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Utilization of Different Levels of Cassava Leaf Meal and Concentrate Feed Fed Basal Diets of Red Corn Meal and Rice Bran on Growth Performance of Local Muscovy Duck

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Abstract **– The experiment was carried out at the center of Agricultural station of Svay Rieng Province from July 04th to August 23rd, 2023. The aim of this study was to compare the feed intake of dry matter of the ducks, to compare the growth rates of ducks, and to compare the feed conversion ratio of ducks. A total of 120 Muscovy ducks with an average live weight of 500g, were selected and assigned by Randomized Complete Block Design (RCBD) with 4 treatments and 3 replications. The experimental treatments are T1: Concentrate feed 22%+Casava leaf meal 5% + Azolla 4% + Rice Bran 39% + Red Corn meal 30. T2: Concentrate feed 17% + Casava leaf meal 10% + Azolla 4% + Rice Bran 39% + Red Corn meal 30%. T3: Concentrate feed 12% + Casava leaf meal 15% + Azolla 4% + Rice Bran 39% + Red Corn meal 30%. And T4: Concentrate feed 7% + Casava leaf meal 20% + Azolla 4% + Rice Bran 39% + Red Corn meal 30%. The results of the study showed that the feed intakes of dry matter (71.9g/day) and crude protein (21.5g/day) for the treatment 1 were higher than other treatments and were very significant different as compared to the treatment 4 (P<0.01). However, the feed intake of crude fibre for the treatment 1 was slightly higher but they were no differences among the four treatments (P>0.05). Growth rates of ducks for the treatment 1 (14.8g/ day) was higher and significant different as compared to the treatment 4 (P<0.05), while there were no differences among the treatment 2, treatment 3 and treatment 4 (P>0.05). In addition, feed conversion of the treatment 1 (4.90) and treatment 3 (4.82) were better improved than the treatment 2 and treatment 4 (P<0.01). In conclusion, the mixtures of 22% concentrate feed mixed with 5% cassava leaf meal, 4% Azolla, 39% rice bran and 30% red corn meal, were found that the amount of feed intakes and growth rates of ducks were higher and better improvement on the feed conversion ratio if compared with the other treatments. Thus, it would recommend that these feeds from cassava leaf, Azolla, corn and rice bran are locally resources of which the famers can easily find in their households and be able to reduce the cost of the feeds once they wish to select them in making as the feed ingredient in the diet of ducks.**

Keywords **– Cassava Leaf Meal, Concentrate Feed, Red Corn Meal, Rice Bran, Growth Performance.**

I. INTRODUCTION

The situation of raising ducks in Cambodia is very popular among consumers now and the number of farmers is increasing due to the delicious meat, large size of meat and market demand Good (Sin Por, 2016). For Muscovy ducks are easy to raise because they are more resistant to diseases and efficiently consume various local feeds to produce meaty carcasses that are sold at higher prices than local common ducks in the Mekong Delta (Nguyen Thi Kim Dong & Brian Ogle, 2000). Muscovy duck raising is playing an important and is high demand for duck meat and eggs in the market. However, backyard duck farming has having lower production level and is less profitable due to the shortage of feed and the high cost involved in the procurement and transport of raw materials or feed materials currently (Sujatha, 2012). In order to improve the feed efficiency in duck raising, there are some local available feeds are selected as following below.

Cassava leaf as foliage that rich in protein, carotene and minerals and for this reason is considered a potential source of protein in tropical countries (Preston, 2001; Bui Van Chinh & Le Viet Ly, 2001). The nutrient compounds of cassava leaf are used from results in the previously analysis such as crude protein of 21.9%, ether extract of 7.89%, ash of 8.97%, Metabolizable energy of 2552 kcal/kg, Calcium of 1.63%, Phosphorus of 0.46% (Aman Getiso, et al., 2021). The disadvantage of fresh cassava leaf is that their content of hydrocyanic acid can be very high and then can make fresh cassava top leaf unsafe as an ingredient as feed for poultry raising. It was found that ensiling and drying cassava leaf is being significantly reduced their HCN content (Bui Van Chinh & Le Viet Ly, 2001).

