# Performances of rabbit fed diets with graded levels of bean offal (*Phaseolus vulgaris L.*)


## Abstract

**Aims:** The aim of the study was to increase rabbit production by evaluating the effects of bean offal on the growth performance of the New Zealand rabbits breed and to reduce the economic costs of feed.

**Study design:** study was conducted in a completely randomized design

**Methodology:** For this purpose, forty-eight (48) rabbits of 50 days old were divided into four equal groups each containing 12 rabbits and into sub-groups of 3 rabbits per cage, depending on the rate of incorporation of bean offal (0, 15, 22.5, and 30% respectively for T0, T15, T22.5 and T30) in a completely randomized design. The diets were iso caloric and iso nitrogenous.

**Results:** The results obtained showed that there was no significance ($p > 0.05$) different among treatment means in final live weight, weekly live weight and feed conversion ratio (FCR), however, feed intake was significantly higher in the control diet T0 (3251±554.96g) as compared to T22.5 (31412±554.96g). Weight gain of rabbit fed dietT22.5 was higher (3173±284.93g) as compared to those fed on control diet T0 that recorded the lowest values (2986.67±284.93g). Cost of production per kg of live weight was significantly higher ($p<0.05$) with rabbit fed on control diet T0 (7835.79±278.62 FCFA) whereas the lowest value was recorded with rabbit under diet T30 (7232.06±278.62 FCFA).

**Conclusion:** It is concluded that up to 22% of bean offal could be included in rabbit diet to reduce cost of feed and improve performances.



**Keywords:** bean offal, diets, growth, and rabbit.


## INTRODUCTION

There is limited access to protein sources in most countries of the sub-Saharan Africa and Cameroon in particular. In Cameroon, animal protein intake is approximately 17 kg/caput/year (1) which is less than the 42 kg/caput/year recommended by the Food and Agricultural Organisation (FAO) and the World Health Organisation (WHO). To cover the gap, there is an urgent need to increase livestock in the country. This necessitated the continuous research into more cost-effective systems for meat production (2) and rabbit production appear as one of the most suitable way. In fact, rabbit have good attributes which include high efficiency in converting forage to meat, short gestation period, high prolificacy, relatively low cost of production, high nutritional quality. Moreover, rabbit possess the ability to digest large amount of fibrous feed in the diet which can be used properly to reduce the cost of production (3). Despite these

advantages, rabbit production in Cameroon is still critically low because of unsuitable production technique, unavailability of parent stock and high feed cost. In rabbit intensive farming, feed accounts for 60 to 70% of production costs (4). The use of unconventional foodstuffs is one of the alternatives that can be adopted to reduce production costs (5). Economically, it would provide the poorer strata of the population with cheap access to animal proteins. In fact, previous research reveals that the utilization of agricultural by product in rabbit diet lead to a reduction in production cost without impairing growth performances (3 and 6**)**. Furthermore, as reported by Hamed et al (7) the used of pea offal and hay in rabbit diet reduce the production cost of the ration and improve the feed conversion ratio. In Cameroon, leguminous plant such as bean is abundantly produced (51×103 tons/year) (INS, 2015), the offal is generally abandoned in fields or sometimes are burn after the harvest. Feedipedia (8), reported that bean offal contains 7.1 % of crude proteins, 41.0 % of crude fiber, 8.9 % of ash. Bean offal properly used, can be a good source fiber which will reduce production cost. This study was aimed to investigate the effect of bean offal on growth performances and cost of production of rabbit.

## MATERIALS AND METHODS

The study was conducted using forty-eight (48) healthy, New Zealand rabbit breed of 50 (fifty) days old and weighing between 1.1 and 1.2 Kg. Before the arrival of the animals the breeding house, the metabolic cages and all equipment such as drinkers, feeders, and buckets were thoroughly cleaned, washed and disinfected with Cresyl®. These rabbits were randomly allocated to 4 groups of 12 animals each. Bean offal was purchase in Badjoun rural organization farm directly after harvest. Four rations were formulated containing 0% (control feed), 15%, 22.5%, and 30% bean offal representing T0, T15, T22.5 and T30 respectively.

