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Performance of rabbits (*Oryctolagus cuniculus*) fed with different levels of trichanthera (*Trichanthera gigantea*) leaf meal in pelletized diets

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Abstract

This study evaluated the effects of incorporating *Trichanthera gigantea* (Madre de Agua) leaf meal into pelletized diets for weaner rabbits. Conducted at Cagayan State University–Piat Campus from August to October 2024, the experiment used a Completely Randomized Design with four dietary treatments: a control (basal commercial diet) and diets containing 5%, 10%, and 15% madre de agua leaf meal. Proximate analysis showed that increasing inclusion levels decreased crude protein and fat while increasing fiber and ash content. Rabbits fed with 5% madre de agua leaf meal exhibited the highest growth performance, feed efficiency, and final weight, although differences among treatments were not statistically significant. Higher inclusion levels (10% and 15%) led to reduced performance, likely due to increased fiber and anti-nutritional compounds. The study concludes that a 5% inclusion level of *T. gigantea* is optimal for rabbit diets, offering a cost-effective and sustainable alternative to commercial feed ingredients without negatively affecting feed intake or health.

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Introduction

Rabbit farming is a growing sector of the livestock industry in the Philippines, recognized for its potential to provide a healthy meat alternative and a sustainable source of income when managed efficiently (Lorio *et al.*, 2023). The Food and Agriculture Organization (FAO) has highlighted rabbits as a viable means of improving food security and nutrition, especially in low-income communities, due to their efficient feed conversion, rapid growth, and high reproductive rate (Lukefahr, 1998).

Domesticated rabbits, all descended from the European rabbit (*Oryctolagus cuniculus*), are raised globally for meat, wool, fur, and as pets (British Columbia 4-H Manual, 2009). As herbivorous, simple-stomached animals, rabbits are known for their fast growth and high feed efficiency. In many parts of Europe, the Americas, and the Middle East, rabbit meat is widely consumed (Li *et al.*, 2018).

In the Philippines, breeds commonly used for meat production include the New Zealand White (NZW), Californian (CAL), and their crosses. Locally, the term "New Zealand" often refers to mixed-breed rabbits resembling the NZW in body type but with varied coloration.

The Californian rabbit, originally developed in the U.S., is known for its muscular body and commercial viability (Ozimba and Lukefahr, 1991; Maj, 2009). Crossbreeding these breeds has been shown to improve growth rate, feed conversion, and carcass traits (Nofal *et al.*, 1997; Gondret *et al.*, 2005).

Despite the growing interest in rabbit meat as a substitute for pork (Medenilla, 2021), the profitability of rabbit production is hindered by the rising cost of commercial feeds, which can account for 40–60% of total production expenses (Jentzer, 2009). This has encouraged the search for alternative, cost-effective, and sustainable feed resources.

One such promising alternative is Madre de Agua (*Trichanthera gigantea*), a fast-growing fodder tree native to Colombia and well-adapted to tropical climates. It has been successfully introduced to several countries, including the Philippines, and is known for its high protein content and good palatability. According to Jaya *et al.*, Madre de Agua leaves contain approximately 18.21% crude protein, making them a suitable ingredient in herbivore diets.

However, fresh forages like *Madre de Agua* pose practical challenges in terms of handling, preservation, and consistent nutrient delivery. Pelletizing forage-based diets can improve feed intake, reduce waste, and enhance nutrient utilization. This study was then designed to evaluate the response of weaner rabbits fed with pelletized diets by incorporating Madre de Agua leaf meal. Specifically, the study aimed to determine the proximate analysis of the different formulated trichanthera leaf-meal based diets, asses the effect of the different formulated trichanthera-leaf meal on the growth performance of rabbit in terms of average daily gain, growth rate, total weight gain, final weight, total feed consumption, and feed conversion ratio and also to assess the carcass recovery and carcass quality of rabbits.

Materials and methods

The following materials were used throughout the experiment: feeding troughs, drinking troughs, plastic bags, rabbit cages, sacks lined with plastic, a digital weighing scale, and a record book for data collection.

