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Effects of Different Levels of Madre de agua, Lead tree and Horseradish Fresh Leaf as Partial Replacement of Feeds on Egg Production Performance of Mallard Duck

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Abstract

This study was conducted to determine the effects of Madre de Agua, Lead tree and Horse radish fresh leaf as partial replacement of feeds on the egg production of Mallard Duck. The study was set in a Simple Completely Randomized Design and replicated six times. Forty two (42) experimental pens measuring nine (9) square feet using net as partition were constructed inside the duck house. Each cage was house three (3) experimental birds per replicate. Data gathered were mean egg production and egg quality such as weight, shell and shape. Average Feed Consumption, Average Daily Gain (ADG) and Feed Conversion Efficiency were also gathered. Average Profitability such feed cost per egg produced was taken as well as the mortality of Mallard layer ducks.

The results showed that there were no significant difference on egg production and egg quality on the first, second, fourth, fifth and sixth week of the study. The significant result was observed on egg production and egg quality of Mallard layer ducks on the third week. There were also significant difference on feed consumption and FCE on the first and fifth week of the study. Feed consumption of experimental Mallard layer ducks may be affected with the texture, the taste and smell of the leaf meal incorporated to their feeds.

Keywords: Minerals; Nutrition; Protein; Supplements; Vitamins

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1. Introduction

Eggs are the most important products in the duck industry because of the increasing demand for duck eggs. Duck is second to chicken in economic importance as source of eggs and meat. Among the avian species, duck is considered as the most versatile because it can subsist under a wide range of climatic and nutritional conditions. Also, duck raising is inexpensive, requires non-elaborate housing facilities, little attention, and less space for rearing compared to chickens. The predominant type of duck used for egg production is the Pateros type or the Philippine Mallard duck locally known as "itik" and primarily raised for *balut* production. The Philippine Mallard duck is very well adapted to local environmental conditions and management practices. Mallard ducks are non-sitters and are good producers of eggs that are relatively large in size. Duck eggs contributed 27,480 tons in the total egg production [1].

In commercial duck farms, feeding under confinement system are raised under complete confinement and fed with commercial feeds either in the form of mash, crumbles or pellets. During the laying period, duck layer pellet is readily available in different commercial brands and can be fed to ducks with or without feed supplements to achieve their performance in terms of egg production. Several studies mentioned that providing high protein diet to ducks during egg production such as protein supplementation will improve their laying performance but the availability of this protein supplemental source like snail is seasonal.

Supplemental source of protein is very important in poultry diets most especially to laying ducks. Protein is likely to be the first limiting factor as well as vitamins and minerals. Research is needed to explore the possibility of utilizing locally available protein sources of plant origin. The leaves from multipurpose trees can reduce the feeding of expensive conventional protein rich concentrate meals to increase the profit of duck raisers. It is common practice by farmers in tropical countries to use small amounts of green feed to protect against possible vitamin deficiencies and to provide unidentified growth factors.

The multi-purpose tree Madre de agua (*Trichantera gigantea*) contains high crude protein content of the foliage particularly the leaves and the thin stems, which are also consumed by the animals and apparently most of that is true protein and has a good amino acid balance [2]. Lead tree *(Leucaena leucocephala)* is valued as an excellent protein source for animal fodder, consumed browsed or harvested, mature or immature, green or dry. The nutritive value of *Leucaena leucocephala* is equal to or superior to alfalfa [3]. The leaves of Horseradish *(Moringa oleifera)* are the most nutritious part of the plant, being a significant source of vitamin B_6, vitamin C, provitamin A as beta-carotene, magnesium and protein [4].

Nowadays, the high prices of raw materials in formulating feeds and making commercial feeds have a great impact to duck raisers with regards to high cost of production. This issue is usually dejecting duck raisers due to low profit concern. Therefore this study was conducted to find out if Madre de Agua, Lead tree and Horse radish fresh leaves will provide a good result in terms of egg production to Mallard duck.

2. Methodology

2.1. Research Design

The study was controlled management of Philippine Mallard layer ducks using net constructed inside the duck house made of galvanized iron sheet roofing under the tamarind tree with favorable temperature and good ventilation. Forty two (42) experimental pens measuring nine (9) square feet with net as partition were constructed inside the duck house. Each cage was house three (3) experimental ducks and were fed with varying levels of Madre de agua 1 (10%), 2 (20%), Horseradish 1 (10%), 2 (20%) and Lead tree 1 (10%) and 2 (20%) in the Laying ration and provided with feeder and waterer. This study was laid in a Simple Completely Randomized Design (CRD).