The composition of the various diets fed to the rabbits is shown in Table1.

**Table 1: Composition of experimental diet**

| Ingredients | $T_0$ | $T_{15}$ | $T_{22.5}$ | $T_{30}$ |
|---|---|---|---|---|
| Maize | 30 | 28.5 | 28.5 | 29 |
| Wheat bran | 5 | 7 | 6.6 | 8 |
| *Pennisetum purpurum* | 30 | 15 | 7.5 | 0 |
| Bean offal | 0 | 15 | 22.5 | 30 |
| Soya bean cake | 5 | 7 | 7 | 7 |
| Cotton cake | 6.5 | 6 | 6 | 7 |
| Palm cake | 11 | 10 | 10 | 6 |
| Fish meal | 3 | 3 | 3 | 4.5 |
| Lime stone | 0.5 | 1 | 1 | 1.5 |
| Premix | 5 | 5 | 5 | 5 |
| Oil | 4 | 2.5 | 2 | 2 |
| **Total** | **100** | **100** | **100** | **100** |
| **Chemical composition** | | | | |
| Metabolisableenergy | 2586 | 2587 | 2580 | 2610 |
| Digestible energy | 3150 | 3154 | 3200 | 3200 |
| Crudeprotein | 17.4 | 17.4 | 17.3 | 17.7 |
| Cellulose | 15 .00 | 15.30 | 15.8 | 15.7 |

| Prize/kg(FCFA) | 241 | 231 | 230 | 227 |
|---|---|---|---|---|

The rabbits were allowed to access water and feed *ad libitum*. The experiment was a complete randomized design. Eighteen weaned rabbits, of average weight 536g were allotted to four treatments, with six rabbits per treatment diet.

The animals were weighed weekly and feed intake was measured daily. Feed conversion ratio was then calculated from the data obtained.

**Economic analysis**

Economic analysis consisted of estimating the economic benefit of incorporating bean offal in rabbit diet. Only the direct variable costs are thus taken into account here. The characteristics evaluated were price of kg of diet, price of feed consumption and prize of kg of live weight.

**Statistical analysis**

At the end of the experiment, the different results were processed using the Microsoft Excel spreadsheet. The statistical analysis and comparison of averages between the different dietary schemes (control and those based on bean offal) were conducted by means of one-way analysis of variance (ANOVA) test using the Statistical Package for the Social Sciences software (SPSS version 21). Duncan test were performed if the ANOVA test displayed a significant difference from the error risk of 5% ($p<0.05$). Pearson test was used to determine the relation between growth parameter and incorporation level of offal bean.

**Ethical approval**

The present study was conducted after approval of Institutional Animal Ethics Committee of Dschang University, Cameroon.

**Results and discussion**

The mean feed intake, body weight, total weight gain and feed conversion ratio (FCR) as affected by bean offal are presented in Table 2. Generally, it appears that apart from feed intake, all other characteristics were not significantly affected ($p>0.05$) with the bean offal levels in the diet.

**Table 2: Growth performances of growing rabbit graded levels of bean offal**

| Characteristics | Diets | | | | SEM | p |
|---|---|---|---|---|---|---|
| | $T_0$ | $T_{15}$ | $T_{22.5}$ | $T_{30}$ | | |
| **Feedintake (g)** | 32513.67$^{b}$ | 32184.67$^{ab}$ | 31412$^{a}$ | 31859.33$^{ab}$ | 554.96 | 0.004 |
| **Body weight (g)** | 7812.5$^{a}$ | 7783.33$^{a}$ | 7791.67$^{a}$ | 7820.83$^{a}$ | 227.88 | 0.998 |
| **Body weight gain (g)** | 2986.67$^{a}$ | 3080.00$^{a}$ | 3173.33$^{a}$ | 3010.00$^{a}$ | 284.93 | 0.891 |
| **Dailly weight gain (g)** | 53.33$^{a}$ | 55.00$^{a}$ | 56.67$^{a}$ | 53.75$^{a}$ | 5.09 | 0.891 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Feed conversion ratio** | 10.95[a] | 10.45[a] | 9.95[a] | 10.81[a] | 1.14 | 0.770 |

a,b: mean with the same superscript are not significantly different at 0.05 significant level; SEM: standard errors of mean; p: p-value