Experimental design and treatment

The study employed a Completely Randomized Design (CRD) consisting of four dietary treatments, each replicated five times. The treatment groups were formulated as follows:

Treatment 1 – Basal Diet (Control) – Yellow Corn (56.6%); Rice Bran (15%); Soybean Meal (16%); Fish Meal (2%); Molasses (2%); DL Methionine (0.06%); Mono Dicalcium Phosphate (0.75%); Limestone (1.7%); Coco Oil (0.1%); Salt (0.3%); Vitamin (0.25%); Mineral (0.25%).

Treatment 2 – Yellow Corn (58.28%); Rice Bran (15%); Soybean Meal (19%); Fish Meal (2%);

Molasses (2%); DL Methionine (0.12%); Mono Dicalcium Phosphate (1%); Limestone (1.7%); Coco Oil (0.1%); Salt (0.3%); Vitamin (0.25%); Mineral (0.25%); and Madre de Agua Leaf Meal (5%).

Treatment 3 – Yellow Corn (54.5%); Rice Bran (15%); Soybean Meal (10%); Fish Meal (2.5%); Molasses (2%); Mono Dicalcium Phosphate (0.5%); Limestone (1.6%); Coco Oil (0.1%); Salt (0.3%); Vitamin (0.25%); Mineral (0.25%); and Madre de Agua Leaf Meal (10%).

Treatment 4 – Yellow Corn (52.5%); Rice Bran (15%); Soybean Meal (10%); Fish Meal (2.7%); Molasses (2%); Mono Dicalcium Phosphate (0.5%); Limestone (1.55%); Coco Oil (0.2%); Salt (0.3%); Vitamin (0.25%); Mineral (0.25%); and Madre de Agua Leaf Meal (15%).

Housing and cage construction

A simple shed was constructed to provide protection from predators and adverse weather conditions such as heat, rain, and cold. Twenty individual cages measuring 40 cm × 40 cm × 40 cm were fabricated to house the 20 experimental rabbits, with one rabbit per cage, in accordance with their territorial nature to prevent aggressive interactions or injuries.

Procurement of feed ingredients

All feed ingredients were procured from a reputable local farm supply store at least one month prior to the initiation of the experiment to ensure quality and availability.

Collection and processing of Trichanthera leaves

Fresh *Trichanthera gigantea* (Madre de Agua) leaves were collected from Palawig, Santa Ana, Cagayan. The leaves were sun-dried for three days, then pounded and sieved to obtain a uniform texture suitable for feed mixing.

Feed preparation, pelleting, and storage

Feed ingredients were prepared one week before the study commenced. The formulated diets were pelletized using a mechanical feed pelletizer. The resulting pellets were sun-dried for five hours to reduce moisture content, prevent mold growth, and prolong shelf life. The dried pellets were stored in plastic bags and placed inside sacks to maintain feed quality.

Selection and procurement of experimental animals

A total of 20 weaner rabbits (8 does and 12 bucks) were obtained from "Furry Place Rabbitry" operated by Mr. Daniel Rivera in the Province of Isabela. All animals were clinically healthy at the time of purchase.

Feeding management

The weaner rabbits were fed their respective treatment diets twice daily (morning and afternoon) at a rate of 75 g per rabbit per day. Clean drinking water was made available at all times.

Sanitation and waste management

Feeding and drinking troughs were cleaned daily. Cages were thoroughly cleaned and disinfected on a weekly basis to minimize the risk of disease and contamination. Rabbit manure was collected regularly and utilized as organic fertilizer by students involved in the study.

Statistical analysis

All collected data were analyzed using Microsoft Excel. Analysis of Variance (ANOVA) was performed to determine treatment effects, and significant differences among means were evaluated using the Least Significant Difference (LSD) test at the 5% and 1% levels of significance.