Azolla is a nitrogen-fixating and also non-conventional nutrient source aquatic fern has been reported to increase production performance of ducks. The feeding value of Azolla has been demonstrated in different poultry species such as chicken, ducks, and quail with promising results in performance, and inclusion of Azolla at 5% or 10% level in the diet improved body weight gain and feed conversion ratio. In addition, Azolla is rich in crude protein 26.4%, ether extract 3.42%, crude fiber 15.9%, nitrogen free extract 41.1%, and ash 14.8% (Pillai et al., 2005). Azolla has great prospective as poultry feed due to its high content of proteins, essential amino acids, vitamins (vitamin A, vitamin B12, β-Carotene), growth promoter intermediaries and minerals. Azolla on meal basis can be included in broiler ration and pullet chick ration up to a level of 5 and 10%, respectively without any adverse effect on their performance. Fresh azolla at a rate 200g/duck/day in White Pekin duck feeding was economical (Bijaya Kumar Swain et al., 2022).

Corn contains of 20 mg/kg of xanthophylls approximately, which are the yellow or red carotenoid pigments found in some plants. Consequently, the low level of carotenoid pigments in sorghum has been the main limitation in the diets. When sorghum replaces corn, there is a proportional reduction in the intensity of yellow of the yolks, demanding the dietary inclusion of pigments (Ligeiro et al., 2009). Corn is the easiest grain for poultries to digest due to low in fiber. Corn contains many chemical compounds such as dry matter of 86%, soluble energy of 3373 kcal /kg, Crude protein of 7.5%, Methionine of 0.18%, Cysteine of 0.18%, Tryptophan of 0.07%, Threonine of 0.29%, Crude fat of 3.5%, Crude fiber of 1.9%, Ash of 1.1%, Calcium of 0.01%, Total phosphorus of 0.28% and Phosphorus of 0.12% (Jacquie Jacob, 2016).

Rice bran is the brown rice kernel after separating the husk while milling brown rice to white. Rice bran is a rich source of nutrients and an active compound and then is currently used as livestock feed and for oil production (Tahira et al., 2007). According to Houston (1972), rice bran often occupies 5-8 percent of paddy rice. On other hand, rice bran is rich in energy and fat. It also contains with vitamin B, vitamin E and many minerals. Nutrient content of rice bran included dry matter of 91%, Digestible energy of 2040 kcal /kg, crude protein of 13.5%, Methionine of 0.17%, Cysteine of 0.10%, Lysine of 0.50%, Tryptophan of 0.10%, Threonine of 0.40%, Crude fat of 5.9%, Crude fiber of 13.0%, Ash of 11.0%, Calcium of 0.10%, Phosphorus of 1.70%, Non-phosphorus of 0.24% (Jacquie Jacob, 2016). The main objectives of this experiment were to determine the feed intake of local Muscovy ducks; to evaluate the growth performance of local Muscovy ducks, and to evaluate the feed conversion ratio of local Muscovy ducks.

II. MATERIALS AND METHODS

A. *Location and Climate*

This experiment was carried out at the center of Agricultural Station of Svay Rieng University, located in Chambak village, Sangkat Chek, Svay Rieng town, Svay Rieng province. The temperature during the experiment ranged from 38 to 40 degrees centigrade.

B. *Experimental Design and Treatments*

There were 120 Muscovy ducks with an average live weight of 500g, were selected and allocated by the Randomized Complete Block Design (RCBD) with 4 treatments and 3 replications. The experimental pens were made of wood, bamboo and plastic net, and each pen is 2 meters length, 1 meter width and 1 meter height. There were 10 ducklings in each pen, and the experiment lasted 50 days after the first experiment, and data was collected daily for feed offer and feed residues. The ducks were weighed at every 10 days from the beginning of the experiment to the end of the experiment. The period of this experiment for 50 days from July 04th to August 23rd, 2023. The treatments (T) and the experimental layout as following below:

- T1: Concentrate feed 22% + Casava leaf meal 5% + Azolla 4% + Rice Bran 39% + Red Corn meal 30%.
- T2: Concentrate feed 17% + Casava leaf meal 10% + Azolla 4% + Rice Bran 39% + Red Corn meal 30%.
- T3: Concentrate feed 12% + Casava leaf meal 15% + Azolla 4% + Rice Bran 39% + Red Corn meal 30%.
- T4: Concentrate feed 7% + Casava leaf meal 20% + Azolla 4% + Rice Bran 39% + Red Corn meal 30%.

Table 1. Experimental Layout.

Block	**I**		**II**		**III**	
Pens	T2	T1	T1	T4	T3	T2
	T4	T3	T2	T3	T4	T1

Table 2. Feed formulation and chemical Composition of the Muscovy duck diets.

