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Performance of Kalung Cricket (*Gryllus bimaculatus*) Fed with a Combination of Concentrate and Cassava Leaves

A. Sunyoto[1], Y. C. Endrawati[1*], D. A. Astuti[2], A. M. Fuah[1], H. Nuraini[1], V. A. Mendrofa[1], A. K. Islami[1], & Winarno[1]

[1]Department of Animal Production and Technology, Faculty of Animal Science, IPB University
[2]Department of Nutrition and Feed Technology, Faculty of Animal Science, IPB University
Jalan Agatis, Kampus IPB Darmaga Bogor 16680, Indonesia
*Corresponding author: y-cahya@apps.ipb.ac.id
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ABSTRACT

Crickets are a promising alternative source of animal protein due to their high levels of amino acids, fatty acids, and protein (61.58%). These nutrients have applications in the pharmaceutical industry, human food, bird feed, and as a substitute for livestock feed, particularly in the form of cricket flour. The Kalung cricket (*Gryllus bimaculatus*) is notable for its rapid growth rate and efficient feed conversion. This study aimed to evaluate the effects of diets combining concentrate with cassava leaves of different maturities on the performance of Kalung crickets (*Gryllus bimaculatus*). A completely randomized design (CRD) was employed, consisting of three treatments with five replications each. The treatments were R1= concentrate+young cassava leaves, R2= concentrate+mature cassava leaves, R3= concentrate+cassava leaf stems, with a combination ratio of 1:1.5. The parameters observed include feed consumption, body weight gain, egg production, feed conversion, mortality, and income over feed cost (IOFC). The results showed that no significant differences among treatments in feed intake, weight gain, and mortality. However, significant differences were observed in egg production (0.022±0.011 g/individu/day) and feed conversion (1,88±0.95) with the R1 treatment showing the most favorable results. A diet combining concentrate with young cassava leaves significantly improves the reproductive performance and feed efficiency of Kalung crickets. This combination is recommended for enhancing productivity in *Gryllus bimaculatus* farming systems.

Keywords: cassava leaves, concentrate, Kalung cricket, performance

ABSTRAK

Jangkrik berpotensi sebagai sumber protein hewani alternatif karena mengandung asam amino, asam lemak, dan protein tinggi (61,58%). Kandungan ini dimanfaatkan dalam industri farmasi, makanan, pakan burung, dan substitusi pakan ternak berupa tepung jangkrik. Jangkrik Kalung (*Gryllus bimaculatus*) unggul dalam pertumbuhan dan efisiensi pakan. Penelitian ini bertujuan untuk mengevaluasi pengaruh kombinasi konsentrat dan daun singkong (umur berbeda) dalam pakan terhadap performa jangkrik Kalung (*Gryllus bimaculatus*). Penelitian menggunakan rancangan acak lengkap (RAL) yang terdiri dari tiga perlakuan dengan lima ulangan. Perlakuan meliputi R1 adalah konsentrat dengan daun singkong muda, R2 adalah konsentrat dengan daun singkong tua, dan R3 adalah konsentrat dengan tangkai daun singkong Parameter yang diamati diantaranya konsumsi pakan, pertambahan bobot badan, produksi telur, konversi pakan, mortalitas, dan *income over feed cost* (IOFC). Hasil penelitian menunjukkan bahwa perlakuan tidak berpengaruh terhadap konsumsi pakan, pertambahan bobot badan, dan mortalitas. Namun berpengaruh signifikan pada produksi telur (0,022 ± 0,011 g/individu/hari) dan rasio konversi pakan (1,88 ± 0,95), dengan hasil terbaik pada perlakuan R1. Kombinasi konsentrat dan daun singkong muda secara signifikan meningkatkan performa reproduksi dan efisiensi pakan jangkrik Kalung. Kombinasi ini direkomendasikan untuk meningkatkan produktivitas *Gryllus bimaculatus*.