Results and discussion

Proximate analysis

Table 1 shows the proximate analysis of the diets reveals important trends in nutrient composition as the inclusion of madre de agua leaf meal increased. Crude protein (CP) content was highest in the control diet (Treatment 1) at 17.56%, gradually decreasing with higher levels of madre de agua, reaching the lowest level at 14.63% in Treatment 4 (15% inclusion). This decline is expected, as madre de agua generally

contains less protein than formulated commercial feeds. While a 5% inclusion (Treatment 2) still maintained an acceptable CP level (15.48%), higher inclusion levels appear to dilute the protein concentration in the total diet.

Crude fiber (CF) showed an increasing trend, rising from 1.96% in the control to 3.14% in the 15% inclusion diet. This is consistent with the fibrous nature of madre de agua leaves. High fiber levels can reduce feed digestibility and nutrient absorption, which helps explain the reduced weight gain and feed conversion efficiency observed in higher inclusion treatments. Crude fat content also decreased with increased madre de agua, from 3.61% in the control to 2.62–2.69% in the higher treatments, which could slightly reduce the energy density of the feed.

Table 1. Proximate composition of the different feed diet for rabbit

Treatments	Proximate analysis				
	Crude protein	Crude fiber	Crude fat	Moisture	Ash
Treatment 1 (No MDALM)	17.56	1.96	3.61	9.22	6.33
Treatment 2 (5% MDALM)	15.48	2.72	3.12	10.01	7.56
Treatment 3 (10% MDALM)	15.66	2.93	2.62	9.15	7.78
Treatment 4 (15% MDALM)	14.63	3.14	2.69	9.92	8.48

Moisture and ash content both increased with madre de agua inclusion. Moisture rose from 9.22% in the control to a peak of 10.01% at 5% inclusion, while ash content increased steadily from 6.33% to 8.48%, reflecting the higher mineral content typically found in leafy forages. These changes in proximate composition align with performance trends observed in the study. Moderate inclusion of madre de agua (up to 5%) provided a balance of nutrients and maintained growth efficiency, while higher levels altered the diet's nutrient density especially protein and fiber leading to reduced performance. These findings are consistent with earlier work by Ly *et al.* (2001), who noted that while *Trichanthera gigantea* is a good source of minerals and fiber, its use must be limited to maintain a balanced diet for monogastric animals.

Final weight

Fig. 1 shows the final weight of rabbits fed with pelletized madre de agua leaf-based diets. Rabbits fed with 5% madre de agua leaf meal (Treatment 2) recorded the heaviest final weight with a mean of 2.26 kilograms. The ranking was followed by rabbits fed with basal feed diet (Treatment 1) and those applied with 10% madre de agua leaf meal (Treatment 3) with means of 2.18 kilograms and 2.14 kilograms respectively. The lowest final weight was recorded on animals fed with 15% of madre de agua leaf meal with a mean of 1.91 kilograms. Despite numerical discrepancies, no significant difference existed among the different treatment tested.

The result of the study suggests that incorporating madre de agua leaf meal at a moderate level (5%) can enhance growth performance, possibly due to its high protein content and digestibility when used in limited amounts. However, higher inclusion levels (10–15%) may reduce weight gain, likely due to increased fiber content and the presence of anti-nutritional compounds such as tannins and saponins, which can interfere with nutrient absorption and digestion.

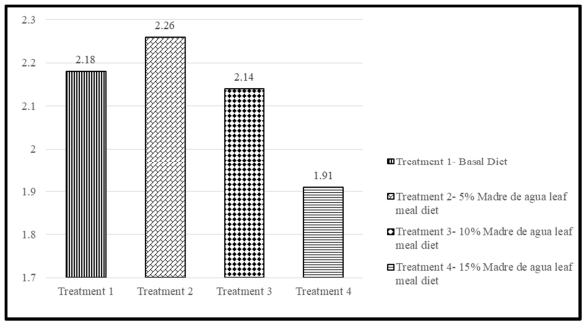

Fig. 1. Final weight of rabbits fed with pelletized madre de agua leaf-based diets