Treatment	**T1**	**T2**	**T3**	**T4**
Concentrate feed	22	17	12	7
Cassava Leaf Meal	5	10	15	20
Azolla	4	4	4	4
Rice Bran	39	39	39	39
Red Corn Meal	30	30	30	30
Chemical composition of the feed (%)				
Dry Matter (DM)	89.5	89.4	89.3	89.2
Crude Protein (CP)	17.4	17.1	16.8	16.6
Organic Matter (OM)	77.2	80.8	84.4	88.0
Crude Fiber (CF)	15.3	15.5	15.9	16.4

C. *Experimental Feeds and Feedings*

The experiment materials such as concentrate feed, red corn meal, rice bran, premix and salt were purchased

from the storing shops in the Svay Ring Province. Azolla material was grown in the research station. However, the fresh cassava leaf was bought from the farmer who growing as farm at Romeas Heak district in Svay Rieng province and then those fresh cassava materials were dried by sun light for 5 days before grinding them into the cassava leaf meal.

The feeding methods to the Muscovy ducks were divided into two times that in the morning, all ducks were regularly prepared and weight the feeds based on duck's body weight and fed to the ducks at 8 am, and in the afternoon is at 3pm. The Muscovy ducks were weighed before the start of the experiment and every 10 days interval until the end of 50 days. The 2 kg scale was used for weighing the feed offer and feed residues, and 5kg scale was used for weighing the Muscovy ducks during the experiment.

D. *Sample Collection*

All Muscovy ducks were weighed in the morning before providing the feed offer. The beginning of the experiment and every 10 days thereafter is that the feed offers and residues were collected and weighed every day, and total amount of 10% from these were kept frozen at -20°C in plastic bags for parameter analysis. At the end of each 10 days period, samples of feed residues and offers were mixed thoroughly by hand and homogenized in a coffee grinder prior to analysis accordingly.

E. *Chemical Analysis*

The ingredients included the feed offer and feed residues were undertaken following the methods of AOAC (1990) to analyze for Organic matter (ash), Nitrogen (N) and Crude fibre (CF). For parameter of Dry Matter (DM) was determined by suing the microwave method of Undersander et al. (1993).

F. *Statistical Analysis*

All data of the experiment were prepared and entered onto Microsoft Excel and used the software program of Minitab Version 16 to analyze ANOVA through General Linear Model in the Minitab program. All mean values were compared by suing turkey method in Minitab version 16 the sources of variation were treatments, replications and error.

III. Results and Discussion

A. *Feed Intake of Ducks*

(1) *Feed Intake in Dry Matter (DM)*

Total of DM feed intake for the treatment 1 was higher and very significant different as compared to the treatment 3 and treatment 4 ($P<0.01$). However, it was non- significant different if comparing to the treatment 2 ($P>0.05$). And there were no differences among the treatment 2, treatment 3 and treatment 4 ($P>0.05$) (Table 3, Figure 1 and Figure 2).

This result is lower than the study of Nguyen Thi Kim Dong & Brian Ogle (2000) who reported that the daily intake of 115g/day when feeding with different levels of concentrate feed with brewery waste plus duckweed to the local Muscovy duck. The reason of the difference is occurred by hydrogen cyanide (HCN) of cassava leaf in the dietary composition of the recent study and then it caused the ducks cannot consume the diets efficiently. And also, this result is lower than the report by Ruben Ngouana Tadjong et al. (2020) who fed the ducks with

different rations of palm kernel meal mixed with maize, wheat bran, cotton seed meal, fish meal and blood meal. In addition, this result is lower than with the result of Maricel Becerra et al. (1995) when the ducks were fed the whole boiled soya beans mixed with different levels of Azolla and sugar can juice ad libitum supplement in the diets on performance of growing ducks. The dietary constrain of the recent study is mixing cassava leaf meal into the feed composition and then caused the ducks to consume the experimental feeds ineffectively, and the result is also lower than the report by Marzoni et al. (2005) who found that Muscovy ducks was fed the quebracho tannin powder in different levels of 1.5% or 2.5% mixed with the traditional feed in difference of duck age interval.

Table 3. Mean values of feed intake of ducks.