Kata kunci: daun singkong, jangkrik Kalung, konsentrat, performa

INTRODUCTION

Crickets, a type of insect recognized for their distinctive chirping sounds, are commonly used as feed for pets, such as songbirds and arowana fish (Zhao *et al.* 2020). They have a brief life cycle, are simple to raise, easily adapt to various feed types, and require minimal capital investment (Wang *et al.* 2021). Among the different species, the Kalung cricket (*Gryllus bimaculatus*) is frequently farmed by farmers because have fast growth rate, efficient feed conversion, and softer exoskeleton, which makes it more attractive to birds and other insect-eating animals (Rahman *et al.* 2023). The growth stages of crickets are divided into four stages: Stage 1: 1-7 days, Stage 2: 8-14 days, Stage 3: 15-22 days, and Stage 4: 23-28 days (Akiyama 2023). Crickets have a short lifespan of 60-70 days, and female crickets can produce between 200-1500 eggs within 21 days. Fertilized cricket eggs hatch in 10-12 days after oviposition (Shah and Wanapat 2021).

Crickets have the potential to serve as an alternative source of animal protein, as they not only contain protein and fat but also vitamins, minerals, and amino acids essential (Stull *et al*. 2018). Research by Phesatcha (2022), found that cricket flour contains 54.10% crude protein, 6.90% crude fiber, 26.90% fat, and 78.90% digestible nutrients, including various amino acids such as methionine, lysine, histidine, valine, and leucine, making it a potential food and feed ingredient. The high protein content has led to increased demand for crickets as a raw material in the feed industry, herbal medicine, and cosmetics. However, this rising demand has not been matched by a corresponding increase in production levels. According to van Huis and Oonincx (2017), the growing interest in edible insects particularly crickets is constrained by the limited availability of large-scale production systems. Furthermore, Halloran *et al*. (2020) emphasized that the global supply chain for crickets remains underdeveloped, resulting in supply shortages despite rising market demand.

The availability of feed, both in quality and quantity, is a crucial factor in cricket farming. Feed can influence reproduction, growth, development, behavior, and other morphological traits. Crickets typically consume concentrates and forage such as leaves, vegetables, and fruits. Crickets can be effectively produced with feed containing 22% protein along with minerals such as phosphorus, potassium, calcium, and sodium to enhance yield (Bawa *et al*. 2020). Cassava leaves and stems are known to have lower moisture content compared to other vegetable feeds for crickets, which helps reduce the likelihood of diarrhea in crickets (Akinmoladun *et al.* 2020). In addition, cassava leaves and stems are high in protein (20% to 30% of dry matter) (Ikhiri *et al*. 2021), and essential amino acids, making them a valuable alternative protein source for animal feed (Okafor *et al.* 2022). The nutritional composition of cassava leaves changes significantly with increasing maturity, however limited information is available on their use at different maturity stages in feed formulation. Specifically, crude protein and carbohydrate contents exhibit a declining trend, while fiber and other proximate constituents demonstrate progressive increases (Ravindran and Ravindran 1988). Therefore, it is crucial to evaluate the effects of feeding a concentrate combined with young cassava leaves, mature cassava leaves, and cassava leaf stems on the productivity of Kalung crickets (*Gryllus bimaculatus*).

MATERIAL AND METHODS

Material

The samples used were Kalung crickets aged 25 days, maintained in the Non-Ruminant Laboratory and Prospective Animals (NRSH), Department of Animal Production and Technology, Faculty of Animal Science, IPB University. These located at an elevation of 190 to 330 meters above sea level, with an annual rainfall of 1000-1500 mm with temperature inside the cages ranged from 25.7±0.73 °C, with humidity at 84.1±4.65%.

The egg-laying medium used was sand, while the concentrate feed consisted of commercial chicken feed (crude protein 20%-22%, crude fat 4%, crude fiber 6%, moisture content 12%, energy 2750 kcal), along with forage (young cassava leaves, mature cassava leaves, and cassava leaf stems). The chemical composition of the forage is presented in Table 1.

