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To cite this article: T Haryati *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **888** 012073

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The effect of *Indigofera zollingeriana* supplementation to performance of rabbit

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Abstract. Rabbit has potency to produce meat since it has high growth rate, litter size, and short calving interval. Rabbit can utilize low nutritional feed and wide various of forages as its feed. Recently, *Indigofera Zollingeriana* (IZ) has been widely used as a green protein source in livestock. The used of IZ in rabbit feed seemed to be able to reduce production cost. The study had objective to observe the effect of IZ supplementation in feed to rabbit performance. A number of 72 heads of 12 weeks old of New Zealand white rabbits were used in the study. Rabbits were distributed in three groups of IZ supplementation levels (R1: 0 %; R2: 20 %, and R3: 30%). The supplementation was applied for five weeks. Data were analysed using one- way ANOVA. The results showed that IZ supplementation effected body weight gain (BWG), feed conversion ratio, and dry matter and energy digestibility ($P < 0.05$). The R2 was the optimal IZ supplementation in the study. The average BWGs of rabbits were 833.38 ± 232 g, 688.50 ± 88 g, and 485.63 ± 130 g for R1, R2, and R3, respectively. In conclusion, the IZ supplementation up to 20 % could be applied in rabbit feed to reduce cost

1. Introduction

Rabbits are livestock that have the potential to be developed as meat producers because they have great biological potential, including fast sexual maturity, short calving intervals, high litter size, high growth rate, easy maintenance, and can be bred on a small and large scale to become a viable business. Rabbits are prolific herbivores that can grow and reproduce from forages, vegetable waste, or food waste [1]. Utilization of forages, vegetable waste, and food waste apart from not competing with human feed also greatly reduces production costs.

Indigofera zollingeriana (IZ) is a tree legume species that is relatively new to be developed in Indonesia. *Indigofera* is suitable to be developed in Indonesia because it is tolerant of dry seasons, waterlogging, and is resistant to salinity [2]. In addition, fast growth, being adaptive to low fertility rates, easy and inexpensive maintenance are supporting factors. This plant contains about 65 chemical compounds of 1-65 namely flavonoids, especially flavonoids glycosides, lignins, and several other constituents including alkaloids, steroids, fatty acids containing amino groups.

Research by [3] showed that the use of indigofera leaf powder has the potential to be used as a protein source in layer feed. In addition, the use of indigofera powder for a substitution of 45% of protein from soybean meal can improve egg quality and increase the intensity of egg yolk color, which reaches 55.88%. Experiments on New Zealand white rabbits conducted by [4] showed that the use of *Indigofera sp* leaf powder up to a level of 40 percent in rations can increase body weight gain and ration efficiency [4].



Currently, the interest of farmers to raise rabbits continues to increase in various locations in Indonesia, but the availability and quality of feed on the market are low because getting good quality feed requires relatively expensive costs. To achieve good quality feed and affordable prices for breeders, it is necessary to look for alternative feed ingredients, one of which is the forage of *Indigofera* sp which has low fiber, high protein, and easy to cultivate. *Indigofera* sp is a legume plant that has the potential as a feed source for protein. The availability of feed ingredients sourced from forage or vegetable waste is not available continuously or depends on the season.

Indigofera is a type of legume plant that has been widely studied in the last 10 years because it has potential as a green concentrate feed ingredient due to its high protein content and low crude fiber. This legume plant is easy to cultivate and is widely grown in Indonesia because of its dry resistance, water resistance, and salinity resistance [2]. High production can produce 5 tonnes / ha of forage after 2 months of age, and 25 tonnes / ha when it is 6 months old. Until now, *indigofera* is only used as feed for ruminants; yet, it has not been widely used for poultry feed, especially for laying hens.

2. Materials and methods

This research was conducted in experimental cages to determine the limit of use of IZ as a feed ingredient for rabbits. The approach referred to the nutritional requirement of rabbits which have been used so far, where the fiber content is around 12% and 16-18% of protein. Feeding trial using a completely randomized design consisting of 3 levels of IZ: 0, 20 and 30% in feed with 12% crude fiber content and 18% protein. Each treatment was repeated 8 times at 3 NZW rabbits weaned off at 12 weeks of age. The experiment was carried out for 5 weeks of observation of growth performance (body weight, feed consumption, and feed use efficiency). Measurement of dry matter digestibility (DMD), Crude Protein Digestibility (CPD), Energy Digestibility (GED), and Crude Fiber Digestibility (CFD) using 3 replications of each of 3 NZW rabbits weaning for 10 days. The resulting data were tested by analysis of variance and LSD.