2.2. Experimental Procedure

This study was limited on the effects of Madre de agua, Lead tree and Horseradish leaves on the egg production performance of Mallard duck. The data gathered were limited to the following parameters such as number of egg production per day, egg quality (weight, shell, and shape), feed consumption, average daily gain, feed conversion efficiency and profitability.

A total of one hundred twenty six (126) apparently healthy mallard ducks with approximately 14 months of age at their second time of laying condition were used in the study and were randomly distributed into four (4) treatments namely Treatment's 1, 2, 3, and 4 each treatment with two (2) sub treatment groups were replicated six (6) times with three (3) mallard ducks per replication. Treatment 1. (control group) no leaf replacement; Treatment 2. Sub-treatment 1. 10 percent of Madre de agua fresh leaves were added in the ration. Treatment 2. Sub-treatment 2, 20 percent of Madre de agua fresh leaves were added in the ration; Treatment 3 Sub-treatment 1. 10 percent of Lead tree fresh leaves were added in the ration; Treatment 3 Sub-treatment 2, 20 percent of Lead tree fresh leaves were added in the ration; Treatment 4 Sub-treatment 1, 10 percent of Horseradish fresh leaves was added in the ration and Treatment 4. Sub-treatment 2, 20 percent of Horseradish fresh leaves was added in the ration.

- Preparation of treatment Ration for Layer Ducks

Table 1. Basal Ration Formulation

Ingredients	Percentage (%)
Corn, yellow (local)	44.67
Soybean meal, US high protein 1	26.67
Fish meal, Peruvian	2.67
Rice bran, D1	8.67
Rice bran, D2	4.67
Coconut oil	4
Limestone	7.55
Monocalcium phosphate	0.9
Multivitamins and minerals	0.2
Total	100

- Average daily feed consumption of duck is 150-200grams of feeds /day [1]. In this study the 150 grams per day per bird was used thus the experimental treatments were as follows:

Table 2. Experimental Treatments

T1 Control	Plain feeds	Basal Ration without leaf meal.
T2 Madre de Agua	Sub.T1 *(10%)*	10 percent Madre de Agua chopped fresh leaves and 90 percent feed mixture duck layer feeds
	Sub.T2 *(20%)*	20 percent Madre de Agua chopped fresh leaves and 80 percent feed mixture duck layer feeds
T3 Horseradish	Sub.T1 *(10%)*	10 percent Horseradish chopped fresh leaves and 90 percent feed mixture duck layer feeds
	Sub.T2 *(20%)*	20 percent Horseradish chopped fresh leaves and 80 percent feed mixture duck layer feeds
T4 Lead tree	Sub.T1 *(10%)*	10 percent Lead tree chopped fresh leaves and 90 percent feed mixture duck layer feeds
	Sub.T2 *(20%)*	20 percent Lead tree chopped fresh leaves and 80 percent feed mixture duck layer feeds

2.3. Feeds and Feeding.

The experimental duck layer feed ration was formulated using Corn, yellow (local), Soybean meal, US high protein 1, Fish meal, Peruvian, Rice bran, D1, Rice bran, D2, Coconut oil, Limestone, Monocalcium phosphate, multivitamins and minerals and leaf meal such as Lead tree leaf meal, Horseradish leaf meal and Madre de Agua leaf meal. Feeding of experimental duck was done daily in the morning.

2.4. Gathering of Data

Egg Production per day

Collections of eggs were done twice a day which is during 6:00 o'clock and second collection at 9:00 o'clock in the morning. The eggs collected were classified according to their classifications based on their quality.

Egg quality

The external qualities of the eggs such as weight, shell and shape were graded based on the following

parameters using the U.S Standards for Quality of individual Eggs with Clean Unbroken Shells [5].

This study was limited to classification of egg qualities as to:

a. Egg weight

Jumbo	more than 65 grams
Extra-large	61-65 grams
Large	50-60 grams
Medium	50-54 grams
Small	45-49 grams
Pewee or mini	less than 45 grams

b. Eggshell

The shell of eggs was graded according to their outside characteristics.

