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Noni (*Morinda citrofolia* L.) foliage as a phytobiotic in broiler chicken feed.

Follaje de Noni (*Morinda citrofolia* L.) como fitobiótico en la alimentación de pollos Broilers

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ABSTRACT

Poultry farming is part of the productive chain of corn, soybeans and balanced, which is one of the most important within the Ecuadorian agricultural sector. Ecuadorian poultry farming has increased its production in recent years, unlike other types of meat production. The objective of the present investigation was to determine the effect of the addition of noni (Morinda citrofolia L.) foliage levels on the productive performance of Broiler chickens. The work was carried out in the "Cañales" Campus of the Mocache Canton, Los Ríos province. 160 Broiler Cobb 500 chickens were used, distributed in a completely randomized design with 4 treatments, 5 repetitions each, with 8 animals as the experimental unit. The evaluated treatments are T1 (Control; Commercial Balanced); T2, T3 and T4 (0.5, 1 and 1.5% respectively of Noni foliage flour). No statistical differences were found in relation to the productive parameters between the means of Tukey treatments (P≤0.05), however in the cost-benefit relation, 0.5% of Noni foliage presented the best value ($ 1.27), which means that for every dollar invested, a profit of 0.27 cents was obtained, with a profitability of 27.49% and a mortality of 2.5%. While the control treatment obtained a value of $ 1.12; a profitability of 11.71% and a mortality of 5%.

Keywords: Probiotic, mortality, profitability, productive parameters, consumption.

RESUMEN

La avicultura forma parte de la cadena productiva del maíz, soya y balanceado, que es una de las de mayor importancia dentro del sector agropecuario ecuatoriano. La avicultura ecuatoriana ha incrementado su producción en los últimos años a diferencia de otros tipos de producciones de carne. El objetivo de la presente investigación fue determinar el efecto de la adición de los niveles del follaje de noni (Morinda citrofolia L.), en el comportamiento productivo de los pollos Broiler. El trabajo se llevó a cabo en el Recinto "Cañales" del Cantón Mocache, provincia de Los Ríos. Se utilizaron 160 pollos Broiler Cobb 500, distribuidos en un diseño completamente al azar con 4 tratamientos 5 repeticiones cada uno, con 8 animales como unidad experimental. Los tratamientos evaluados son T1 (Testigo; Balanceado Comercial); T2, T3 y T4 (0.5; 1 y 1.5% respectivamente de harina de follaje de Noni). No se encontraron diferencias estadísticas en relación a los parámetros productivos entre las medias de tratamientos Tukey (P≤0,05), sin embargo en la relación beneficio costo el 0,5% de follaje de Noni presentó el mejor valor ($1,27), lo que significa que por cada dólar invertido se obtuvo una ganancia de 0,27 centavos., con una rentabilidad del 27,49% y una mortalidad del 2,5%. Mientras que el tratamiento testigo obtuvo un valor de $1,12; una rentabilidad de 11.71% y una mortalidad del 5%.

Palabras clave: Probiótico, mortalidad, rentabilidad, parámetros productivos, consumo

1. Introduction

Poultry farming is part of the corn, soybean and feed production chain, which is one of the most important in the Ecuadorian agricultural sector. Ecuadorian poultry farming has increased its production in recent years, in contrast to other types of meat production. (Jarrín, 2015) .

Poultry farming represents one of the most important livestock activities due to the great demand for products such as meat and eggs. This market has grown in recent years, so this industry is looking for nutritional alternatives that make production more efficient in the shortest time possible. (Herrera Mendoza, Use of three levels of ginger (Zingiber officinalis) meal as a growth promoter in broiler diets, 2016).

To achieve optimum productivity, the poultry needs many factors such as obtaining adequate nutrients, high quality raw materials, specific diets for each stage of life, diets according to the genetic line, climate, adequate biosecurity program and trained labor. Poultry nutrition represents 70% to 80% of the total production costs, however, for the diets to be processed correctly (digested and absorbed) the intestinal mucosa must present adequate structural and morpho-physiological characteristics. (Ronchi & Tepper, 2011).

