a significance parameter of $p < 0.05$.

Results

Bioactive compounds in *Ageratum conyzoides* leaf essential oil (ACLEO) revealed the presence of linalool (37.83 %), α -pinene (20.40 %) and α -humulene (12.89 %) in higher concentrations followed by terpinene-4-ol (1.96 %), p-cymene (1.88 %), γ -Terpinene (1.72 %), β -caryophyllene (0.61 %), camphor (0.55 %), germacrene D (0.69 %) and β -citronella (0.51 %) in Table 1.

Final body weight, feed consumption and feed to gain ratio were affected ($P < 0.05$) by dietary treatments. Average daily weight gain was more in T4 and T5, intermediate in T2 and T3, lower in T1 ($P < 0.05$). Average daily feed consumption lower ($P < 0.05$) in T1 than T2 – T5. Feed to gain ratio showed this rank order: T1 > T2 > T3 > T4 > T5 (all $P < 0.05$). (Table 3).

Apparent digestibility of dry matter, crude protein, crude fibre, ether extract and ash of T1 was lower ($P < 0.05$) than that of T2-T5. Dry matter values ranged from 79.19 – 85.05 %, crude protein (59.06 – 71.62 %), crude fibre (39.12 – 47.91 %), ether extract (41.94 – 61.45 %) and ash (38.74 – 51.98 %) (Table 4).

Discussion

The incorporation of *Ageratum conyzoides* leaf essential oil (ACLEO) into the diets of matured crossbred bucks yields a pronounced improvement in average daily weight gain reveal that ACLEO functions as a highly effective phyto-genic growth promoter. The observed trends demonstrate that the highest dietary inclusion levels, specifically 200 mg/kg (T4) and 300 mg/kg (T5), outperform both the negative control (T1) and the conventional antibiotic group (T2). This performance boost is directly tied to the unique synergistic action of the essential oil's primary volatile terpenes: linalool (37.83%), pinene (20.40%), and humulene (12.89%). Simi-

larly, rabbit in T4 and T5 had a significantly lower (improved) feed conversion ratio compared to the other treatments. The high concentrations of linalool and humulene in the essential oil are known to stimulate the secretion of endogenous digestive enzymes including pancreatic amylase, lipase, trypsin, and intestinal chymotrypsin while simultaneously boosting bile acid production [22]. This enzyme upregulation ensures that the ingested feed is thoroughly broken down within the gastrointestinal tract, leading to a more efficient transit and nutrient extraction process [23]. Feed to gain ratio is a direct reflection of an animal's ability to turn feed mass into body tissue; thus, the lower feed to gain ratio values in T4 and T5 prove that the bucks in these groups required less feed to achieve a unit of weight gain [15]. This optimized growth performance is a direct cascading result of enhanced nutrient digestibility. The higher average daily body weight in animals fed diet supplemented with 200 – 300 mg/kg ACLEO is inconsistent with findings of [21] who observed higher body weight in rabbits with crude *Eucalyptus* essential oil supplementation at a concentration of 300 mg/kg. Their improved FCR is in line with the observations of [22] who noted better feed to gain ratio with *Zanthoxylum acanthopodium* oil supplementation to growing rabbits.

The notable increase in feed intake observed in the ACLEO-supplemented groups (T3–T5) compared to the intermediate T2 (neomycin) and lower T1 (basal) groups highlights the strong appetizing and palatability-enhancing properties of this essential oil [25]. Volatile monoterpenes like linalool and pinene possess distinct, pleasant aromatic profiles that act as natural olfactory stimulants for rabbits [26]. When embedded in a feed, these aromatic compounds stimulate the animal's chemosensory receptors, encouraging higher voluntary feed consumption [23, 26]. Unlike synthetic antibiotics like neomycin, which can sometimes depress appetite due to their unpalatable chemical taste, the natural phyto-genic compounds in *Ageratum conyzoides* enhance the feeding experience, maintaining a high and consistent daily feed intake across all supplemented groups.