Table 3. Egg Shell Quality Scoring

Scoring	Descriptions	Quality
1	Clean unbroken practically normal	A.A
2	Clean unbroken may be slightly abnormal	B
3	Clean unbroken may be abnormal	C
4	Unbroken, may be stained or soiled	Stained
5	Unbroken, may be dirty	Dirty
6	Check for cracked but not leaking	Checked
7	Broken so contents are leaking	Leaker

c. Egg shape

The shapes of eggs were graded according to their characteristic shape.

Table 4. Egg Shape Quality Scoring

Scoring	Descriptions	Quality
1	Ovoid, Elliptical, Egg shape	Oval
2	Irregular shape	Misshape
3	Circle shape	Round
4	Elongated shape	Long

Feed Consumption

The feeds given during the course of the study were recorded daily. Unconsumed feeds *(left over feeds)* with the treatments were weighed and recorded for computation.

Feed consumption = feed given - feed consumed + left over feeds

Average Daily Gain

The weight performance of birds was gathered on a daily basis (average). It was determined by using the formula:

$$ADG = \frac{\text{Final weight (kg)} - \text{Initial weight (kg)}}{\text{Rearing Period}}$$

Feed Conversion Efficiency

FCE refers to the amount of feeds needed to produce one kilogram in live weight. Lower FCE indicates the better the performance of the animal.

$$FCE = \frac{\text{Total Feed Consumed}}{\text{Final weight (kg)} - \text{Initial weight}}$$

Return Over Investment (ROI)

At the end of the study total expenses such as inputs (ducks, feeds, electricity, labor and miscellaneous) were computed and subtracted to the total returns to get the net return.

Items	**T1 Contro**	**T2 Madre de Agua**		**T3 Horse Radish**		**T4 Lead tree**	
A. Expenses		Sub T1	Sub T2	Sub T1	Sub T2	Sub T1	Sub T2
1. Stocks	3240	3240	3240	3240	3240	3240	3240
2. Feeds	2341.251	2115.492	1946.711	2114.667	1877.501	2163.948	1942.053
3. Electricity	20	20	20	20	20	20	20
4. Cost of Labor	285.714	285.714	285.714	285.714	285.714	285.714	285.714
5. Miscellaneous	20	20	20	20	20	20	20
Total Expenses	5906.965	5681.21	5512.43	5680.38	5443.22	5729.66	5507.77
Mean	1040.776	1008.87	985.54	1009.05	975.85	1015.95	984.888
B. Returns							
1. Egg sale	2360	1930	1670	1950	2290	1920	1640

2. Culled ducks	3180	3180	3180	3180	3180	3180	3180
3. Feed bags	30	30	30	30	30	30	30
Total returns	5570	5140	4880	5160	5500,	5130	4850
Net returns per peso cost	-336.965	-541.206	-632.425	-520.381	56.785	-599.662	-657.767
% Return on investment	-0.057	-0.095	-0.115	-0.09	0.01	-0.105	-0.119

Statistical Analysis

All data gathered were subjected to Analysis of Variance (ANOVA) using the IRRI STAT program to analyze among treatments. Treatments with significant differences were subjected to Duncan's Multiple Range Test (DMRT) to determine the level of significance.

3. Results and Discussion

3.1. Egg Production

The egg production in this study was evaluated to determine the egg production performance of Mallard Ducks per day and egg quality (weight, shell and shape) with partial replacement of Madre de Agua, Horseradish and Lead tree leaf meal. The eggs were collected per treatment were weigh and classify according to U.S Standard in Classifying Egg.

Table 5. presents the mean egg production of mallard ducks fed with different levels of fresh leaf as partial replacement of feed throughout the duration of the study.

Table 5: Summary Table of the Number of Eggs Produced in Different Treatment Groups.

	Number of Weeks					
Treatment	I	II	III	IV	Total	Mean ^{ns}
T1 (control)	62	88	76	10	236	39.3
T2ST1(10% Madre de agua)	55	77	54	7	193	32.2
T2ST2 (20% Madre de agua)	46	83	32	6	167	27.8
T3ST1 (10% Horseradish)	38	86	65	6	195	32.5
T3ST2 (20% Horseradish)	55	92	75	7	229	38.2
T4ST1 (10% Lead tree)	47	75	66	4	192	32.0
T4ST2 (20% Lead tree)	56	68	37	3	164	27.3
			Grand Mean			32.8

Results showed that the highest number of egg produced was T1 with 39.3 without leaf meal replacement, followed by T3ST2 with 38.2 fed with 20% Horseradish, followed by T3ST1 with 32.5 fed with 10% Horseradish, followed by T2ST1 with 32.2 fed 10% Madre de agua, followed by T4ST1 with 32.0 fed with 10% Lead tree, followed by T2ST2 with 27.8 fed with 20% Madre de agua and T4ST4 with 27.3 fed with 20% Lead tree. Based from the statistical data there were no significant differences among treatments. Partial replacement did not significantly affect the mean egg production of Mallard ducks.