Rabbit fed on the control diet recorded the highest feed intake ($p>0.05$) as compared to rabbit fed on diet containing bean offal. This decreased in trend is confirmed by the regression curve presented in figure 1. This curve reveals that, 60% of variation recorded in feed intake can be attributed to bean offal level in the diet ($R^2$=0.61). This feed intake reduction can be attributed to the high concentration of tannin and lignin present in bean offal. In fact, tannin and lignin are antinutritional factors in agricultural by products which deprived intake (9; 3). This result corroborated with those of El-Gendy et al. (10) and Mennani *et al* 5(3) that recorded a decrease in feed intake in rabbits when fed with graded level of sorghum offal and apricot kernel respectively. In contrary, Fatma *et al* (11) and Omer *et al* (12) recorded no significant difference between control diet and those containing hay in rabbit. This difference may be attributed to the high incorporation level and type of agricultural by product used.

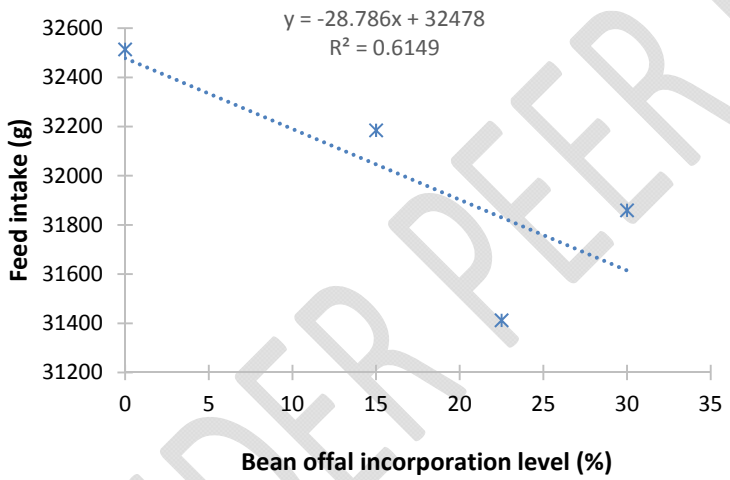
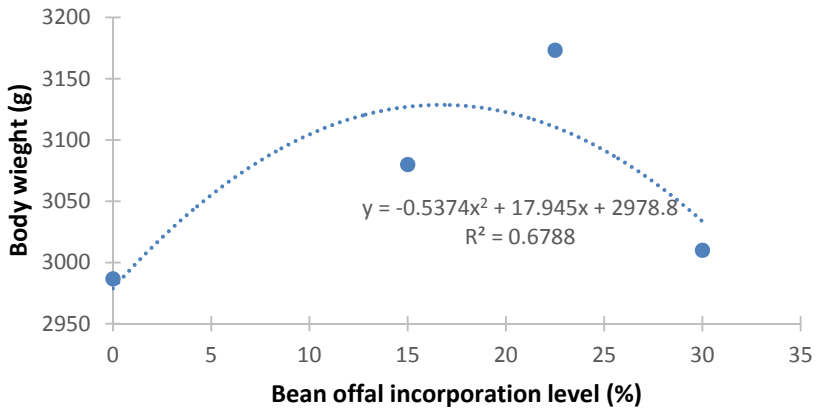



**Figure 1: Relationships feed intake in rabbit and level of incorporation of bean offal**

The inclusion of *bean offal* in the diet did not significantly affected body weight, body weight gain and feed conversion ratio. Similar results have also been reported by other authors (13; 3). However, it tends to increase body weight and body weight gain as compared to the control diet (Table 2). This trend is illustrated in figure 2. The parabolic shape shows that from 0 to 22.5%, body weight increases with the level of bean offal in the diet up to 30% it tends to decrease weight. This result is in line with those of (13) which obtained an improved in rabbit weight when fed diet containing Bersem offal as compared to the control diet.