Poultry farmers are interested in looking for new nutritional alternatives, so that the production periods are carried out in less time and the product to be obtained is of higher quality, in the alternatives of additives are the synthetic ones such as vitamins, enzymes, probiotics, amino acids and APCs (Antibiotic Growth Promoters), among others. These help to improve production rates, so the poultry industry has generated different ways to innovate these synthetic additives looking for natural alternatives that have been used empirically and without scientific study of the properties they have trying to improve their production costs. (Herrera Mendoza, Use of three levels of ginger (Zingiber officinalis) meal as a growth promoter in broiler diets, 2016).

Using antibiotics as growth promoters (APCs) in therapeutic subdoses in feed increases animal performance and productivity by controlling pathogenic bacteria, inhibiting their growth or controlling them, keeping the animal's digestive tract healthy and thus having a better utilization of the nutrients contained in the feed. (Ranilla & Carro, 2002) .

The application of antimicrobials in animal nutrition (antibiotics and chemotherapeutics) dates back 50 years. The first experiences (in chickens) demonstrated their beneficial effects at the end of the 1940s, and in the 1960s their commercial use was widely spread in Europe. (Cepero Briz, 2006) .

The trend towards natural products and the concern of some social sectors has led to the reduction or prohibition of the use of APCs in the production of animal protein for human consumption due to the possibility of the development of microbial resistance. (Gonzáles, et al., 2013) . The use of antibiotics, although they have played an important role in the safe production of meat, their use is being limited due to the consequences they cause to the consumer, and trends have been generated to look for alternatives to replace them. (Méndez, et al., 2015).

Additives have played an important role in the safe production of meat, but their use is being limited due to the consequences they cause to the consumer, which has generated a tendency to look for alternatives to replace them. (Méndez, García, Santellano, Durán, & Silva, 2015).

The use of certain plants as alternative medicine long ago to improve health or cure diseases in humans, there has been a growing interest in these medicinal plants lately, which has led to a significant increase in scientific research has led to the identification of the active components of phytobiotics and the mechanisms of action of these in the animal organism. (Roofchaee, Irani, Ebrahimzadeh, & Akbari, 2011).

The present study allowed to evaluate the effect of the addition of Noni (Morinda citrofolia L.) foliage, which will contribute to reduce feed costs, since this represents the highest percentage in poultry production and to obtain safe chicken meat.

2. Materials and Methods

Location and duration of the investigation.

The present investigation was carried out in the "Cañales" area, which is located in the Mocache canton, province of Los Ríos; its geographical location is 01° 11'25.6" South latitude and 79° 30'49.9" West latitude, at an altitude of 73 meters above sea level. The climatic conditions of the locality are: temperature 24.80 °C, relative humidity 84 %, rainfall 343.70 and average evaporation of 65.50 mm, this research had a duration of 42 days.

Experiment management.

The research carried out was of an exploratory, formative, documentary and field type, which contributes to the line of research:

Productive behavior of broiler chickens of the Cobb 500 genetic line fed with Noni foliage meal as phytobiotic. Exploratory type, the productive parameters and the improvement of nutritional quality were measured. By means of the quantitative method, the productive parameters of the variables under investigation were evaluated; by the experimental method, the best feeding treatment was determined with significance tests with Tukey at 5% probability. A completely randomized design (CRD) was used with four treatments and five replications, eight unsexed broilers per experimental unit. Tables 1 and 2 show the ADEVA and the description of the research treatments. The statistical model under which the response variables were analyzed is as follows:

$$Yij= u + Ti + Eij$$

Table 1. *Analysis of variance (ADEVA).*

Source of variation	Formula	Degrees of freedom
Treatments	*t – 1*	
Experimental error	*t (r- 1)*	
Total	*tr - 1*	

Prepared by: Authors.

3. Results

Analysis of the data obtained from the production indexes

Table 3 shows the variables: feed intake (FC), weight gain (WG), feed conversion ratio (FCR), carcass weight (CW) and carcass yield (CW) with their respective results obtained in the research.