Total weight gain

Fig. 2 shows the total weight gain of rabbits fed with pelletized madre de agua (*Trichanthera gigantea*) leaf-based diets. The highest total weight gain of 1.07

kilograms was recorded in rabbits fed with 5% madre de agua leaf meal (Treatment 2). This was closely followed by those fed with basal feed diet (Treatment 1) at 1.01 kilograms, and those with 10% madre de agua leaf meal (Treatment 3) at 0.89 kilograms. The lowest weight gain was observed in rabbits fed with 15% madre de agua leaf meal (Treatment 4), which had a mean gain of only 0.70 kilograms. Analysis of variance reveals no significant difference existed among the different treatments tested.

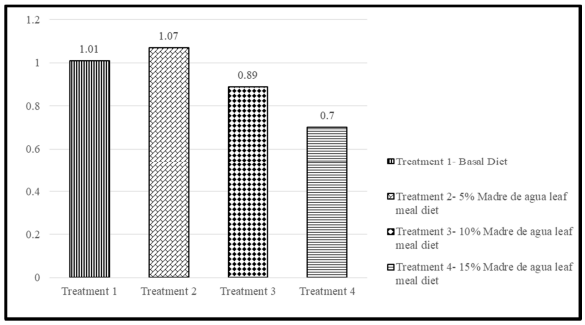

Fig. 2. Total weight gain of rabbits fed with pelletized madre de agua leaf-based diets

The result suggests that moderate inclusion of madre de agua in rabbit diets (around 5%) supports optimal growth, likely due to its good protein content and digestibility. However, increasing the level beyond 10% appears to reduce weight gain, possibly due to higher fiber levels and anti-nutritional factors such as tannins that can interfere with nutrient absorption and reduce feed efficiency. According to Sarwatt *et al.* (2003), *Trichanthera gigantea* can be a beneficial component of rabbit diets when properly balanced with other ingredients.

Likewise, Rosales (1997) emphasized that while madre de agua is a rich source of protein and minerals, excessive inclusion may limit performance due to its fiber and anti-nutritional content.

Average daily gain

Fig. 3 shows the average daily gain of rabbits fed with pelletized madre de agua leaf-based diets. The highest ADG was recorded in rabbits fed with a 5% madre de agua leaf meal diet (Treatment 2), with a mean of 19.07 grams per day. This was followed by rabbits fed with basal feed diet (Treatment 1) at 17.96 grams, and those fed with a 10% madre de agua leaf meal diet (Treatment 3) at 15.91 grams. The lowest ADG was observed in rabbits receiving the 15% madre de agua diet (Treatment 4).

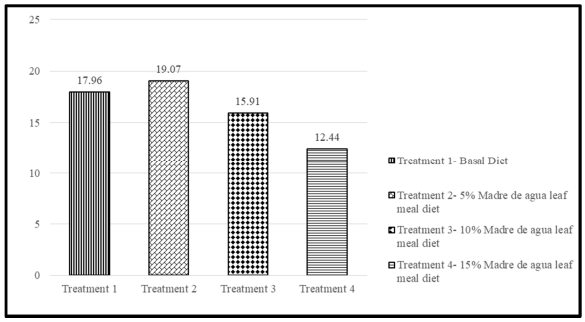

Fig. 3. Average daily gain (ADG) of rabbits fed with pelletized madre de agua leaf-based diets

Although numerical differences were observed among treatments, the analysis of variance showed no statistically significant difference in average daily gain. This suggests that while a 5% inclusion of madre de agua leaf meal may offer slight growth benefits, increasing the level beyond this point does not improve daily weight gain and may even reduce it. Similar patterns have been reported in studies where moderate inclusion of *Trichanthera gigantea* enhanced growth, while higher levels, likely due to increased fiber and anti-nutritional factors, negatively impacted feed efficiency and nutrient absorption (Nguyen *et al.*, 2017; Sarwatt *et al.*, 2003).