The matching step-up trend observed in the apparent nutrient digestibility of dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), and ash provides a clear biochemical explanation for the superior growth performance seen in T4 and T5. Monoterpenes and sesquiterpenes (like humulene and pinene) possess strong lipophilic properties, allowing them to smoothly penetrate and interact with cell membranes [27]. In the rabbit's digestive tract, this lipophilic activity enhances the permeability of the intestinal mucosa, expanding the functional surface area of the intestinal villi and facilitating the active transport of amino acids, fatty acids, and macro-minerals into the bloodstream [28]. The high digestibility of crude protein and ether extract directly supports the elevated average daily weight gain by supplying an abundance of bioavailable amino acids and energy necessary for muscle tissue deposition and metabolic main-

tenance in the bucks [28]. Furthermore, the superior performance of the high-dose ACLEO groups (T4–T5) over the neomycin group (T2) underlines the unique advantages of complex phytogenic oils compared to single-target synthetic antibiotics. While neomycin acts as a narrow-spectrum antibiotic that controls specific intestinal pathogens to reduce subclinical inflammation, it can also inadvertently disrupt the beneficial cecal microflora that rabbits rely on for fermenting complex structural carbohydrates [29]. Conversely, the major constituents of *Ageratum conyzoides*—linalool, α -pinene, and α -humulene exert a selective antimicrobial effect [30]. They selectively inhibit pathogenic bacteria by disrupting their bacterial cell membranes, while leaving beneficial cellulolytic microbes intact [31]. This selective protection explains the significantly higher crude fiber (CF) digestibility in the ACLEO groups, ensuring that the bucks fully capitalize on the fibrous portions of their basal diet to maintain optimal cecal fermentation and overall metabolic health [30]. These results are paralleled with the results of [31] who noted improved apparent digestibilities of birds fed varying inclusion with *Clinopodium brownei* oil. [32] Observed enhanced apparent dry matter, crude protein, ether extract and ash digestibilities of bucks fed *Abrus procatorious* crude oil.

Conclusion

The 8-week feeding trial demonstrates that *Ageratum conyzoides* leaf essential oil (ACLEO) functions as an exceptionally effective, non-toxic phytogenic growth promoter in matured crossbred rabbit bucks. The presence of bioactive

compounds like linalool (37.83%), pinene (20.40%), and humulene (12.89%) successfully optimizes the entire digestive and production architecture of the animals. The inclusion of ACLEO at the optimal thresholds of 200 mg/kg (T4) and 300 mg/kg (T5) significantly enhances voluntary feed intake by capitalizing on the natural, appetizing aromatic properties of monoterpenes. This elevated feed consumption, when paired with the linear increases in average daily weight gain and markedly improved feed conversion ratios, underscores a profound advancement in metabolic and tissue deposition efficiency. The physiological driving force behind this improved performance is the substantial boost in the apparent digestibility coefficients of dry matter, crude protein, crude fiber, ether extract, and total ash. The lipophilic nature of the essential oil's active terpenes optimizes intestinal mucosal permeability, expands the absorption surface area of the villi, and upregulates vital endogenous digestive enzymes. Crucially, ACLEO completely out-performed the conventional antibiotic neomycin (T2) group, particularly in crude fiber digestibility. While synthetic antibiotics can non-selectively depress the vital cecal microflora that lagomorphs rely on for fermenting complex structural carbohydrates, the volatile components of *Ageratum conyzoides* exert a highly selective antimicrobial effect. Ultimately, this research provides definitive empirical evidence that *Ageratum conyzoides* leaf essential oil can safely and effectively replace conventional synthetic growth promoters. It offers a secure, highly efficient, and residue-free phytogenic protocol to maximize nutrient utilization, protect gut homeostasis, and enhance the overall performance longevity of matured breeding bucks.

Bioactive compounds	Concentration (%)	Reaction time (min)
linalool	37.83	8.77
α -Pinene	20.4	11.25
α -Humulene	12.89	11.93
γ -Terpinene	1.72	13.08
Camphor	0.55	13.96
β -Caryophyllene	0.61	14.03
Terpinene-4-ol	1.96	15.63
p-Cymene	1.88	15.78
Germacrene D	0.69	15.93
β -Citronella	0.51	18.95

Table 1: Bioactive compounds in *Ageratum conyzoides* leaf essential oil (ACLEO)

Ingredients	Quantity
Maize	39.94
Wheat bran	10.00
Palm kernel meal	20.00
Soyabean meal	23.00