	T1	T2	T3	T4	SEM	P-value
DM intake, g/day						
Concentrate Feed (CF)	16.5	12.3	8.55	5.37	0.30	
Cassava Leaf Meal (CM)	0.82	1.23	1.29	1.05	0.03	
Azolla (AZ)	2.99	2.89	2.91	2.96	0.07	
Rice Bran (RB)	18.7	18.1	18.2	18.5	0.47	
Red Corn Meal (RCM)	32.6	31.5	31.6	32.2	0.81	
Premix/salt (P/S)	0.37	0.36	0.36	0.37	0.01	
Total	71.9^{a}	66.3^{ab}	62.9^{b}	60.4^{b}	1.69	<0.001
DM, g/kg LW	96.1^{a}	91.7^{b}	86.4^{c}	81.8^{d}	0.08	<0.001
Total CP, g/day	21.5^{a}	20.1^{ab}	19.3^{b}	18.9^{b}	0.51	0.002
Total OM, g/day	120^{a}	112^{ab}	109^{ab}	108^{b}	2.89	0.022
Total CF, g/day	18.9	18.3	18.3	18.5	0.47	0.743

abcd Mean values within row without a common letter are different at P<0.05.

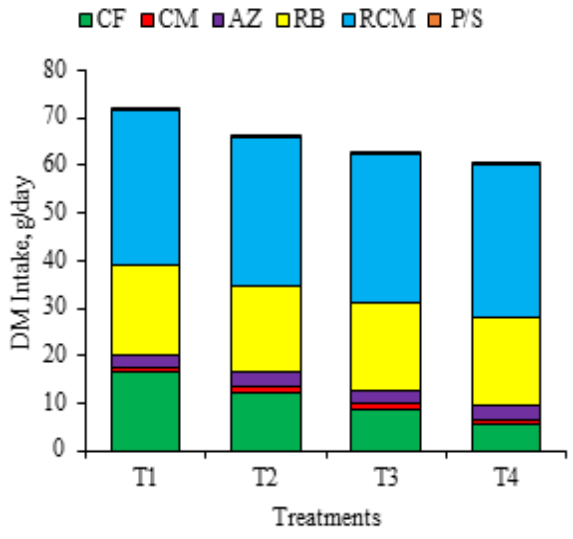

Fig. 1. DM feed intake of ducks in feed composition.

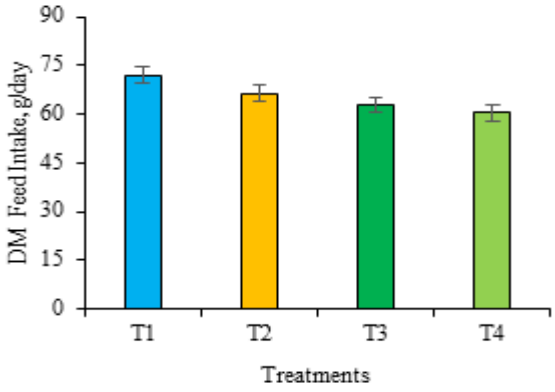

Fig. 2. DM feed intake of ducks from 0-50 days.

(2) *Intake of Crude Protein (CP) of Ducks*

Total intake of crude protein for the treatment 1 was higher and very significant different as compared with the treatment 4 ($P<0.01$). However, it was non-significant different if comparing to the treatment 2 ($P>0.05$). In addition, there were non-significant different among the treatment 2, treatment 3 and treatment 4 ($P>0.05$) (Table 3 and Figure 3).

This result is consistent with the findings of Nguyen Thi Kim Dong & Brian Ogle (2000) who resulted that the daily intake of crude protein 24.4g/day when using 75% of concentrate feed mixed with brewery waste plus duckweed to the growing of local Muscovy duck. Moreover, this result is also lower than the report by Ruben Ngouana Tadjong et al. (2020) who fed the ducks with different rations of palm kernel meal mixed with many ingredients such as maize, wheat bran, cotton seed meal, fish meal and blood meal into the feed formulation. However, this result is similar with the finding of Maricel Becerra et al. (1995) who reported that the intake of crude protein of 22.7g/day when the ducks were fed the whole boiled soya beans mixed with 15% of Azolla plus sugar can juice ad libitum supplement in the diets.

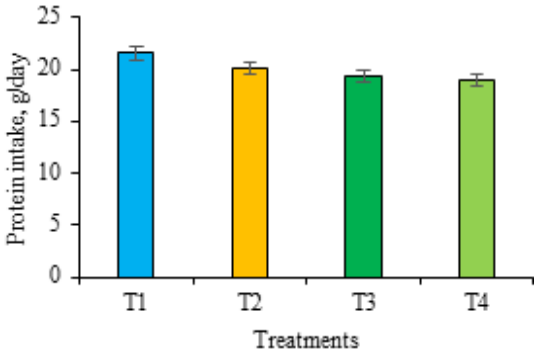

Fig. 3. Protein intake of ducks from 0-50 days.