Methods

Feed Treatments. Feed treatments were initiated when the crickets were 25 days old to minimize stress caused by the treatments. The crickets were housed in growth cages measuring 50×50×30 cm were made of plywood and covered with wire mesh to prevent predators from entering. The interior of the cages was kept dark and filled with dried banana leaves, providing a place for the crickets to hide and mate. Each cage contained 150 crickets, with a male-to-female ra-

Table 1. Chemical composition of the forage and the feed treatments (%)

Variables	Forage (cassava leave)			Treatments		
	Young leaves	Mature leaves	Leaf stems	R1	R2	R3
Dry matter (%)	84.47	91.53	89.98	85.88	90.12	89.19
Crude protein (%)	38.62	34.48	10.74	31.97	29.49	15.24
Crude fiber (%)	13.33	14.77	32.38	21.83	11.26	21.83
Crude fat (%)	2.33	2.40	4.67	3.00	3.04	4.40
Energy (kkal/kg)	4 621	4 675	4 684	3872.6	3905	3910.4

R1 = concentrate + young cassava leaves, R2 = concentrate + mature cassava leaves, R3 = concentrate + cassava leaf stems, with a combination ratio of 1:1.5.

tio of 1:5. This is consistent with previous research, which found that the optimal male-to-female ratio is 1:5, using a cage size of 60×90×30 cm that can accommodate 600 adult crickets (Yuliana 2016; Paimin *et al*. 1999). The feed treatments involved combinations of concentrate+young cassava leaves (R1), concentrate+mature cassava leaves (R2), and concentrate with cassava leaf stems (R3). The chemical composition of the feed treatments is presented in Table 1. The criteria for young leaves included lighter green coloration, smaller size, thinner leaf texture, small petioles, and leaves located within 30-50 cm from the shoot tip, while mature leaves had darker green coloration, thicker leaf texture, larger petioles, and were positioned approximately 50 cm below the shoot tip. The forage was wilted for 24 hours before being offered to the crickets without being chopped and sourced from the same origin. The concentrate and forage were given ad libitum at a ratio of 1:1.5. At the beginning of the maintenance period at 25 days of age, 5 g of concentrate and 7.5 g of fresh forage were provided per treatment, which was subsequently increased according to age. The feed amount was increased every two days by an average of 5% of the crickets body weight. The rearing of crickets from 25 days to 67 days of age.

Productivity Analysis. The analyzed feed consumption includes as fed, dry matter, protein, and energy consumption. As fed consumption is calculated as the amount of feed provided per day minus the leftover feed per day. Dry matter consumption is determined by multiplying as fed consumption by the percentage of dry matter in the feed. Protein consumption is calculated as dry matter consumption multiplied by the protein content of the feed (%). Energy consumption is calculated as dry matter consumption multiplied by the energy content of the feed (kcal/kg). Cricket body weight gain (g/individu/week) is obtained by subtracting the body weight recorded during weighing from the body weight measured seven days earlier, then dividing the difference by seven. Daily egg production (g/individu/day) is calculated by dividing the total weight of eggs harvested daily from each cage by the number of live female crickets. Feed conversion based on egg production (g) is calculated by dividing the average total feed consumption by the average number of eggs produced per day. Mortality of female crickets (%) represents the percentage of female crickets that died relative to the total female population during the study.

Income Over Feed Cost (IOFC). Income Over Feed Cost (IOFC) refers to the income obtained from the difference between the sales of crickets or egg and the feed costs over a specific period. The IOFC formula (Rp/kg) is as follows:

IOFC=(kg weight of crickets or egg × price of crickets per kg) − (kg feed consumption × cost of feed per kg)

Estimated prices are as follows: Cricket eggs (kg): Rp 175,000; Crickets (kg): Rp 27,000; Young cassava leaves (kg): Rp 1500; Mature cassava leaves (kg): Rp 1000; Cassava leaf stems (kg): Rp 1000; dan Concentrate (kg): Rp 7000.