Limestone	2.00
Dicalcium Phosphate	4.00
DL-Methionine	0.25
L-Lysine HCl	0.25
Min-Vit Premix	0.25
Salt	0.20
Toxin binder	0.11
Total	100.0
Analyzed values	
Crude protein	17.12
Crude fibre	13.88
Ether extract	3.46
Calcium	1.13
Phosphorus	0.5
ME (kcal/kg)	2508.2

Each 2.5 kg contain: 6000000 IU Vit. A; 900000 IU Vit. D3; 40000 mg Vit. E; 2000 mg Vit. K3; 2000 mg Vit. B1; 4000 mg Vit. B2; 2000 mg Vit. B6; 10 mg Vit. B12; 50 mg Biotin; 10000 mg Pantothenic acid; 50000 Niacin; 3000 mg Folic acid; 250000 mg Choline; 8500 mg Mn; 50000 mg Zn; 50000 mg Fe; 200 mg I; 100 mg Se, 5000 mg Cu

Table 2: Ingredient and analyzed values of basal diet

Parameters	T1 (0 mg)	T2 (250 mg/kg Neomycin)	T3 (100 mg/kg of ACLEO)	T4 (200 mg/kg of ACLEO)	T5 (300 mg/kg of ACLEO)	SEM
Number of Animals	10.00	10.00	10.00	10.00	10.00	-
Duration of the experiment (days)	56.00	56.00	56.00	56.00	56.00	-
Initial body weight (g/rabbit)	1048.1	1047.6	1048.3	1046.8	1047.4	53.12
Final body weight (g/rabbit)	2006.3c	2107.1b	2110.3b	2405.3a	2411.5a	109.4
Body weight gain (g/rabbit)	998.2c	1059.5b	1062b	1358.5a	1364.1a	50.71
Daily weight gain (g/rabbit)	16.93c	18.92b	18.96b	24.25a	24.36a	0.02
Feed consumption (g/rabbit)	5005.0c	5302.1b	5512.4a	5515.9a	5516.4a	152.6
Daily consumption (g/rabbit)	90.66c	94.68b	98.44a	98.50a	98.51a	0.08
Feed to gain ratio	5.65a	5.00b	5.01b	4.06c	4.04c	0.01

Means within the same row carrying different superscript letters (a, b, c) differ significantly (P<0.05)

Table 3: Effect of dietary supplementation of ACLEO on the growth performance of rabbits

Parameters	T1 (0 mg)	T2 (250 mg/kg Neomycin)	T3 (100 mg/kg of ACLEO)	T4 (200 mg/kg of ACLEO)	T5 (300 mg/kg of ACLEO)	SEM
Dry matter	79.17c	80.31b	80.28b	85.02a	85.05a	0.07
Crude protein	59.06c	60.33b	60.82b	71.55a	71.62a	0.04
Crude fibre	39.12c	41.11b	41.83b	47.93a	47.91a	0.02
Ether extract	41.94c	52.41b	53.21b	60.07a	61.45a	0.06
Ash	39.74c	43.28b	43.77b	51.93a	51.98a	0.05

Means within the same row carrying different superscript letters (a, b, c) differ significantly (P<0.05)

Table 4: Effect of dietary supplementation of ACLEO on nutrient digestibility of rabbits