B. *Intake of Organic Matter (OM) of Ducks*

Total intake of organic matter for the treatment 1 was higher and very significant different if compared with treatment 4 ($P<0.05$). However, it was non- significant different if comparing to the treatment 2 and treatment 3 ($P>0.05$). And also, there were non-significant different among the treatment 2, treatment 3 and treatment 4 ($P>0.05$) (Table 3).

These findings are lower than the report by Ruben Ngouana Tadjong et al. (2020) who fed the Muscovy duc-

-ks with different rations of palm kernel meal mixed with maize, wheat bran, cotton seed meal, fish meal and blood meal into the dietary composition. However, these results are higher than the findings of Loan Chhum Phith & Chey Montha (2007) when the ducks were fed different levels of cassava leaf meal ranged from 3.5%, 7%, 10% and 15% by replacing dried fish on the growth performance and digestibility study. The main effect of the differences is using cassava leaf meal with high levels up to 20% into the dietary composition for the recent study, and to that it caused the ducks could not digested the dietary materials completely via digestive tract of the ducks, while the report of Loan Chhum Phith & Chey Montha (2007) who used the dried cassava leaves with low levels up to 15% mixed with maize meal, rice bran, dried fish and soya bean meal on the growth rate and also on digestibility of Local and Pekin ducks.

(3) *Intake of Crude Fiber (CF) of Duck*

Total intake of crude fibre of the treatment 1 was slightly high but they were non-significant different if comparing among the four treatments of the treatment 1, treatment 2, treatment 3 and treatment 4 (P>0.05) (Table 3 and Figure 4).

These results are higher than to the stduy of Nguyen Thi Kim Dong & Brian Ogle (2000) who reported that the intake of crude fibres was 8.69g/day, 26g/day and 14.9g/day once using different levels of 25%, 50% and 75% of concentrate feed mixed with brewery waste plus duckweed respectively on the growth performance of local Muscovy duck. The highest of crude fibre intakes of the ducks in the recent study is caused by high contain of fibre from cassava leaves, Azolla and rice bran in the feed composition. Furthermore, this result is lower than the report by Ruben Ngouana Tadjong et al. (2020) who fed with different rations of palm kernel meal mixed with maize, wheat bran, cotton seed meal, fish meal and blood meal on the growth performance of Muscovy ducks 84days.

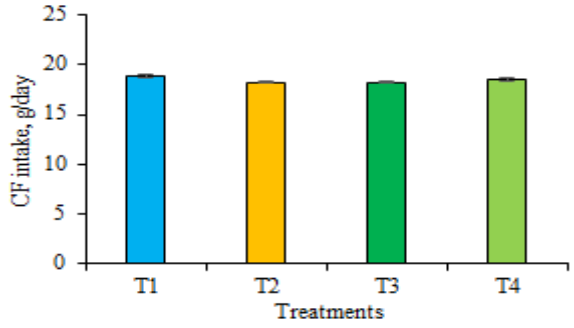

Fig. 4. Crude fiber intake of ducks from 0-50 days.

C. *The Growth Performance of Ducks*

The overall of live weight gain of ducks for the treatment 1 was higher and significant different if compared to the treatment 4 (P<0.05). However, there were non-significant different as comparing with the treatment 2 and treatment 3 (P>0.05) and also, there were non-significant different if comparing treatment 2, treatment3 and treatment 4 (P>0.05) (Table 4 and Figure 5). This result is lower than the report by Ruben Ngouana Tadjong et al. (2020) who fed the ducks with different rations in 50%, 75% and 100% of palm kernel meal mixed with maize, wheat bran, cotton seed meal, fish meal and blood meal. Furthermore, this result is lower than the report of Maricel Becerra et al. (1995) when the ducks were fed the boiled soya beans mixed with Azolla plus sugar can juice ad libitum supplement, and the result is lower than the resulted by Nguyen Thi Kim Dong et al. (1997)