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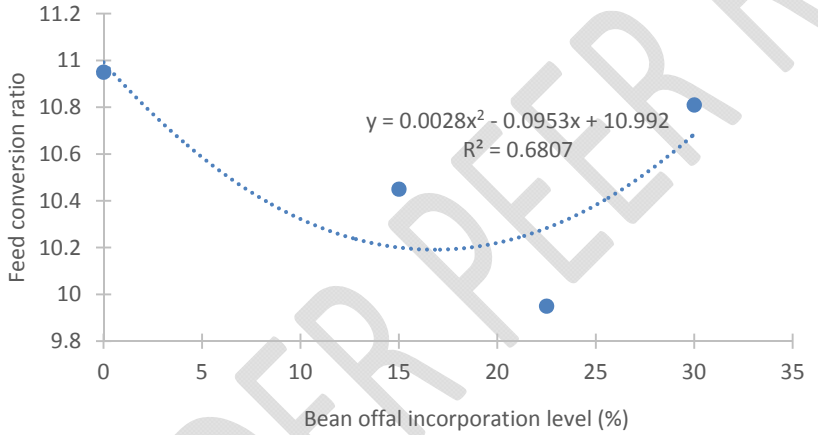
106 **Figure 2: Correlation between final body weight and bean offal incorporation level in rabbit diet**

107 Feed conversion was not significantly affected ($p>0.05$) by bean offal incorporation in the diet. However, it
108 tends to decrease with the level of offal in the diet. The illustration of this trend is presented in figure 3
109 showing that from 0 to 22.5% bean offal decreased FCR but above this level, FCR increases instead.

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111 **Figure 3: Correlation between feed conversion ratio and bean offal incorporation level in rabbit diet**

112 Feeding rabbits with bean offal at 22.5% in the diet reduced FCR by 10% when bean offal was as
113 compared to control. We can therefore suggest that, feed efficiency is improved by bean offal as source of
114 fiber. This finding is in line with those of Safwat et al. (14) who reported that leguminous offal (bean and
115 groundnut) in rabbit diet reduced feed conversion ratio. This can be explained by the reduction in digestive
116 transit time and increase in caeca microbiota as reported by Bennegadi *et al* (14) and Fatma et al (11).

117 **Economics analysis**

118 Effects of bean offal on feed cost of production of rabbit are presented in table 3. Feed consumption
119 decreases significantly ($p<0.05$) with the incorporation of bean offal in the diet.

**Table 3: Economic analysis of rabbit production as affected by incorporation of bean offal in the diet**

| Characteristics | Rations | | | | SEM | p |
|---|---|---|---|---|---|---|
| | $T_0$ | $T_{15}$ | $T_{22.5}$ | $T_{30}$ | | |
| **Price of feed (FCFA/kg)** | 241 | 231 | 230 | 227 | / | |
| **Feedconsumptioncost** | 7835.79$^{c}$ | 7434.66$^{b}$ | 7224.76$^{a}$ | 7232.07$^{a}$ | 278.62 | 0.000 |
| **Feed cost for production of Kg of live weight (FCFA)** | 2639.36$^{a}$ | 2414.26$^{a}$ | 2289.19$^{a}$ | 2454.62$^{a}$ | 271.41 | 0.548 |

a,b: mean with the same superscript are not significantly different at 0.05 significant level SEM: standard errors of mean; p: p-value