References

1. Hernandez, M and Alagbe, J.O. (2025). Influence of Abrus procatorious crude oil supplementation on the growth performance, Nutrient digestibility, Ruminal fermentation and Microbial population of Malabari Bucks. *International Journal of Global Sustainable Research*, 3(7): 527-538.
2. Morris, Hernández, and Alagbe John Olujimi. "INFLUENCE OF Odontonema Strictum OIL ON THE GROWTH PERFORMANCE AND RUMINAL FERMENTATION OF BARBARI BUCKS." Research in: *Agricultural & Veterinary Sciences* 9, no. 2 (2025).
3. Emmanuel, U.A and Alagbe, J.O. (2026). Nutrient digestibility, rumen fermentation and Nitrogen retention of Yankasa rams supplemented Piliostigma thonningii essential oil based diet. Research in: *Agricultural and Veterinary Sciences*, 9(3): 106-120.
4. Emmanuel, U.A and Alagbe, J.O. (2026). Ecofriendly feeding strategies: effect of ginger essential oil on carcass yield and meat quality in white Fulani bulls. Research in: *Agricultural and Veterinary Sciences*, 9(3): 169-180.
5. Alagbe, J.O. (2026). Can Dietary Supplementation of Clinopodium brownei oil influence the growth performance, haematological and serum indices of Hubbard broiler chickens? *Pharmacy and Drug Development*, 5(1): 018.
6. Alagbe, John Olujimi, Karimat Imam Aliyu, and Orelaja Ithiel Tijesunimi. "Melaleuca quinquernervia leaf extract: Effect on growth performance and apparent digestibility of Japanese quails." (2026).
7. Alagbe, J.O., Anaso, E.U., Shittu, M.D., Anorue, D.N and Emiola, I.A (2026). Toxicological assessment of Supplemental Zanthoxylum acanthopodium essential oil in Rabbits: Evidence to Biochemical and Histopathological indices. *Biomedical and Biotechnological Sciences*, 2(1): 1-9.
8. Ayodele, S. O., O. D. Oloruntola, and J. O. Agbede. "Effect of Alchornea cordifolia leaf meal inclusion and enzyme supplementation on performance and digestibility of rabbits." *World Rabbit Science* 24, no. 3 (2016): 201-206.
9. Abdelli, Nedra, David Solà-Oriol, and José Francisco Pérez. "Phytogenic feed additives in poultry: achievements, prospective and challenges." *Animals* 11, no. 12 (2021): 3471.
10. Shittu, M. D., O. J. Alagbe, O. Alaba, E. O. Okanlawon, F. A. Adelakun, P. O. Emmanuel, and D. O. Adejumo. "Effect of ginger, garlic and negro pepper on gut microbes, gut histomorphometry and pathological assessment of selected organs of broiler chickens." *Adan Journal of Agriculture* 5, no. 1 (2024).
11. Anaso, Emmanuel U., Olurotimi A. Olafadehan, Ijeoma C. Chibuogwu, and John O. Alagbe. "Seminal morphology and organ morphometrics of rabbit bucks fed Piliostigma thonningii essential oil supplemented diet." *Science Letters* 12, no. 2 (2024): 70-75.
12. Aliyu, K.I., Agubosi, O.C.P., Sadiq, H.O., Alagbe, J.O and Adieme, G.E. (2024). Blood profile of rabbits fed varying levels of Phyllanthus amarus aqueous extract. *African Journal of Agriculture and Allied Sciences*, 4(1): 231-240.
13. Alagbe, J.O. (2025). Investigating the effect of dietary supplementation of Ficus exasperata oil on the growth performance, apparent digestibility and nitrogen utilization of weaner rabbits. *International Journal of Applied and Advanced Multidisciplinary Research*, 3(9): 661-668.
14. Alagbe, J.O. (2025). Effect of dietary supplementation of Asparagus racemosus essential oil on some haemato-biochemical constituents and oxidative stress indices of Gaddi rams. *International Journal of Advanced Technology and Social Science*, 3(9): 1229-1240
15. Alagbe, J.O., Anaso, E.U., Anorue, D.N and Zubairu, H. (2025). Influence of Chrimilaena odorata leaf extract on the growth performance and fatty acid composition of weaned rabbits. *International Journal of Advanced Technology and Social Sciences*, 3(8): 1191-1211.
16. National Research Council, and Subcommittee on Poultry Nutrition. Nutrient requirements of poultry: 1994. National Academies Press, 1994.
17. Alagbe, J.O and Anorue, D.N (2026). Influence of fermented Hunteria umbellata seed oil on the haematology, serum biochemistry, immune response and oxidative status of Growing Rabbits. *Clinical Sciences and Clinical Research*, 8(1): 016.
18. AOAC. (1990). Official methods of analysis, Association of Official Analytical Chemists, Washington, D.C., USA. 15th Edition, pp. 807-928
19. Ojediran, Taiwo Kayode, I. A. Emiola, V. Durojave, and John Olujimi Alagbe. "Proximate, vitamin and GC-MS profiling of Kigelia africana fruit powder." *Cerrado: Agricultural and Biological Research* 1, no. 1 (2024): 13-20.
20. Ojediran, Taiwo Kayode, Olujimi John Alagbe, Durojaye Victor, and Emiola Adewale. "Analysis of Kigelia africana (Lam.) Benth. fruit powder's antioxidant and phytochemical properties." *Brazilian Journal of Science* 3, no. 7 (2024): 38-49.
21. Anorue, Daniel Nnadozie, Friday Ubong, and Alagbe Olujimi John. "Investigating the effects of pawpaw (Carica papaya) essential oil dietary supplementation on the growth performance and carcass characteristics of broilers." Research in: *Agricultural and Veterinary Sciences* 7, no. 3 (2023): 164-174.
22. Alagbe, J. O. "Effects of feeding varying levels of tigernut (Cyperus esculentus) seed meal on the performance and blood profile of weaner grass cutters." *Scholarly Journal of Agricultural Science* 7, no. 1 (2017): 15-19.
23. Omokore, E. O., and J. O. Alagbe. "Efficacy of dried Phyllanthus amarus leaf meal as an herbal feed additive on the growth performance, haematology and serum biochemistry of growing rabbits." *International Journal of Academic Research and Development* 4, no. 3 (2019): 97-104.