Data Analysis

The experimental design used in this study was a Completely Randomized Design with three treatments, each replicated five times, employing the mathematical model (Walpole *et al*. 2012):

$$Y_{ij} = \mu + P_{(i)} + \varepsilon_{(ij)}$$

Description:
Y_{ij} : the observation; μ : the overall mean; P(i) : the effect of treatment at the *i*-th level on the variable; and Ɛ(ij) : the experimental error of the *i*-th treatment on the *j*-th replication.

Data on cricket productivity, such as weight gain, egg production, feed conversion, and mortality of breeding crickets, were analyzed using analysis of variance (ANOVA). If there were differences among treatments, the analysis was continued with the Tukey test.

RESULT AND DISCUSSION

Feed Consumption

Feed can influence reproduction, growth, development, and even mortality in insects (Kang *et al*. 2011). The average feed consumption data for Kalung crickets at each phase is presented in Table 2**.**

As Fed Consumption

The feed combination had no significant effect (P>0.05) on the amount of as fed consumed per cricket in either the nymph cricket or adult phase. The highest as fed consumption (Table 2) during the nymph cricket phase was in R1, at 0.035 g/individu/day, while the highest as fed consumption during the adult phase was in R2 and R3, each at 0.103 g/individu/day. These results are lower than those reported by Mustawa (2019), who found a as fed consumption of 0.126 g/individu/day in adult crickets using the same type of feed (concentrate and cassava leaves), but higher than those of Yuliana (2016), who reported 0.083 g/individu/day. In the adult phase, crickets consume more forage (2-3 times) compared to the nymph cricket phase. Nutritional requirements in insects change with age, growth stage, and reproductive condition (Rahayu 2018).

Dry Matter Consumption

The feed combination had no significant effect (P>0.05) on the amount of dry matter (DM) consumed per cricket. The consumption of all types of feed increases as the crickets enter the adult phase (>45 days). The dry matter consumption of Kalung crickets showed an increase in line with the age of the crickets. From Table 2, it is evident that the consumption of all types of feed increases when crickets reach the adult phase (>45 days). This increase in feed consumption corresponds to the age when crickets begin egg production, which occurs at day 53 (adult phase).

Protein Consumption

The feed combination had a significant effect (P<0.05) on the amount of protein consumed per cricket during the nymph cricket phase. The mean protein consumption results are presented in Table 2. Crickets in the nymph cricket

Table 2. Feed consumption of Kalung crickets (*Gryllus bimaculatus*)

Variables	Unit	Treatments		
		R1	R2	R3
		Nymph cricket (25-45 days)		
As fed	g/individual/day	0.035 ± 0.014	0.033 ± 0.015	0.031 ± 0.010
Dry matter	g/individual/day	0.014 ± 0.006	0.014 ± 0.007	0.013 ± 0.004
Protein	g/individual/day	0.004 ± 0.002a	0.004 ± 0.002a	0.003 ± 0.001b
Energy	cal/individual/day	0.477 ± 0.190	0.472 ± 0.232	0.415 ± 0.128
		Adult (45-66 days)		
As fed	g/individual/day	0.095 ± 0.031	0.103 ± 0.032	0.103 ± 0.042
Dry matter	g/individual/day	0.036 ± 0.013	0.045 ± 0.014	0.036 ± 0.016
Protein	g/individual/day	0.010 ± 0.003	0.012 ± 0.003	0.007 ± 0.003
Energy	cal/individual/day	1.230 ± 0.450	1.506 ± 0.450	1.207 ± 0.520

Means in the same row followed by different letters indicate statistically significant differences (P<0.05). R1 = concentrate + young cassava leaves, R2 = concentrate + mature cassava leaves, R3 = concentrate + cassava leaf stems, with a combination ratio of 1:1.5.

phase on R1 consumed 0.004±0.002 g per individual, R2 consumed 0.004±0.002 g per individual, and R3 consumed 0.003±0.001 g per individual. Protein consumption in R1 and R2 was higher than in R3 during the nymph cricket phase, likely due to the higher protein content in R1 and R2 (Table 2). The protein consumption analysis during the adult phase showed that the feed combination had no significant effect on the amount of protein consumed per individual.