The lowest feed consumption cost was recorded with diet T22.5 and T30 containing 22.5 and 30% bean offal respectively as compared to the rest of the treatment. In contrary, cost of production was not significantly affected (p>0.05) by the level of bean offal in the diet although a slit decrease was recorded in production cost when the rate of incorporation of bean offal increased (Figure 4). Diet T22.5 decreased feed production cost by 13% as compared to the control diet. Moreover, the relation between bean offal ratio and cost of production was very high. As presented in figure 4, the correlation coefficient between these two variables was R2=0.97 meaning that 97% of variation observed in feed cost of production are related to bean offal.

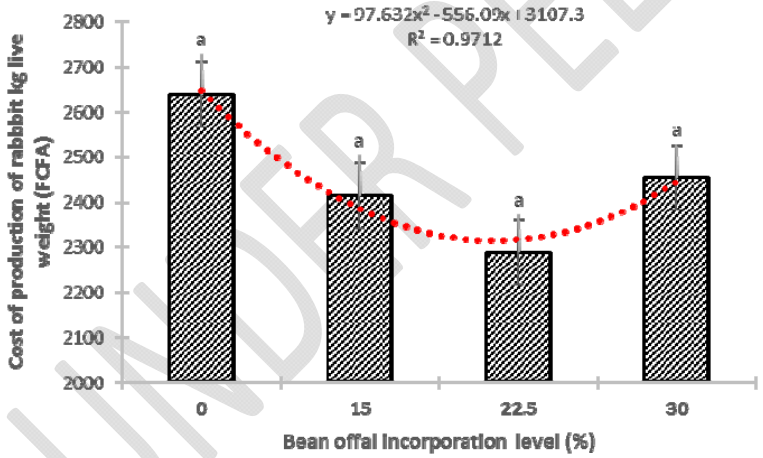


**Figure 4: Correlation between feed cost of production per kg of live weight and bean offal incorporation level in rabbit diet**

The utilization of agricultural by product lead to the reduction in the cost of production off rabbit maet. Similar results were reported by El-Medany et al (15) and later Hamed et al (7). These authors recorded that, incorporation of red bean and peanut offal in the diet resulted to a decrease in production cost and were therefore more economically efficient (increase breeder net return). This improvement is due to the

combined effect of this ingredient on the low cost of the diet and the benefit on digestion via the caeca microbiota (16).

## CONCLUSION

The result of the study indicated that 22.5% of bean offal could be included in the diet of weaned rabbits without adverse effects on performance.

Rabbits fed on bean offal inclusion level of 22.5 % recorded the highest weight gain and cheapest cost of production.

Farmers should therefore take advantage of the availability of bean offal to lower the cost of feed and also increase their profit margin.

### Ethical approval

The present study was conducted after approval of Institutional Animal Ethics Committee of Dschang University, Cameroon.

## REFERENCES


1- **Onakpa M M, Ode J O, Ajagbonna O P and Asuzu I U 2016** In Vivo and In Vitro Antioxidant Effects of *Icacina trichantha* Tuber Extract. *Nigerian Veterinary Journal*. Vol. 37 (3): 148-154. ISSN 0331-3026

**2- World Food Programme 2017** Cameroon: Comprehensive Food Security and Vulnerability Analysis. United Nations World Food Programme. http://vam.wfp.org/default.aspx. Pp 138.

3- **Mennani A, Arbouche R, ArboucheY, Montaigne E, Arbouche F andArbouche H S 2017** Effects of incorporating agro-industrial by-products into diet of New Zealand rabbits: Case of rebus of date and apricot kernel meal. Veterinary world, 10(12), 1456-1463.