Total feed consumption

Fig. 4 presents the total feed consumption of rabbits fed with pelletized madre de agua (*Trichanthera gigantea*) leaf-based diets. The highest feed intake was recorded in rabbits fed with a 10% madre de agua leaf meal diet (Treatment 3), with a mean consumption of 3.90 kilograms. This was followed by rabbits given the 5% madre de agua diet (Treatment 2) and those fed with basal feed diet only (Treatment 1), with average feed intakes of 3.72 and 3.52 kilograms, respectively. The lowest feed consumption was observed in rabbits fed with the 15% madre de agua leaf meal diet (Treatment 4), also with 3.52 kilograms.

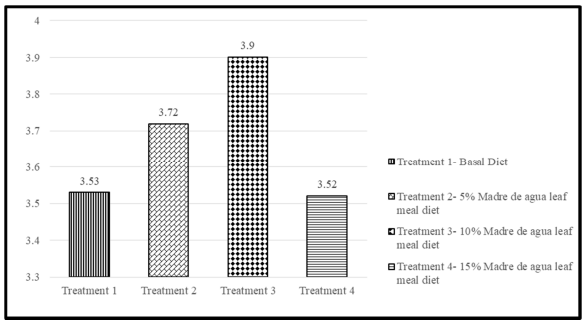

Fig. 4. Total feed consumed by rabbits fed with pelletized madre de agua leaf-based diets

Analysis of variance revealed no significant difference in feed consumption among the treatments. This suggests that while feed intake varied slightly with different inclusion levels of madre de agua, the variations were not large enough to be considered statistically meaningful. The relatively lower intake at higher inclusion levels may be due to increased fiber or reduced palatability, which has been noted in studies involving high levels of *Trichanthera gigantea* in animal diets (Sarwatt *et al.*, 2003). Still, the fact that feed intake remained fairly consistent suggests that madre de agua can be incorporated into rabbit diets without drastically affecting overall feed consumption.

Feed conversion ratio

Fig. 5 illustrates the feed conversion ratio (FCR) of rabbits fed with pelletized madre de agua (*Trichanthera gigantea*) leaf-based diets. The best FCR of 3.31 was observed in rabbits fed with the 5% *madre de agua* diet (Treatment 2), indicating efficient feed utilization. This was closely followed by rabbits on a basal feed diet (Treatment 1), which had an FCR of 3.59. Rabbits receiving the 10% *madre de agua* diet (Treatment 3) recorded a less efficient FCR of 4.48, while the poorest FCR was observed in Treatment 4, where animals were fed with a 15% *madre de agua* diet.

Analysis of variance revealed no statistically significant difference among the treatments tested. The results suggest that moderate inclusion of madre de agua (particularly at 5%) supports efficient feed conversion, likely due to its balanced protein and energy content. Higher inclusion levels may reduce digestibility due to increased fiber and the presence of anti-nutritional factors, which are known to affect feed efficiency in monogastric animals like rabbits (D'Mello, 1995; Nguyen *et al.*, 2017).

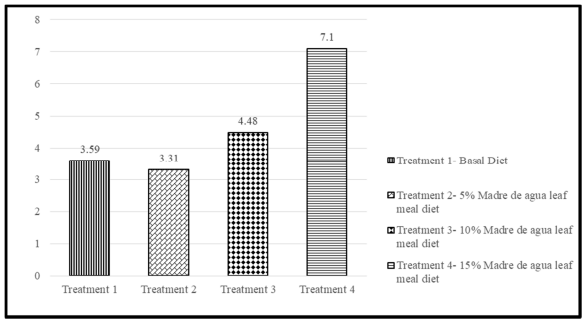

Fig. 5. Feed conversion ratio of rabbits fed with pelletized madre de agua leaf-based diets

Conclusion

The inclusion of *Trichanthera gigantea* (Madre de Agua) in pelletized rabbit diets has the potential to partially replace commercial feed ingredients, particularly at moderate levels. The 5% inclusion level yielded optimal results in terms of growth performance, carcass quality, and feed efficiency. However, increasing the inclusion to 10% and 15% led to a decline in performance indicators, likely due to increased fiber and the presence of anti-nutritional compounds. The study also highlighted that madre de agua can be a feasible alternative feed resource that does not negatively impact total feed intake or cause adverse health effects in rabbits.