3. Results and discussions

The feed that has been used is formulated using iso protein, iso crude fiber, feed formula of treatment, and chemical composition as shown in Table 1.

Table 1. Formula and Feed composition during experiment.

No	Ingredient	(%)		
		R1	R1	R2
1	Indigofera	0	20	30
2	SBM	16,5	12	10
3	Corn	13	16	14
4	Pollard	11,5	8	7
5	Rice bran	10	8	7
6	CPO	2	2	2
7	Molases	2	2	2
8	King grass	25	20,3	18,3
9	Copra meal	18,3	10	8
10	Premix	1,7	1,7	1,7
	Total	100	100	100

Chemical composition calculation			
Treatment	Crude Protein (%)	Gross Energy (kcal/kg)	Crude Fiber (%)
R1	18,64	3940	11,30
R2	18,54	3877	11,47
R3	18,97	3869	11,93
Composition of chemical analysis			
Treatment	Crude Protein	Gross Energy	Crude Fiber
R1	17,95	3933	13,26
R2	17,77	3952	16,07
R3	17,93	4003	19,41

The results of the calculation and chemical analysis of the formulated feed are slightly different, especially for the crude fiber content. This difference is because the calculation uses the average composition data from the existing analysis results and may differ from the chemical composition of the materials used in the treatment ration. Crude fiber content in the analysis varies widely.

Indigofera is used to substitute protein sources from other ingredients. It is also used as a source of fiber besides elephant grass. The nutritional content of elephant grass is relatively low because of its high fiber content, low protein content, while the mineral content of elephant grass is also lower than the needs of livestock.

Feed consumption in each treatment during the study was quite consistent; in the first week, it was around 60 grams/head/ day, then it increased with time. At week five, it was between 80-110 g/head/ day. According to [5], rabbits consume about 5% of their body weight. This is also supported by the results of research by [6] which state that rabbits weighing 1.8 kg-3.2 kg consume dry matter of 112 g/head/day-173 g/head/day or the equivalent of 5.4. % -6.2% of the live weight of livestock.

Research conducted by [4] also shows that the use of *indigofera* in rabbit feed does not affect feed consumption. *Indigofera* sp contains anti-nutrients and bioactive ingredients, including tannins or saponins, alkaloids [7]. The use of *indigofera* leaves in feed up to 20% does not affect feed palatability, the antinutrient content does not result in a decrease in feed consumption, so there is no difference in the amount of feed consumption.

Table 2. Feed consumption (g/h/d) during 5 weeks experiment.

Treatment	Week1	Week 2	Week 3	Week 4	Week 5
R1	66,64	70,20	84,39	100,54	108,42
R2	61,70	84,58	72,29	91,88	95,21
R3	69,08	77,32	92,91	98,44	89,18

The crude fiber content of the ration affects the consumption of dry matter; feed containing high crude fiber is more voluminous in nature, causing limited capacity in the digestive tract to consume more feed. [8] stated that the slow rate of feed in the digestive tract will reduce consumption.

The increase in body weight during experiment is presented in Table 3. The Body Weight Gain (BWG) increased according to the age of experiment, the highest body weight gain was obtained in the control

treatment, and then treatment with the use of 20% *indigofera*, and the lowest was obtained in the treatment with the use of 30% *indigofera*. The highest body weight gain occurred at 3, 4, and 5 weeks of experiment or at the age of 15, 16, and 17 weeks of rabbits. In rabbit breeders, the optimum age for harvesting rabbits for slaughter is around 15-17 weeks of age, where body weight gain is at a good value and the best quality of meat.

Table 3. Weekly Average body weight gain (g/h) during experiment.