Table 6: Analysis of Variance (ANOVA) of the Number of Eggs Produced in Different Treatment Groups.

Source of Variance	Df	SS	MS	Fc	F- tab	
					5 %	1%
Treatment	6	6.001526	1.0002544	1.23 ns	2.37	3.36
Error	35	28.496276	0.814179			
Total	41	34.497803				

Note: ns – not significant

3.2. Egg Quality

Table 7. presents the mean egg weight of mallard ducks fed with different levels of fresh leaf as partial replacement of feed throughout the duration of the study.

Table 7: Summary Table of Weight (grams) of Eggs Produced in Different Treatment Groups.

	Number of Weeks					
	I	II	III	IV		
Treatment					Total	Mean ns
T1 (control)	5210	7020	6005	740	18975	3162.5
T2ST1 (10% Madre de agua)	4210	6115	4295	560	15180	2530.0
T2ST2 (20% Madre de agua)	3395	5930	1450	210	10985	1830.8
T3ST1 (10% Horseradish)	3100	6400	5205	485	15190	2531.7
T3ST2 (20% Horseradish)	4565	7225	5525	540	17855	2975.8
T4ST1 (10% Lead tree)	3430	5780	4965	290	14465	2410.8
T4ST2 (20% Lead tree)	3975	5005	2685	210	11875	1979.2
			Grand Mean			2488.7

Results showed that the treatment with the highest weight of egg produced was T1 with 3162.5 without leaf meal replacement, followed by T3ST2 with 2975.8 grams fed with 20% Horseradish, followed by T3ST1 with 2531.7 grams fed with 10% Horseradish, followed by T2ST1 with 2530.0 grams fed 10% Madre de agua, followed by T4ST1 with 2410.8 grams fed with 10% Lead tree, followed by T2ST2 with 1830.8 grams fed with

20% Madre de agua and T4ST2 with 1979.2 grams fed with 20% Lead tree. Based from the statistical data there were no significant differences among treatments. Partial replacement of leaf meal did not significantly affect the mean weight of egg quality of Mallard ducks.

Table 8: Analysis of Variance (ANOVA) of the Weight (grams) of Eggs Produced in Different Treatment Groups.

Source of Variance	Df	SS	MS	Fc	F- tab	
					5 %	1%
Treatment	6	900.075986	150.0126644	2.12 ^{ns}	2.37	3.36
Error	35	2477.56920	70.787691			
Total	41	3377.645192				

Note: ^{ns} – not significant

Table 9. presents the mean of AA class eggs produced by Mallard ducks fed with different levels of fresh leaf as partial replacement of feed during the conduct of the study.

Table 9: Summary Table of Egg Shell with AA Class Produced in Different Treatment Groups.

	Number of Weeks					
	I	II	III	IV		
Treatment					Total	Mean^{ns}
T1 (control)	62	82	72	10	226	37.7
T2ST1 (10% Madre de agua)	53	67	53	7	180	30.0
T2ST2 (20% Madre de agua)	46	77	28	6	157	26.2
T3ST1 (10% Horseradish)	38	86	61	4	189	31.5
T3ST2 (20% Horseradish)	55	90	73	6	224	37.3
T4ST1 (10% Lead tree)	47	70	55	3	175	29.2
T4ST2 (20% Lead tree)	54	65	33	3	155	25.8
			Grand Mean			31.3

Results showed that the highest eggs with AA class shell produced was T1 with 37.7 without leaf meal replacement, followed by T3ST2 with 37.3 fed with 20% Horseradish, followed by T3ST1 with 31.5 fed with 10% Horseradish, followed by T2ST1 with 30.0 fed 10% Madre de agua, followed by T4ST1 with 29.2 fed with 10% Lead tree, followed by T2ST2 with 26.2 fed with 20% Madre de agua and T4ST2 with 25.8 fed with 20% Lead tree. Based from the statistical results there were no significant differences among treatments. Partial replacement of leaf meal did not significantly affect the mean of AA class egg quality of Mallard ducks.