Cricket protein consumption continues to increase with growth and age (Liu *et al*. 2017). Adult crickets consume more protein than nymph cricket-phase crickets, as the protein is utilized for egg production. Young crickets eat to grow into adults, while adult crickets eat to gain energy for mating and reproduction (Widyastuti and Harlita 2023). Permatahati *et al*. (2019) and Miech *et al*. (2017) suggest that crickets require nutrients and protein for development and growth, particularly for body weight gain and egg production. In addition, protein is essential for providing the primary building materials for tissue growth and cell renewal (Wang *et al*. 2022).

Energy Consumption

The feed combination had no significant effect (P>0.05) on the energy consumption per cricket. Energy consumption increased as crickets entered the adult phase. Energy, along with protein, influences carcass weight. It is necessary as a source of vitality for survival and production (Li *et al*. 2023). The nearly identical energy content in each feed treatment is suspected to be one of the reasons for the non-significant differences in body weight among the Kalung crickets.

Weight of Crickets

The average body weight of Kalung crickets fed with concentrate feed combined with young cassava leaves, mature cassava leaves, or cassava stems is presented in Table 3. Variance analysis of cricket body weight indicated that the feed combination had no significant effect (P>0.05) on the body weight of Kalung crickets.

The provision of different feeds did not significantly affect the average body weight of crickets at each growth phase, as the amount of fresh feed consumed was also not significantly different across the phases. Growth is influenced, among other factors, by the amount of feed consumed; a decrease in feed consumption leads to reduced growth. Crickets are ready for harvest at 40–50 days of age. According to Table 3, crickets at 46 days of age had the highest body weight of 0.512 g/individual under the R1 treatment. This result is lower than the findings of Miech *et al*. (2016), where crickets reared for 49 days and fed cassava leaves had a body weight of 0.75 g per individual. The differences in results are presumed to be due to the use of different cricket species, which may have affected the feed conversion ratio (FCR), thereby leading to variations in body weight. The body weight of crickets continues to increase until they reach 53 days of age, after which it stabilizes until 67 days of age (culled stage). At 53 days of age, crickets begin entering the egg production phase, so the nutrients consumed are redirected toward egg production.

Egg Productions

The difference in feed combinations had a significant effect (P<0.05) on the productivity of female breeders in producing eggs. Based on the study, Kalung crickets began laying eggs for the first time at 53 days of age.

Table 3. Weight of Kalung crickets (*Gryllus bimaculatus*)

Age (day)	Treatment		
	R1	R2	R3
	------ (g/individual) ------		
25	0.069 ± 0.030	0.060 ± 0.029	0.075 ± 0.028
32	0.175 ± 0.080	0.157 ± 0.072	0.178 ± 0.072
39	0.291 ± 0.120	0.288 ± 0.128	0.338 ± 0.129
46	0.512 ± 0.128	0.461 ± 0.138	0.468 ± 0.134
53	0.757 ± 0.104	0.774 ± 0.150	0.753 ± 0.148
60	0.740 ± 0.094	0.738 ± 0.111	0.805 ± 0.147
67	0.669 ± 0.167	0.777 ± 0.170	0.742 ± 0.160

R1 = concentrate + young cassava leaves, R2 = concentrate + mature cassava leaves, R3 = concentrate + cassava leaf stems, with a combination ratio of 1:1.5.