who fed the Muscovy ducks with paddy rice mixed with waste fish and water plants, and also lower than the findings of Marzoni et al. (2005) when the growing Muscovy ducks was fed the quebracho tannin powder 1.5% or 2.5% with the traditional feed in difference of duck age interval of 42-56 days, 56-70 days, 70-84 days and 42-84 days. In addition, this result is lower than the study of Nguyen Thi Kim Dong & Brian Ogle (2000) who fed with different levels of concentrate feed mixed with brewery waste plus duckweed to the both of local or cross breed Muscovy duck. The main effect of the differences is mixing cassava leaf meal into the dietary composition for the recent study, and to that it caused the ducks ate less consumption. Anyway, the growth curves between the live weight gain and the day of experiment found that when increased the day of the experiment and then the live weight gain of ducks were increased. However, there was high increased in the treatment 1 as compared to other treatments (Figure 6). For the relationship between the feed intake in dry matter and live weight gain were also indicated that the live weight gain was increased linear related to the intake in dry matter (Figure 7).

Table 4. Mean values for the main effects on the growth performance and feed conversion ratio of ducks.

	T1	T2	T3	T4	SEM	P-value
Live weight, g						
Initial	486	518	554	552	48.6	0.726
10 days	610	628	645	653	52.2	0.941
20 days	745	728	720	744	58.9	0.987
30 days	891	817	828	824	68.7	0.860
40 days	1011	925	905	906	75.7	0.728
Final	1224	1127	1225	1069	100	0.705
Live weight gain, g/day						
0-10 days	12.4	11.0	9.12	10.1	1.41	0.409
10-20 days	13.5^{a}	10.0^{ab}	7.45^{b}	9.16^{b}	0.99	0.001
20-30 days	14.6^{a}	8.91^{b}	10.8^{ab}	7.94^{b}	1.33	0.007
30-40 days	11.9^{a}	10.7^{ab}	7.77^{b}	8.28^{ab}	0.96	0.012
40-50 days	17.5^{a}	14.3^{b}	12.3^{ab}	11.2^{b}	2.85	0.004
0-50 days	14.8^{a}	12.2^{ab}	13.4^{ab}	10.3^{b}	1.13	0.048
FCR, kg/kg of body weight						
0-10 days	3.75^{b}	4.56^{ab}	5.29^{ab}	9.84^{a}	1.53	0.037
10-20 days	4.37^{b}	5.90^{ab}	7.63^{a}	6.58^{a}	0.53	0.001
20-30 days	5.01^{b}	9.03^{ab}	5.84^{ab}	11.5^{a}	1.52	0.019
30-40 days	7.34^{b}	6.98^{b}	10.2^{a}	8.27^{ab}	0.66	0.008
40-50 days	4.67^{b}	4.48^{b}	6.81^{a}	4.73^{b}	0.31	0.021
0-50 days	4.90^{b}	5.51^{ab}	4.82^{b}	5.98^{a}	0.26	0.009

abcd Mean values within row without a common letter are different at $P<0.05$.

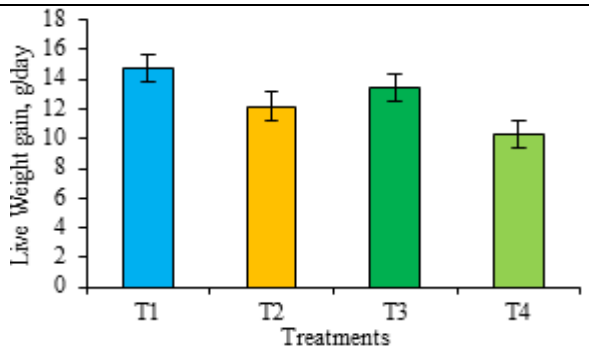

Fig. 5. Growth performance of ducks from 0-50 days.

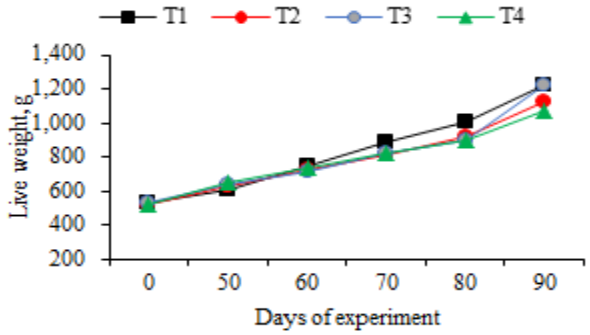

Fig. 6. Growth curves of live weight with days of experiment of ducks from 0-50 days.