24. Olatunji, A.K., Alagbe, J.O and Hammed, M.A. (2016). Effects of varying levels of Moringa olifera leaf meal on performance and blood profile of weaner rabbits. *International Journal of Science and Research*. 5(6):803-806.
25. Alagbe, J. O. "Performance and blood profile of grass cutters (*Thryonomys swinderianus*) fed wild sunflower (*Tithonia diversifolia* Hamsl. A Gray) leaf meal." *Sch. J. Agric. Sci* 6 (2016): 57-61.
26. Alagbe, J. O., O. C. P. Agubosi, A. D. Ajagbe, M. D. Shittu, and O. M. Akintayo Balogun. "Performance, Haematology and Serum Biochemical Parameters Of Growing Grass Cutters (*Thryonomys Swinderianus*) Fed *Phyllanthus Amarus* and *Pillogstigma Thonngii* Leaf Meal Mixture as Partial Replacement for Soya Bean Meal." *United International Journal for Research & Technology (UIJRT)* 2, no. 1 (2020): 14-23.
27. Choi, Bong-Keun, Sung-Bum Park, Dong-Ryung Lee, Hae Jin Lee, Ying-Yu Jin, Seung Hwan Yang, and Joo-Won Suh. "Green coffee bean extract improves obesity by decreasing body fat in high-fat diet-induced obese mice." *Asian Pacific journal of tropical medicine* 9, no. 7 (2016): 635-643.
28. Barakat, Safaa Ataya. "Growth performance and physiological responses of growing rabbits supplemented with green coffee extract." *Egyptian Poultry Science Journal* 41, no. 4 (2021): 753-768.
29. Osman, Hisham M., Mohamed E. Shayoub, and Elsiddig M. Babiker. "The effect of Moringa oleifera leaves on blood parameters and body weights of albino rats and rabbits." *Jordan Journal of Biological Sciences* 5, no. 3 (2012): 147-150.
30. Dognon, T. J., B. A. Aboh, S. Honvou, and I. Youssao. "Effects of substitution of pellet of Moringa oleifera to commercial feed on rabbit's digestion, growth performance and carcass trait." *Journal of Applied Pharmaceutical Science* 2, no. 9 (2012): 015-019.
31. Olafadehan, O.A., Oluwafemi, R.A and Alagbe, J.O. (2020). Carcass quality, nutrient retention and caeca microbial population of broiler chicks administered Rolfe (*Daniellia oliveri*) leaf extract as an antibiotic alternative. *Journal of Drug Discovery*. 14(33):146-154.
32. Olafadehan, O. A., R. A. Oluwafemi, and J. O. Alagbe. "Performance, haemato-biochemical parameters of broiler chicks administered Rolfe (*Daniellia oliveri*) leaf extract as an antibiotic alternative." *Drug Discovery* 14, no. 33 (2020): 135-145.

Citation: Alagbe, John Olujimi, Anorue Daniel N. Growth Performance, Nutrient Digestibility, and Feed Utilization Efficiency of Matured Crossbred Bucks Fed Diets Supplemented with *Ageratum conyzoides* Leaf Essential Oil. *Biomed. Biotechnol.Sci.* Vol. 2 Iss. 1. (2026) DOI: 10.58489/2833-0951.012