Table 10: Analysis of Variance (ANOVA) of Class AA Eggs Produced in Different Treatment Groups.

Source of Variance	Df	SS	MS	Fc	F- tab	
					5 %	1%
Treatment	6	7.0315726	1.171928	1.38 ns	2.37	3.36
Error	35	29.735264	0.849578			
Total	41	36.7668376				

Note: ns not significant

Table 11. presents the mean egg produced by Mallard ducks with dirty shell fed with different levels of fresh leaf as partial replacement of feed during the conduct of the study.

Table 11: Summary Table of Egg Shell with Dirty Class Produced in Different Treatment Groups.

	Number of Weeks					
	I	II	III	IV		
Treatment					Total	Mean ns
T1 (control)	0	6	4	0	10	1.7
T2ST1 (10% Madre de agua)	2	10	1	0	13	2.2
T2ST2 (20% Madre de agua)	0	6	4	0	10	1.7
T3ST1 (10% Horseradish)	0	0	4	2	6	1.0
T3ST2 (20% Horseradish)	0	2	2	1	5	0.8
T4ST1 (10% Lead tree)	0	5	11	1	17	2.8
T4ST2 (20% Lead tree)	2	3	4	0	9	1.5
			Grand Mean			1.7

Results showed that the highest eggs with Dirty class shell produced was T4ST1 with 2.8 fed with 10% Lead tree, followed by T2ST1 with 2.2 fed 10% Madre de agua, followed by T2ST2 with 1.7 fed with 20% Madre de agua, and T1 with 1.7 without leaf meal replacement, followed T4ST2 with 1.5 fed with 20% Lead tree followed by T3ST1 with 1.0 fed with 10% Horseradish, and T3ST2 with 0.8 fed with 20% Horseradish. Based from the statistical data there were no significant differences among treatments. Partial replacement of leaf meal did not significantly affect the mean of Dirty class egg quality of Mallard ducks.

Table 13 presents the mean egg produced by mallard ducks with oval shape eggs fed with different levels of fresh leaf as partial replacement of feed throughout the duration of the study.

Results showed that the highest treatment produced with oval shape eggs was T1 with 39.3 without leaf meal replacement, followed by T3ST2 with 38.2 fed with 20% Horseradish, followed by T3ST1 with 32.5 fed with 10% Horseradish, followed by T4ST1 with 32.0 fed with 10% Lead tree, followed by T2ST1 with 31.8 fed 10%

Madre de agua followed by T2ST2 with 27.8 fed with 20% Madre de agua, and T4ST2 with 27.0 fed with 20% Lead tree. On the other hand the statistical data shows that were no significant differences among treatments. Partial replacement of leaf meal did not significantly affect the mean of eggs with oval shape egg quality of Mallard ducks.

Table 12: Analysis of Variance (ANOVA) of Dirty Class Eggs Produced in Different Treatment Groups.

Source of Variance	Df	SS	MS	Fc	F- tab	
					5 %	1%
Treatment	6	16.66667	2.777778	0.18 ^{ns}	2.37	3.36
Error	35	2756.66666	15.619047			
Total	41	563.33334				

Note: ^{ns} – not significant

Table 13: Summary Table of Eggs with Oval Shape Produced in Different Treatment Groups.

	Number of Weeks					
	I	II	III	IV		
Treatment					Total	Mean ^{ns}
T1 (control)	62	88	76	10	236	39.3
T2ST1 (10% Madre de agua)	55	76	53	7	191	31.8
T2ST2 (20% Madre de agua)	46	83	32	6	167	27.8
T3ST1 (10% Horseradish)	38	86	65	6	195	32.5
T3ST2 (20% Horseradish)	55	92	75	7	229	38.2
T4ST1 (10% Lead tree)	47	75	66	4	192	32.0
T4ST2 (20% Lead tree)	55	68	36	3	162	27.0
			Grand Mean			32.7

Table 14: Analysis of Variance (ANOVA) of Eggs with Oval Shape Produced in Different Treatment Groups.

Source of Variance	Df	SS	MS	Fc	F- tab	
					5 %	1%
Treatment	6	6.247039	1.0411732	1.29 ^{ns}	2.37	3.36
Error	35	28.2124581	0.8060702			
Total	41	34.459497				

Note: ^{ns} - not significant

3.3. Feed Consumption

Table 15. presents the mean feed consumption of mallard ducks fed with partial replacement of leaf meal throughout the duration of the study.