Recommendation

Based on the results of the study, it is recommended that *Trichanthera gigantea* (Madre de Agua) leaf meal be incorporated at a 5% inclusion level in the pelletized diets of weaner rabbits. This level was found to offer the best balance between growth performance, feed efficiency, and carcass quality, without compromising the nutritional value of the diet.

References

D'Mello JPF. 1995. Antinutritional substances in legume seeds. In: J.P.F. D'Mello and C. Devendra (Eds.), Tropical legumes in animal nutrition. CAB International, Wallingford, UK, pp. 135–172.

Gondret F, Combes S, Larzul C, De Rochambeu H. 2005. The influence of divergent selection for body weight at 63 days of age in rabbits on muscle characteristics at a same age or at similar weight. Arch Tierz **48**(SI), 98–104.

Jaya AF, Soriano MLL, Vallador DM, Intong RL, Carpentero BB. 2008. Utilization of Madre de Agua (*Trichanthera gigantea* var. *guianensis*) leaf meal as feed for growing-finishing pigs. Philippine Journal of Veterinary and Animal Sciences **34**(2), 117–126.

Jentzer A. 2009. Main results from the network of rabbit reference farms during the 2007–2008 season. In: G. Bolet (Ed.), 13th Journées de la Recherche Cunicole, ITAVI, Paris, France, pp. 95–103.

Li S, Zeng W, Li R, Hoffman LZ, He Z, Sun Q, Li H. 2018. Rabbit meat production and processing in China. Meat Science **145**, 320–328.

Lorio JP, Villareal GM. 2023. Discovering rabbit (*Oryctolagus cuniculus* L.) farming in Partido, Camarines Sur, Philippines: Raisers' perspectives. Open Access Library Journal **10**, 1–16. https://doi.org/10.4236/oalib.1109765

Lukefahr SD. 1998. Rabbit production in Uganda: Potential versus opportunity. World Rabbit Science **6**(3–4), 331–340.

Ly J, Preston TR, Rosales M. 2001. Nutritional evaluation of *Trichanthera gigantea* for rabbits and pigs in small-scale systems. Livestock Research for Rural Development **13**(4). Retrieved from http://www.lrrd.org/lrrd13/4/ly134.htm

Medenilla V. 2021. A basic guide to raising rabbits for food. Manila Bulletin Special News. https://mb.com.ph/2021/02/18/a-basic-guide-to-raising-rabbits-for-food/13

Nguyen XT, Huyền NTD, Đạt DV, Bằng NG. 2017. Effects of proportion of para grass (*Brachiaria mutica*) and gigantea leaves (*Trichanthera gigantea*) in the diet on feed utilization and growth performance of New Zealand White rabbits. Vietnam Journal of Agricultural Science **15**(4). https://vjol.info.vn/index.php/hvnn/article/view/31259

Nofal RY, Toth S, Virag G. 1997. Evaluation of seven genetic groups of rabbits for carcass traits. Arch Tierz **40**, 61–67.

Ozimba CE, Lukefahr SD. 1991. Comparison of rabbit breed types for post-weaning litter growth, feed efficiency and survival performance traits. Journal of Animal Science **69**, 3494–3500.

Rosales M. 1997. *Trichanthera gigantea* (madre de agua): A multipurpose forage tree for tropical regions. FAO Animal Production and Health Paper. Retrieved from http://www.fao.org/ag/againfo/resources/documents/frg/conf96/html/rosales.htm

Sarwatt SV, Mtengeti EJ, Mushi DE. 2003. Effects of proportion of para grass (*Brachiaria mutica*) and gigantea leaves (*Trichanthera gigantea*) in the diet on feed utilization and growth performance of New Zealand White rabbits. Livestock Research for Rural Development **15**(11). Retrieved from https://www.lrrd.org/lrrd15/11/sarw1511.htm