The calculation of the average daily egg production per female breeder (Table 4) revealed that breeders fed R1 feed had a higher average egg production, weighing 0.022 ± 0.011 g/individual/day. In contrast, breeders fed R2 and R3 feeds produced averages of 0.015 ± 0.011 and 0.014 ± 0.007 g/individual/day, respectively. This is likely due to the higher protein content in young cassava leaves compared to mature cassava leaves or cassava stems. Crickets in the egg production phase require higher protein intake to enhance egg production. This assumption is supported by research from Widyastuti and Harlita (2023), which found that crickets fed high-protein artificial diets produced greater egg yields.

Crickets fed R1 produced an average egg production of 0.022 g/individual/day, which is higher than the findings of Mustawa (2019). Using the same cricket species and feed combination (concentrate with cassava leaves), Mustawa reported an average egg production of 0.020 g per individual per day.

Feed Conversion in Egg Production

Feed efficiency can be assessed by calculating the feed conversion ratio. Feed conversion is the ratio between the amount of feed given and the total weight of the harvested commodity (Liwu *et al*. 2023). The feed conversion to egg production refers to the amount of feed consumed to increase the egg production of crickets. The calculation of the feed conversion ratio is performed when the crickets start producing eggs for the first time, which is at 53 days of age.

The average feed conversion ratio to egg production (Table 4) shows that the R1 feed treatment has a lower conversion rate (1.876±0.948) compared to the other treatments. This indicates that to produce 1 g of eggs, female crickets must consume 1.876±0.948 g of feed, which is more efficient compared to crickets fed with R2 or R3, which require 5.363±3.792 g and 2.996±2.816 g of feed, respectively, to produce 1 g of eggs. The feed conversion ratio in crickets is influenced by the protein content in the feed provided. A study by Bawa *et al.* (2020) showed that crickets fed with a diet containing 22% protein have a feed conversion ratio of around 1.50, which is more efficient compared to those fed with lower-protein diets.

Mortality of Crickets

The results of the analysis of variance indicate that the provision of different feed combinations did not affect ($P>0.05$) the mortality rate of the crickets. The mortality results are presented in Table 5. The highest mortality occurred when the crickets were between 46 and 52 days old, reaching 13.90 individuals per day in the R3 treatment. The adult phase had a higher mortality rate compared to the nymph cricket phase. This mortality rate is still within normal limits, lower than the studies by Widyaningrum (2001) at 66.02% and Herdiana (2001) at 89.35%, but higher than the study by Yuliana (2016) at 43.10%. In the adult

Table 4. Production and feed conversion of Kalung crickets (*Gryllus bimaculatus*)

Parameter	Unit	Treatment		
		R1	R2	R3
Egg production	g/individual/day	0.022 ± 0.011a	0.015 ± 0.011ab	0.014 ± 0.007b
Feed convertion (with Egg production)		1.876 ± 0.948b	5.363 ± 3.792a	2.996 ± 2.816ab

Means in the same row followed by different letters indicate statistically significant differences ($P<0.05$). R1 = concentrate + young cassava leaves, R2 = concentrate + mature cassava leaves, R3 = concentrate + cassava leaf stems, with a combination ratio of 1:1.5.

Table 5. Mortality of Kalung crickets (*Gryllus bimaculatus*)

Age	Mortality (individual/day)		
(day)	R1	R2	R3
Nymph cricket Fase (25-45 day)			
25-31	1.619 ± 0.297	0.905 ± 0.577	0.810 ± 0.360
32-38	3.762 ± 2.106	2.190 ± 0.502	2.476 ± 0.787
39-45	6.714 ± 7.919	5.000 ± 1.270	3.524 ± 1.528
Average	4.032 ± 3.441	2.698 ± 0.783	2.270 ± 0.891
Percentage (%)	33.87	22.67	19.07
Adult Fase (45-66 day)			
46-52	7.905 ± 7.002	10.71 ± 0.247	13.90 ± 1.215
53-59	1.429 ± 0.742	1.000 ± 0.869	0.571 ± 0.378
60	5.048 ± 0.861	3.714 ± 2.755	4.714 ± 0.990
Average	4.794 ± 2.868	5.143 ± 1.291	6.367 ±0.861
Percentage (%)	40.27	43.20	53.73
Total Average	4.413 ± 3.155	3.921 ± 1.037	4.333 ± 0.876
Total Percentage (%)	74.13	65.87	72.80