Table 15: Summary Table of Feed Consumption of Mallard Duck fed with Partial Replacement of Leaf Meal in Different Treatment Groups.

	Number of Weeks							
	I	II	III	IV	V	VI		
Treatment							Total	Mean
T1 (control)	17951	17968	17971	17967	17972	17972	107801	17966.8b
T2ST1 (10% Madre de agua)	17969	17967	17968	17968	17965	17967	107804	17967.3b
T2ST2 (20% Madre de agua)	17968	17963	18000	17963	17975	17964	107833	17922.2b
T3ST1 (10% Horseradish)	17976	17988	17985	17977	17988	17981	107895	17982.5a
T3ST2 (20% Horseradish)	17978	17974	17977	17964	17951	17970	107814	17969.0b
T4ST1 (10% Lead tree)	17967	17966	17953	17963	17968	17964	107781	17963.5b
T4ST2 (20% Lead tree)	17978	17966	17968	17977	17966	17973	107828	17921.3b
			Grand Mean					17970.4

Means followed by a common letter are not significantly different at 5% level by DMRT

Results showed that the treatment with highest feed consumption was T3ST1 with 17982.5 grams fed with 10% Horseradish, followed by T3ST2 with 17969.0 grams fed with 20% Horseradish, followed by T2ST1 with 17967.3 grams fed 10% Madre de agua, followed by T1 with 17966.8 grams without leaf meal replacement, T4ST1 with 17963.5 grams fed with 10% Lead tree, followed by T2ST2 with 17922.2 grams fed with 20% Madre de agua, and T4ST2 with 17921.3 grams fed with 20% Lead tree. Based from the statistical result there were significant differences among treatments. Feed consumption may vary depending on the different factors such as weather condition, age of the animals routine feed given to ducks. Partial replacements of leaf meal were significantly affects the mean of feed consumption per treatment group of Mallard ducks.

Table 16: Analysis of Variance (ANOVA) of Feed Consumption of Mallard Duck in Different Treatment Groups.

Source of Variance	Df	SS	MS	Fc	F- tab	
					5 %	1%
Treatment	6	1332.571426	222.0952377	3.34*	2.37	3.36
Error	35	2325.333333	66.4380952			
Total	41	3657.904760				

Note: *- significant at 0.0 5

Table 17. presents the mean of feed refusal (left over) of mallard ducks fed with different levels of fresh leaf as partial replacement of feed throughout the duration of the study.

Table 17: Summary Table of Left over Feeds (grams) of Mallard Duck fed with Partial Replacement of Leaf Meal in Different Treatment Groups.

	Number of Weeks							
	I	II	III	IV	V	VI		
Treatment							Total	Mean*
T1 (control)	49	32	29	33	28	28	199	33.2a
T2ST1 (10% Madre de agua)	31	33	32	32	35	33	196	32.7a
T2ST2 (20% Madre de agua)	32	37	0	37	25	36	167	27.8a
T3ST1 (10% Horseradish)	24	12	15	23	12	19	105	17.5b
T3ST2 (20% Horseradish)	22	26	23	36	49	30	186	31.0a
T4ST1 (10% Lead tree)	33	34	47	37	32	36	219	36.5a
T4ST2 (20% Lead tree)	22	34	32	23	34	27	172	28.7a
			Grand Mean					29.6

Means followed by a common letter are not significantly different at 5% level by DMRT

Results showed that the treatment with highest left over was T4ST1 with 36.5 grams fed with 10% Lead tree, followed by T1 with 33.2 grams without leaf meal replacement, followed by T2ST1 with 32.7 grams fed 10% Madre de agua, T3ST2 with 31.0 grams fed with 20% Horseradish followed T4ST2 with 28.7 grams fed with 20% Lead tree, followed by T2ST2 with 27.8 grams fed with 20% Madre de agua, and T3ST1 with 17.5 grams fed with 10% Horseradish. Based from the statistical result there were significant differences among treatments. Feed refusal may vary depending on the routine feed given to ducks. Partial replacements of leaf meal were significantly affects the mean of feed refusal per treatment group of Mallard ducks.

Table 18: Analysis of Variance (ANOVA) of Left over Feeds in Different Treatment Groups.