Food consumption

Total feed consumption was higher for T1 (4616.74 g), followed by T2 (4511.08 g), T3 (4478.75 g) and T4 (4425.33 g), which is why this diet is the one with the lowest consumption. Statistical differences were found between the means of the treatments according to Tukey (P≤0.05), which means that the inclusion of noni foliage meal as a phytobiotic in the diet produces an effect on feed consumption.

Results different from those reported by Morales and Murillo (2016), where they observed that T1A (350 g of chili bell pepper meal/ton of feed with 8 chickens/m2) presented higher feed intake with 4524.18 g (±514), to those of Herrera (2016), where he found differences in feed intake when including 0.3% of ginger flour and Siles (2017); in his study of the effect of Noni extract where T2 (3 cc/Lt) presented higher feed consumption compared to T1 (Control), different cases since throughout the development of this research the highest consumption was recorded in the control treatment.

Weight Gain

Total weight gain was higher for T2 (2310.09 g), followed by T4 (2115.73 g), T3 (2083.97 g) and T1 (2051.79 g), so this diet presented lower weight, no statistical differences were found between the means of the treatments according to Tukey (P≤0.05), which means that the inclusion of noni foliage meal as a phytobiotic in the diet does not produce an effect on weight gain.

Results different from those reported by Alarcón (2019), where he observed that weight gain increased significantly in the treatment of the 0.2% proportion in the combination of Molle: Rosemary (70:30). While Morales and Murillo (2016), where they observed that T2B (500 g of chili bell pepper meal/ton of feed with 10 chicken/m2) presented higher weight with 2411.67 g (±148.99), as well as Siles (2017), where he observed higher weight gain in treatments T2 (3 cc/Lt) and T3 (6 cc/Lt) in his research on the effect of Noni extract, a similar case to this research since the highest weight gain presented T2 with inclusion of noni foliage meal compared to the control and to Montoya (2016), where he found higher weight gain with T1 (Butanoic acid) with 3037.77 g.

Food Conversion

The total feed conversion index there is a numerical difference, T2 (1.96) the one with the lowest index, followed by T4 (2.10), T3 (2.16) and with T1 (2.29) being this diet the one with the highest conversion index, no statistical differences were found between the means of the treatments according to Tukey (P≤0.05), which means that the inclusion of noni foliage meal as phytobiotic in the feed does not produce an effect on the feed conversion index.

These results are similar to those reported by Herrera (2016), who found differences in the feed conversion ratio when including 0.3% ginger flour. Like Montoya (2016), who found statistical differences in this parameter in the T1 treatment (Butanoic acid) with 1.78. While Siles (2017), where he found no differences in his investigation of the effect of Noni extract in his treatments T1 (Control), T2, T3 and T4 (3, 6 and 9 cc/Lt respectively). When working with noni foliage, the individual behavior and the effect it had on feed conversion in the broiler diet was observed (see Table 3), in comparison to what Alarcón (2019) reports, who with the combination of Molle and Rosemary in a ratio of 70:30 obtained good results with the ratio of 0.2% compared to the control.

Carcass yield

In carcass yield there is no statistical difference but numerically it is observed that T1 (69.580%) has the highest yield, followed by T2 (68.35%), T4 (67.67%) and T3 (65.59%), with T2 having the highest live weight and carcass weight, so its yield is the best among the means of the treatments according to Tukey (P≤0.05), which means that the inclusion of noni foliage meal as a phytobiotic in the feed does not produce an effect on the feed conversion rate (see Table 3).

Results similar to those reported by Alarcón (2019), where he found differences in carcass yield in the combination of Molle and Rosemary in a ratio of 70:30 obtained good results with the ratio of 0.2% compared to the control. Like Montoya (2016), where the best carcass yield was obtained with T1 (Butanoic acid) with 67.93 %. While Ordoñez et al (2018), when using oregano and an enzyme complex in broiler diets obtained higher carcass weight in the control groups. Roldan (2010), reported in his research where he used plants such as rosemary and basil values of 65.3% and 63.5% respectively, compared to the control treatments.

Profitability of Treatments.

Table 4 shows the economic analysis where T2 obtained the highest profit/cost ($1.27), which means that for each dollar invested, a profit of 0.27 cents is

obtained. USD; followed by T1 ($1.12), while T3 ($1.11) and T4 ($1.11) obtained the lowest profit, values that are acceptable within poultry production.