R1 = concentrate + young cassava leaves, R2 = concentrate + mature cassava leaves, R3 = concentrate + cassava leaf stems, with a combination ratio of 1:1.5.

Table 6. Income Over Feed Cost (IOFC) of rearing Kalung crickets (*Gryllus bimaculatus*)

Treatment	Kalung Crickets			Egg		
	Feed Cost (Rp kg-1)	Income (Rp kg-1)	IOFC Crickets (Rp kg-1)	Feed Cost (Rp kg-1)	Income (Rp kg-1)	IOFC Crickets (Rp kg-1)
R1	7 206.5	27 000	19 973.9	16 852.49	113 134.47	96 281.98
R2	7 151.7	27 000	19 848.3	20 520.53	81 236.16	60 715.63
R3	6 667.1	27 000	20 332.9	18 499.97	68 906.13	50 406.16

R1 = concentrate + young cassava leaves, R2 = concentrate + mature cassava leaves, R3 = concentrate + cassava leaf stems, with a combination ratio of 1:1.5.

phase, crickets have entered the mating stage, which makes them more aggressive (Nugroho *et al*. 2020). Additionally, research by Olzer *et al*. (2019) showed that male crickets from captivity have an aggression score 1.5 times higher than those from wild populations. The highest mortality rate in the nymph cricket phase was found in the R1 treatment at 33.87%, but it was still within the normal range. This result is lower than the study by Maharani (2004), which reported a mortality rate of 61.48%. The mortality rate of crickets in the nymph cricket phase ranges from 45%-86% (Widyaningrum 2001), but it is higher than the study by Yuliana (2016), which reported a mortality rate of 19.75%.

Diseases, environmental factors, predators, and cannibalism can be factors contributing to the high mortality rate. Cannibalism is common among crickets, especially those that have entered the mating stage, which makes them more aggressive. Another cause of cannibalism is overcrowding. One way to avoid cannibalism is by providing adequate hiding places in the cage, a comfortable environment, and enough feed for the crickets. Additionally, a simple management practice is to provide separate cages for crickets based on their age stages (Fuah *et al*. 2016).

Income Over Feed Cost (IOFC)

Income Over Feed Cost (IOFC) is the difference between total revenue and the total feed costs incurred during the farming operation. IOFC is calculated by subtracting the feed costs from the business revenue. According to Supartini (2016), revenue is the product of livestock production or weight gain resulting from treatments multiplied by the selling price. The IOFC calculation results can be seen in Table 6.

The IOFC calculation results show that there is no significant difference in the IOFC for crickets between the R1, R2, and R3 treatments. However, a difference was observed in the IOFC for cricket eggs, where the R1 treatment had a higher IOFC value compared to R2 and R3. This is because the feed conversion with a combination of concentrate feed and young cassava leaves (R1) is more efficient.

CONCLUSION

The combination of concentrate feed with forages (such as young cassava leaves, mature cassava leaves, or cassava stems) did not show a significant effect on the consumption of fresh matter, dry matter, or energy. However, protein consumption was significantly affected due to the variation in protein content in each type of forage used in the feed combinations. The provision of concentrate feed with young cassava leaves increased the protein intake of the crickets, leading to higher egg production and better feed conversion efficiency. Although the mortality rate was higher in the treatment with concentrate feed and young cassava leaves, it remained within normal limits.

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