4- **Oseni S O and Lukefahr S D 2014** Rabbit production in low-input systems in africa: situation, knowledge and perspectives – a review. *World Rabbit Sciences*. 2014, 22: 147-160 doi:10.4995/wrs.2014.1348

5- **Edgar Molina, Pedro González-Redondo, Rafael Moreno-Rojas, Keyla Montero-Quintero and Adriana Sánchez-Urdaneta 2018** Effect of the inclusion of *Amaranthus dubius* in diets on carcass characteristics and meat quality of fattening rabbits, *Journal of Applied Animal Research*, 46:1, 218-223, DOI:10.1080/09712119.2017.1287078 https://doi.org/10.1080/09712119.2017.1287078

6- **Kadi S A, Mouhous A, Djellal F, Senhadji Y, Tiguemit N et Gidenne T 2017** Feuilles sèches de Figuier et foin de Sulla (Hedysarumflexuosum) en alimentation du lapin en engraissement. Livestock Research for Rural Development. Volume 29, Article #86. Retrieved March 9, 2019, from http://www.lrrd.org/lrrd29/5/kadi29086.html

7- **Hamed Abdel-Aziz, Ali Omer, Mohamed Farouk El Karamany, Sawsan Mansour Ahmed, Soha Sayed Abdel-Magid and Bakry Ahmed Bakry2018** Incorporation field crop residues in

rabbit rations. Bulletin of the National Research Centrehttps://doi.org/10.1186/s42269-018-0025-2 42 (27): 224-233.

8- **Feedipedia 2018** Animal feed resources information system. https://www.feedipedia.org/node/266

9- **Myrie SB,Bertolo RF, Sauer WC and Ball RO 2008** Effect of common antinutritive factors and fibrous feedstuffs in pig diets on amino acid digestibility with special emphasis on threonine. J. Anim. Sci., 86: 609- 619.

**10- El-Gendy KM,AbdeL-Baki SM, Sarhan MAand Moawd RI 2002** Evaluation of sweet lupin (lupin albus) as green forage for sheep and rabbits 3rd Sci. Congress Rabbit Production in Hot Climates. 8-11 October, 677-692.

11- **Fatma A, Elgohary Hayam M A and Abo EL- Maaty 2014** Phaseolus vulgaris Straw as a Substitute for Clover Hay in Rabbit Diets with Prebiotic Supplementation and Feed Restriction Interaction: Influence on Nutrient Utilization, Caecal Activity, Carcass Yield and Blood Plasma Constituents. Global Veterinaria 13 (6): 1010-1021.

12- **Omer HAA and BadrAzza MM 2013** Growth performance of New Zealand White rabbits fed diets containing different levels of pea straw. Life Science Journal, 10 (2): 18151822.

13- **Omer H A A, Ali F A F and Ibrahim ShA M 2011** Strawberry by-products as a partial replacement of clover hay in rabbit diets. American-Eurasian J. Agric. & Environ. Sci., 11 (6): 815-823.

14- **Safwat M A, Sarmiento-Franco L and Santos- Ricalde R H 2014** Rabbit production using local resources as feedstuffs in the tropics. *Tropical and Subtropical Agroecosystems* [Internet]. 2014;17(2):161-171. Recuperado de: https://www.redalyc.org/articulo.oa?id=93931761002

15- **El-Medany N M, Hashem NA and Abdl-Azeem F 2008** Effect of incorporating dried carrot processing waste in growing rabbit diets. Egyptian J. Nutrition and Feeds, 11 (1): 25-37.

16- **Abo EL-MaatyHayam MA, Abo Egla EL-Samra HA, Qota E.M and EL-DesoukySheren M 2014** Performance and economical efficiency of growing New Zealand White rabbits fed cucumber (C*urcumis sativus* l) veins straw without or with some feed additives under Egyptian conditions. *Egyptian Poultry Sciences*., 34 (2) : 413-431.

17- **Bennegadi N, Fonty G, Miller L, Gidenne T and Licois D 2003** Effects of Age and Dietary Fiber Level on Caecal Microbial Communities of Conventional and Specific Pathogen-Free of rabbits. Microbiology and Ecology Health Disease, 5: 23-32