Results that are similar to those reported by Lozada (2014), where he obtained a benefit of 0.28 ctvs. USD per dollar invested in the treatment that incorporated 0.3% chili bell pepper flour, while in the control treatment he obtained a profit of 0.08 ctvs. USD. While Iza and Quispe (2011), determined that the highest profitability was achieved when they used feed with the incorporation of 2% PV of chili/poultry (T2), with a profit of $ 1.59 per bird, 1% PV of chili/poultry (T1) with a profit of 1.40 per bird. And to Siles (2017), where he observed the best economic result with treatment T3 (6 cc/Lt), followed by T1 (Control) and finally treatments T2 and T4 (3 and 9 cc/Lt respectively) in his investigation of the effect of Noni extract.

Table 2. *Economic analysis on the effect of "Noni (Morinda citrofolia L.) Foliage as a Phytobiotic in Broiler Chicken Feed", 2020*.

ITEMS	**0% NONI FLOUR**	**0.5% NONI FLOUR**	**1.0% NONI FLOUR**	**1.5% NONI FLOUR**
INCOME	**T1**	**T2**	**T3**	**T4**
Total pounds (lb)	162,47	197,08	172,21	171,36
Price per lb, USD	1,75	1,75	1,75	1,75
Total Revenues, USD	284,32	344,89	301,36	299,88
COSTS				
Chicken bb (40 birds)	27,20	27,20	27,20	27,20
Labor	2,50	2,50	2,50	2,50

Depreciation of Warehouse	0,026	0,026	0,026	0,026
Vaccines	0,80	0,80	0,80	0,80
Feeding	224,00	240,00	240,00	240,00
Total Costs, USD	254,53	270,53	270,53	270,53
Net Profit	29,80	74,37	30,84	29,25
Benefit / Cost	1,12	1,27	1,11	1,11
Yield, %, %, %, %, %, %, %, %, %, %, %, %.	11,71	27,49	11,40	10,85

Prepared by: Authors.

Mortality

In mortality, the treatments with the highest mortality rate were T1 and T4 (5%) for both and those with the lowest mortality rate were T2 and T3 (2.5%) for both as shown in Table 5, while the average mortality rate for the entire study was 3.75% and for the treatments that received noni leaf meal was 3%.

Results similar to those reported by Iza and Quispe (2011), where they obtained a mortality of 2% when using chili bell pepper meal in broiler chicken feed. While Ordoñez *et al* (2018), found no differences in this parameter when using oregano and an enzyme complex in broiler diets.

4. Conclusions

No effect of noni (*Morinda citrofolia* L.) foliage meal as a phytobiotic in the feeding of broiler chickens was found, since there were no significant differences between the groups with the inclusion of the foliage meal and the control group, indicating that the way in which the phytobiotic was included and at the

proposed doses have no improving effect on the zootechnical performance. In the economic analysis, the highest benefit/cost was that of 0.5% noni (*Morinda citrofolia* L.) foliage meal with $1.27 and a profitability of 27.49 %. The lowest mortality rate was presented in the treatments 0.5% and 1.0% of Noni (*Morinda citrofolia* L.) foliage meal in the feed with 2.5% for both.

References

Alarcón Alarcón, W. Y. (2019). *Acción fitobiótica en pollos de carne con Molle: Romero (70: 30) en la dieta.* Tesis de Grado, Universidad Nacional Pedro Ruiz Gallo, Facultad de Ingenieria Zootecnia, Lambayeque.

Barrantes, G., Chaves, H., & Vinueza , M. (Mayo de 2010). *Corporación de Manejo Forestal Sustentable.* Recuperado el 12 de Diciembre de 2014, de http://comafors.org/wp-content/uploads/2010/05/El-Bosque-en-el-Ecuador.pdf

BCE. (2015). *Banco Central del Ecuador.* Recuperado el 5 de Marzo de 2015, de http://contenido.bce.fin.ec/indicador.php?tbl=inflacion

Cepero Briz, R. (2006). *Retirada de los antibióticos promotores de crecimiento en la Unión Europea: Causas y Consecuencias.* Universidad de Zaragoza , Producción Animal y Ciencias de los Alimentos, España.