Source of Variance	Df	SS	MS	Fc	F- tab	
					5 %	1%
Treatment	6	13.741215	2.290202	2.64 *	2.37	3.36
Error	35	30.393783	0.868393			
Total	41	44.134998				

Note: * significant at 0.05

3.4. Return on Investment

Table 19. presents the mean return on investment of mallard layer ducks fed with different levels of fresh leaf as partial replacement of feed at the end of the study.

Table 19: Return on Investment of Mallard Layer Ducks on Egg Production.

Treatment	R1	R2	R3	R4	R5	R6	TOTAL	Mean ns
T1 (control)	-109.49	0.5058	-169.494	-119.494	50.5058	10.506	-336.965	-56.16
T2ST1(10% Madre de agua)	-391.87	-1.8676	-71.868	8.1323	18.1324	-101.868	-541.206	-90.20
T2ST2 (20% Madre de agua)	-143.74	-33.7375	-23.738	-73.7375	-183.737	-173.737	-632.424	-105.40
T3ST1 (10% Horse radish)	-11.73	-11.7302	-71.730	-111.73	-71.7302	-241.73	-520.381	-86.73
T3ST2 (20% Horse radish)	17.80	77.7975	17.798	27.7975	-12.2025	-72.203	56.78512	9.46
T4ST1 (10% Lead tree)	-109.94	-79.9437	-169.944	-159.944	-49.9437	-29.944	-599.663	-99.94
T4ST2 (20% Lead tree)	-142.96	-42.9612	-92.961	-122.961	-92.9612	-162.961	-657.767	-109.63
Grand total *(G)*							*-3231.62*	
Grand mean								*-76.9*

Results showed that the highest mean ROI of ducks per treatment was T3ST2 with 9.46 fed with 20% Horseradish, followed by T1 with -56.16 fed without leaf meal replacement, followed by T3ST1 with -86.73 fed with 10% Horseradish, followed by T2ST1 with -90.20 fed with 10% Madre de agua, followed by T4ST1 with -99.94 fed 10% Lead tree, followed by T2ST2 with -105.40 fed with 20% Madre de agua, and T4ST2 with -109.63 fed with 20% Lead tree. Based from the statistical data there were no significant differences among treatments. Partial replacement of leaf meals did not significantly affect the mean ROI of Mallard ducks on the study.

Table 20: Analysis of Variance (ANOVA) on the Return on Investment of Mallard Layer Ducks in Different Treatment Groups on Egg Production.

Source of Variance	Df	SS	MS	Fc	F- tab	
					5 %	1%
Treatment	6	63452.8949	10575.4824	1.43 ns	2.37	3.36
Error	35	258655.8670	7390.1676			
Total	41	322108.7619				

Note: ns – not significant

4. Conclusion and Recommendations

*4.1. Conclusion*s

The above findings indicate that the egg performance of Mallard layer ducks is affected with different percentage level of different leaf meal in terms of numbers of eggs produce and egg quality. The feed consumption and feed conversion efficiency are also affected. The return on investment is better in 20% partial replacement of Horseradish in the ration in terms of egg production to Mallard layer ducks.

4.2. Recommendations

With the results discussed, the partial replacement of duck layer feeds can be done using the Madre de Agua, Horseradish and Lead tree leaves. In terms of profitability the use of 20% Horseradish is more profitable in egg production to Mallard layer Ducks. Study trial must be conducted on semi-confined backyard duck raisers field using leaf meal replacement. Further study on the metabolizable energy of different leaf meal and feeding trial on other laying bird such as quail must be conducted.

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References

[1] *Philippines Recommends for Duck Egg Production.* PCCARRD series Duck Egg Production 2003.

[2] N.T Hong Nhan. (1997). "Use of *Trichantera gigantea* leaf meal and fresh leaves as livestock feed." Available: *www.fao.org/ag/aga/agap/frg/LRRD9/1/nhan91.htm.* [January 2013].

[3] J.A. Duke. (1983). "Handbook of Energy Crops." Available: www.hort.purdue.edu/newcrop/duke_energy/Leucaena_leucocephala.html. [February 2013].

[4] USDA. (2011). National Nutrient Database for Standard Reference. *Moringa oleifera* for birds. Internet: *www.birds2u.info/moringa_oleifera_for_birds.htm* [February 2013].

[5] USDA. (2000). United States Standards, Grades and Weight Classes for Shell Eggs. July 20, 2000 Internet: *www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELDEV3004376* [April 2013].