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5
R1	170	294	458	687	833
R2	98	186	308	526	657
R3	106	196	327	444	492

Table 4. Average performance of rabbits for 5 weeks of experiment

Treatment	BWG (g/h)	Consumption (g/h)	FCR
R1	833.38 ^b ± 232	2814 ± 348	3.77 ^a ± 0,71
R2	688.50 ^b ± 88	2988 ± 257	4.25 ^a ± 0,47
R3	485.63 ^a ± 130	3011 ± 256	6.36 ^b ± 1,56

* Different letters in the same column indicate significantly different (P< .05)

The performance of rabbits in Table 4 shows that the treatment has an effect on BWG and feed efficiency. The treatment had a significant effect (P<0.05) on the BWG of livestock. The use of *indigofera* up to 20% did not make a difference with the control without the use of *indigofera*; the use of *indigofera* up to 30% had a significant effect on BWG of livestock (P<0.05). The treatment had no effect on livestock consumption (P<0.05), and during the 5 weeks trial, the feed consumption was around 2,500 – 3,000 g/head. Consumption is not influenced by the use of *indigofera* in the ration. The preference test of various tropical forages [9] shows *indigofera* is the preferred forage, so the use of *indigofera* up to 30% does not affect the amount of livestock consumption. There are many factors that can influence the acceptance and preference of legume forage, such as smell/aroma, freshness, taste, size, and texture, including crunchiness, chewiness, and mouth taste. In addition, some nutrients may contain anti-nutritional factors such as amino acids or toxic alkaloids. For example, anti-nutritional substances are found in the leaves and seeds of the *Indigofera sp.*, including tannins and saponins, the rests of which are alkaloids, flavonoids, carbohydrate glycosides, terpenoids, steroids, and indospicine can cause poor daily weight gain and feed intake. Not are all legumes suitable to replace commercial feed intake for rabbits, but some legumes have shown that they can be combined with other forages in rabbit feed for good production. [10] concluded that various tropical forages were consumed in acceptable quantities by rabbits, which indicate that rations, based on these forage ingredients and concentrate supplements, could be used well for rabbit production.

3.1. Digestibility measurement

The level of use of *indigofera* had a significant effect on the digestibility of dry matter and energy (P<0.05), but had no effect on the digestibility of protein and digestibility of crude fiber. The more consumption of dry matter which has high crude fiber content will stimulate the production of digestive enzymes, thereby, increasing the digestive process. [11] stated that enzymes are able to simplify complex chemical chains into simple and more digestible chains. Crude fiber in feedstuffs improves digestibility [12].

Table 5. Nutrition digestibility (%) of feed during experiment.

Treatment	DMD	CPD	CED	CFD
R1	57,24 ^a ± 5,28	68,21 ± 4,36	60,69 ^b ± 4,36	68,21 ± 13,27
R2	51,72 ^b ± 3,11	68,58 ± 2,88	51,95 ^a ± 2,88	68,58 ± 5,60
R3	47,51 ^c ± 3,13	69,84 ± 5,56	53,46 ^a ± 3,54	69,84 ± 8,13

* Different letters in the same column indicate significantly different (P < .05)

[1] states that the Dry Matter Digestibility (DMD) of rabbits, which are fed with complete pellets, is 47%. The higher level of DMD proves that the treated ration has good quality [1]. [13] stated that the DMD in rabbits fed with alfalfa was 61.4% -62.7%. The DMD of rabbits in this study was not far from that of obtained by [1].

The Crude Fiber Digestibility (CFD) in this study was not different in each treatment, which indicates that the fiber content in the feed can be digested properly. The results of the chemical composition analysis of the feed showed that the crude fiber content of the treatment using 20% and 30% *indigofera* was higher than the calculated results. It is estimated that the fiber in the ration originating from *indigofera* is easily digested fiber and contains little lignin. [1] also states that the high digestibility value of crude fiber indicates that the fiber in feed is digested properly and is low in lignin content.

Rations that contain high crude fiber will reduce the digestibility coefficient of other feed substances such as protein and fat. According to [14], the high amount of crude fiber content in the ration consumed by a livestock causes the rate of movement of feed in the digestive tract of the livestock to be high, so the digestive enzymes work shorter and ultimately reduce digestibility. [15] states that the high indigestible plant components (lignin and silica) included in ADF can cause low digestibility. *Indigofera zollingeriana* is a forage with a low crude fiber content with an NDF digestibility value of 52.13% and an ADF digestibility value of 55.26% [16].

The high digestibility value of crude protein indicates that the protein content in the ration can be digested properly by livestock. The high crude protein digestibility of rabbits in the study was caused by the high crude protein content in the treatment rations, which ranged from 18%. [17] stated that crude protein digestibility was influenced by crude fiber and ration protein content; besides that, consumption would also affect the level of protein digestibility. According to [18], the higher the consumption of dry matter in rations with high crude protein content, the higher the consumption of crude protein. Protein consumption will determine the digestibility level of the ration protein.