Ecopapel. (2011). *Ecopapel.* Recuperado el 14 de Diciembre de 2014, de http://www.ecopapel.es/inicio/es/envase-sostenible/proceso-de-produccion.html

Gonzáles, S., Icochea, E., Reyna, P., Guzmán, J., Cazorla, F., Lúcar, J., & San Martín, V. (2013). Efecto de la suplementación de ácidos orgánicos sobre los párametros productivos en pollos de engorde. *Revista de Investigaciones Veterinarias del Perú, 24*(1). Obtenido de http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S1609-91172013000100004

Herrera Mendoza, B. R. (2016). *Utilización de tres niveles de harina de Jengibre (Zingiber officinalis) como promotor de crecimiento en dietas para pollos de engorde.* Tesis de Grado, Universidad Técnica de Ambato, Facultad de Ciencias Agropecuarias - Carrera de Medicina Veterinaria y Zootecnia, Cevallos - Ecuador.

Herrera Mendoza, B. R. (2016). *Utilización de tres niveles de harina de jengibre (Zingibre officinalis) como promotor de crecimiento en dietas para pollos de engorde.* Tesis de Grado, Universidad Técnica de Ambato., Facultad de Ciencias Agropecuarias - Carrera de Medicina Veterinaria y Zootecnia., Cevallos - Ecuador.

Inec. (2000). Obtenido de http://www.produccion.gob.ec/wp-content/uploads/downloads/2013/02/AGENDA-TERRITORIAL-SANTO-DOMINGO.pdf

Iza Cofre, N. J., & Quispe Sangucho, M. L. (2011). *Evaluación del promotor de crecimiento natural a base de ají en la dieta alimenticia de pollos broiler en la calera ciudad de Latacunga provincia de Cotopaxi.* Tesis de Pregrado, Inversidad Técnica de Cotopaxi, Unidad Académica de Ciencias Agropecuarias y Recursos Naturales. Carrera de Medicina Veterinaria y Zootecnia., Latacunga.

Jarrín, J. (2015). Análisis de la Avicultura en Ecuador. *Revista ElAgro*.

Lozada Ortiz, J. P. (2014). *Evaluación del ají (Capsicum annum) como aditivo natural para la prevención de coccidiosis en pollos parrilleros.* Tesis de Pregrado, Universidad Técnica de Ambato, Facultad de Ciencias Agropecuarias, Cevallos.

Méndez, G., García, J., Durán, L., Hernan, E., Santellano, E., & Silva, R. (2015). Aceite esencial de orégano (Lippia berlandieri Schauer) en variables de calidad de la canal de pollo. *Ecosistemas y recursos agropecuaios., 2*(4), 41-51. Obtenido de http://www.scielo.org.mx/scielo.php?pid=S2007-90282015000100004&script=sci_arttext&tlng=en

Méndez, G., García, J., Santellano, E., Durán, L., & Silva, R. (2015). Aceite de orégano sobre la calidad de pechuga de pollos de engorda. *Investigación y Ciencia, 23*(65), 5-12. Obtenido de http://www.redalyc.org/articulo.oa?id=67443217001

Montoya, E. (2016). *Respuesta en el desempeño de pollos de engorde al actigen; a un probiotico y al ácido butanóico.* Trabajo de Titulación, Escuela Politécnica Superior de Chimborazo , Facultad de Ciencias Pecuarias-Carrera de Ingeniería Zootécnica, Riobamba-Ecuador.

Morales Morales, K. F., & Murillo Loor, D. A. (2016). *Inclusión de harina de ají como coccidiostato en dos densidades poblacionales y su influencia en parámetros*

productivos en pollos Cobb 500. Tesis de Grado, Escuela Superior Politécnica Agropecuaria de Manabí Manuel Félix López, Carrera Pecuaria, Calceta.