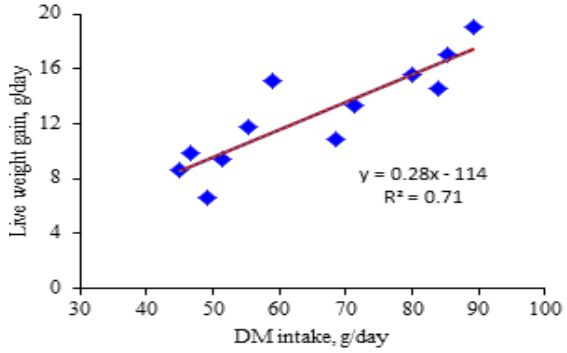

Fig. 7. Relationship between live weight gain and DM intake of ducks from 0-50 days.

D. *Feed Conversion Ratio of Ducks*

The overall of feed conversion for the treatment 1 and treatment 3 were better and very significant different as compared with the treatment 4 ($P<0.01$), but they were no differences among these two treatments ($P>0.05$). And there were non-significant different among the treatment 1, treatment 2 and treatment 4 or treatment 2 and treatment 4 ($P>0.05$) (Table 4 and Figure 8).

This finding is higher than the report with Nguyen Thi Kim Dong & Brian Ogle (2000) when the Muscovy ducks were fed concentrate feed of 75% mixed with brewery waste plus duckweed while the recent study was fed the concentrate feed of 22% mixed with cassava leaf meal of 5%, Azolla of 4% plus rice bran and red corn meal to the Muscovy ducks. 50%, 75% and 100%. However, this result is agreed with Ruben Ngouana Tadjong et al. (2020) who found that feed conversion was better improvement once the Muscovy ducks were fed with different rations of palm kernel meal mixed with maize, wheat bran, cotton seed meal, fish meal and blood meal, and also agreed to the finding of Marzoni et al. (2005) when the growing Muscovy ducks was fed the quebracho

tannin powder of 1.5% or 2.5% with the traditional feed in different of duck age interval of 42-84 days. In addition, this result is also similar to the result of Maricel Becerra et al. (1995) when the ducks were fed the whole boiled soya beans mixed with using 15% of Azolla plus sugar can juice ad libitum supplement in the diets of ducks.

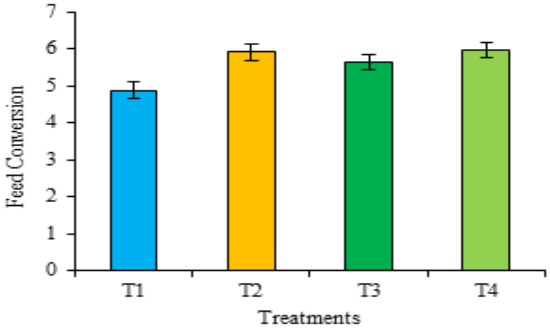

Fig. 8. Feed conversion ratio of ducks from 0-50 days.

IV. Conclusion and Recommendation

Based on of the experimental implementation with the research title on utilization of different levels of cassava leaf meal and concentrate feed fed basal diets of red corn meal and rice bran on growth performance of local Muscovy duck, it could conclude as below:

Intakes of dry matter (71.9g/day), crude protein (21.5g/day) and organic matter (120g/day) for the treatment 1 were higher than other treatments and were significant different as compared to the treatment 4 while the treatment 2, treatment 3 and treatment 4 were non-significant different. For the intake of crude fibre were no differences among the four treatments.

Growth rates of ducks for the treatment 1 (14.8g/day) was high and significant different as compared to the treatment 4 while there were no differences among the treatment 2, treatment 3 and treatment 4.

Feed conversion of the treatment 1 (4.90) and treatment 3 (4.82) were better improved than the treatment 2 and treatment 4 at the end of the experiment.

In conclusion, the composition of 22% concentrate feed mixed with 5% cassava leaf meal, 4% Azolla, 39% rice bran and 30% red corn meal, were found that the amount of feed intakes and growth rates of ducks were higher than other treatments as well as better improvement on the feed conversion ratio. On the other hand, these feeds are locally resources of which the famers can easily find and reduce the cost of feed composition.

The recommendation of these findings is using the local resources such as cassava leaf meal and Azolla are good sources of protein that being able to use for replacing some parts of the protein feeds such as mother feeds, concentrate feeds, fish meal and soybean that currently facing with high cost on the market.

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