4. Conclusion

Legume *Indigofera zollingeriana* can be used as an alternative feed ingredient for rabbit feed. The use of *Indigofera zollingeriana* in feed up to 20% did not reduce the DWG and feed efficiency compared to control, so the use of as much as 20% in rations with 18% protein content can save feed costs.

References

- [1] Cheeke P R, Patton N M, Lukefahr S D and McNitt J I 1987 Rabbit production *The interstate printers and publishers Inc.* Danville, illinois
- [2] Hassen A, Rethman N F G, Van Niekerk, and Tjelele T J 2007 Influence of season/year and species chemical composition and in vitro digestibility of five *Indigofera* Accessions *Animal Feed Science Technology* 136: 312-322
- [3] Palupi R, Abdullah L, Astuti D A, dan Sumiati 2014 Potensi dan pemanfaatan tepung pucuk *Indigofera* sp. sebagai bahan pakan substitusi bungkil kedelai dalam ransum ayam petelur *Jurnal ilmu ternak dan veteriner* **19** (3): 210—219

- [4] Tambunan, Halomoan M, Yurmiaty H, dan Mansyur 2015 Pengaruh pemberian tepung daun indigofera sp terhadap konsumsi, penambahan bobot badan, dan efisiensi ransum kelinci peranakan New Zealand White *Jurnal UNPAD* vol **4**(1)
- [5] Irlbeck, N. A. 2001. How to feed the rabbit (*Oryctolagus cuniculus*) gastrointestinal tract *Journal of animal sciences* **79**: 343-346
- [6] Ensminger M E 1990 *Animal science 9th Ed. Interstate Publisher, Inc.* Danville, Illinois.
- [7] Saurabh J S, Nayak, and Joshi P 2010 Phytochemical study and physical evaluation of Indigoferatinctoria leaves *International Journal Compr Pharmacy* **01**
- [8] Nuswantara L K, Soejono M, Utomo R, dan Widyobroto A B P 2005 Kecernaan nutrien ransum precursor nitrogen dan energi tinggi pada sapi perah yang diberikan basal jerami padi *Journal of the Indonesian Animal Agriculture* **30** (3): 167-172
- [9] Jusoh S and Nur_Hafifah, C.S. 2018. Nutritive value, palatability, and selectivity of 10 different legume herbage by rabbits *Mal. J. Anim. Sci.* **21**(2): 69-75
- [10] Safwat A M., Sarmiento-Franco L, Santos-Ricalde R H, and Nieves D 2014 Determination of tropical forage preferences using two offering methods in rabbits *Asian Aust. J. Anim. Sci.* **27** (4): 524-529
- [11] Semiadi G dan Nugraha R T P 2004 Panduan pemeliharaan rusa tropis *Puslit Biologi LIPI Bogor*
- [12] Banerjee C G 1978 *Animal Nutrition Oxford & IBH Publishing Co.* Calcuta.
- [13] Cunha. L. Falcão-e-, Peres H, Freire J P B, and Castro-Solla L 2004 Effects of alfalfa, wheat bran or beet pulp, with or without sunflower oil, on caecal fermentation and on digestibility in the rabbit *J. Anim. Feed Sci and Tech.* **117**:131-149
- [14] Dewi N W S 2008 Kajian pemberian tepung buah pare (*Momordica charantia* L.) terhadap konsumsi, pencernaan bahan kering dan performa tikus (*Rattus norvegicus*) *Skripsi Fakultas Peternakan, Institut Pertanian Bogor.*
- [15] Oluokun J A 2005 Intake, digestion and nitrogen balance of diets blended with urea treated and untreated cowpea husk by growing rabbit *African journal of biotechnology.* **4** (10): 1203-1208
- [16] Tarigan A 2009 Produktivitas dan pemanfaatan Indigofera sp sebagai Pakan Ternak Kambing pada masa interval dan intensitas pemotongan yang berbeda *Tesis Sekolah Pascasarjana Institut Pertanian Bogor.*
- [17] Garcia J, Galvec J F, and. De blas J C 1993 Effect of substitution of sugarbeet pulp for barley in diet for finishing rabbit on growth performance and on energy and nitrogen efficiency *Journal of animal science* **77**: 898-905.
- [18] Okmal 1993 Manfaat leguminosa pohon sebagai suplemen protein dan minyak kelapa sebagai agen defaunasi dalam ransum pertumbuhan domba *Tesis Fakultas Pascasarjana, Institut Pertanian Bogor.*