Ordoñez Rumiche, E. M., Del Carpio Ramos, P. A., & Cayo Colca, I. S. (2018). Suplementación alimenticia con orégano (Origanum vulgare) y complejo enzimático en pollos de carne: I. Indicadores Productivos. *Revista de Invetigación y Cultura, VII*(1), 31 - 44.

Paschoal, J. (2007). *Macroeconomía* (Quinta ed.). México: Pearzon Educación, S.A.

Proyecto Ecologista CMEA. (14 de Abril de 2010). Recuperado el 14 de Diciembre de 2014, de http://proyectoecologistacmea.blogspot.com/2010/04/por-que-reciclar-papel.html

Ranilla, M., & Carro, D. (2002). *Antibióticos: debate sobre la resistencia antimicrobiana.* Leon : Mundo Veterinario. Obtenido de http://www.magrama.gob.es/ministerio/pags/biblioteca/revistas/pdf_MG/MG_2002_149_82_85.pdf

Rocafort, A., & Ferrer, V. (2010). *Contabilidad de Costes.* Barcelona: Profit Editorial I.

Roldán Forero, L. P. (2010). *Evaluación del uso de los aceites esenciales como alternativa al uso de los antibióticos promotores de crecimiento en pollos de engorde.* Tesis de maestria, Universidad Nacional de Colombia, Facultad de Medicina Veterinaria y de Zootecnia, Bogota.

Ronchi, C., & Tepper, R. (2011). Utilización de Enzimas, Prebióticos y Probióticos en la Alimentación Animal. *Revista Avicultores*.

Roofchaee, A., Irani, M., Ebrahimzadeh, M., & Akbari, M. (2011). Effect of dietary orégano (Origanum vulgare L.) essential oil on growth performance, cecal microflora and serum antioxidant activity of broiler chickens. *African Journal of Biotechnology, 10*(32), 6177-6183. Obtenido de https://www.ajol.info/index.php/ajb/article/view/94499/83870

Senasa. (2013). *senasa.org.ar*. Recuperado el 20 de Enero de 2014, de http://www.senasa.gov.ar/estadistica.php#

Siles Gama, P. R. (2017). *Efecto del extracto de Noni (Morinda citrifolia L) en el comportaniento productivo de pollos broiler en Pucallpa.* Tesis de Pregrado, Universidad Naciona de Ucayali, Facultad de Ciencias Agropecuarias, Pucallpa - Perú.

Sim. (2000). *Agronet.* Recuperado el 20 de Enero de 2014, de http://www.agronet.gov.co/www/docs_agronet/2005114104651_Perfil_ecuador.pdf

Simbaña, A. (2012). *EVALUACIÓN AGRONÓMICA DEL CULTIVO DEL CILANTRO.* Guaranda: Universiadad Estatal de Bolívar. Obtenido de http://www.biblioteca.ueb.edu.ec/bitstream/15001/972/1/0.40%20AG.pdf

Sinagap. (2012). Recuperado el 21 de Enero de 2014, de http://sinagap.agricultura.gob.ec/

Ten, H. (2010). *Administración de Empresas Agropecuarias.* México: Trillas.

Toro, F. (2010). *Costos ABC y Presupuestos.* Bogotá: Ecoe Ediciones.

Urquizo, J., Acero, H., & Rodríguez, J. (12 de Diciembre de 2011). *Escuela Superior Politécnica del Litoral*. Recuperado el Diciembre de 2014, de Dspace: http://www.dspace.espol.edu.ec/handle/123456789/19195

Váquiro, J. (23 de Febrero de 2010). *Pymes Futuro.* Recuperado el 20 de Febrero de 2015, de http://www.pymesfuturo.com/costobeneficio.html

Zorrilla, S. (2004). *Como aprender Economía conceptos básicos.* México: Limusa, S.A de C.V.

Zuñiga, C. (2011). *Texto Básico de Economía Agrícola.* Nicaragua: Universitaria UNAN-León. Obtenido de http://books.google.com.ec/books?id=Sfv-Yr1xdE4C&printsec=frontcover&dq=economia+agricola&hl=es&sa=X&ei=wiU3VLbJGseTsQTD5oDoBQ&ved=0CBoQ6AEwAA#v=onepage&q=economia%20agricola&f=false