UNIVERSITI PUTRA MALAYSIA

POTENTIAL OF POULTRY REARING IN AN INTEGRATED FARMING SYSTEM

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POTENTIAL OF POULTRY REARING IN AN INTEGRATED FARMING SYSTEM

By

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DEDICATION

This book is affectionately dedicated

to my family especially and my supervisor,

Miss and all my friends.

ABSTRACT

A study on the capability usage treated chicken dung as fertilizers to be applied in the prawn pond and to assess the growth rate of prawn, growth performance, survival, and food conversion ratio (FCR) of broiler chicken in an integrated farming system. This study starts with poultry farming to produce chicken dung. The chicken dung was applied into the pond after the dung has been treated. A total of 400 broiler chickens (*Ross*) were divided into 4 replications. The stocking density of the chickens is 11 per meter square each replication. A total of 8260 freshwater prawns (*Macrobrachium rosenbergii*) were involved and conducted by stocking density of 20 individuals per meter square of 40 kg of treated chicken dung were applied into the pond with capacity 0.08g per meter square. The result of broiler chicken between the cycles shows significant different in the growth performance. Furthermore, the chicken farming is done successfully. The growth performance for freshwater prawn can not be determined because of the some technical and environmental problems during the experiment progress.

ABSTRAK

Satu kajian terhadap kebolehan penggunaan najis ayam yang telah diproses untuk digunakan sebagai baja di dalam kolam ternakan udang. Kajian ini juga adalah untuk menkaji kadar pembesaran udang, prestasi pembesaran, kelangsungan hidup dan kadar tukaran makanan bagi ayam pedaging dalam sistem ladang intergrasi. Kajian dimulakan dengan penternakan ayam pedaging bagi menghasilkan najis untuk diapplikasikan ke dalam kolam udang. Sebanyak 400 ekor ayam pedaging telah dibahagikan kepada 4 replikasi dengan kepadatan 11 ekor pada setiap 1 meter luas pada setiap replikasi. Sebanyak 8260 ekor udang telah terlibat dalam kajian ini dengan kepadatan sebanyak 20 ekor pada setiap 1 meter luas kolam. 40 kilogram najis ayam yang telah diprosess akan diapplikasi kan sebagai baja kedalam kolam udang dengan kapasiti 0.08 gram pada setiap 1 meter luas. Keputusan yang diperolehi adalah terdapat perbezaan yang jelas pada prestasi pembesaran ayam di antara kedua-dua kitran ternakan. Berdasarkan keputusan, ternakan ayam menunjukkan potensi yang baik untuk dilakukan dalam ladang integrasi ini. Namun, prestasi pembesaran udang tidak dapat direkodkan disebabkan kematian berpunca daripada masalah teknikal dan persekitaran semasa kajian sedang dijalankan.

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APPROVAL

I certify that this project report entitled "Potential of Poultry Rearing in an Integrated Farming System" has been examined and approved as a partial fulfillment of the requirement for the degree of Bachelor of Bioindustry Science in the Faculty of Agriculture and Food Sciences, Universiti Putra Malaysia Bintulu Sarawak Campus.

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LIST OF ABBREVIATIONS

IAA	Integrated Aquaculture-Agriculture
FCR	Feed Conversion Ratio
LEIA	Low External Input Agriculture
D.O	Dissolved Oxygen
VAC	Vuon-Ao-Chuong=garden-fishpond-animal stall
N	Nitrogen
K	Potassium
P	Phosphorus
%	Percentage
Kg	Kilogram
ha	Hectare
D.O	Dissolves Oxygen
°C	Celsius
cm	Centimetre
m	Meter
g/m^2	Gram per meter square
TFC	Total Feed Consumption
WC	Weight current
SD	Standard Deviation
LSD	Less Standard Deviation

CHAPTER 1

INTRODUCTION

The system integration is a concept introduced by the early Chinese immigrants into Malaysia. Integrated farming is simply common to most parts of Asia because of the preponderance of small farm systems which form the backbone of traditional agriculture. For small farmers, these systems enable a means of diversifying the use of meager resources in the context of a rational means of reducing risk. Additionally, it also enables increased efficiency in the use of these same resources in a manner that there will be livelihood, security and stability to farming systems.

Integrated farming in its wider context of agricultural development means widening, or reducing the degree of concentration in, the rage of the products on which a given farm depends for its income. It follows, therefore that from the standpoint of individual farms, the main purpose of pursuing integrated farming is to broaden and strengthen their sources of income.

Integrated farming may also have a regional dimension, in which individual regions through the practice of integrated farming become specialized in a number of products. The rationale for integrated farming in this particular case is individual farming in the particular region pursuing those products for which they enjoy greatest comparative advantage relative to other farms and regions.

Integrated farming also provides a means to achieve the ends desired by individual farms and country. The purpose of developing integrated farming systems is to create some flexibility for individual farms to pursue any of a variety of products, for instance, in response to market change.

Integrated farming also activity has opened new horizons of increasing production per unit area at low inputs through an increased interest in utilization of animal manures as a substitute of high cost of major inputs (prawn feed and inorganic fertilizer, involved in aquaculture). It is a multi-commodity farming system with the waste recycling as the key feature and prawn culture as the major activity.

It has now been well demonstrated that integrated farming is one strategy that can be adopted by small farmers in many developing countries to increase farm returns from per unit area of land. Moreover, integrated farming is a way by which a farmer insures himself against the risk of falling into crises of subsistence since he is able to spread the risk of production over several activities. It is because animal and fish production activities are not usually characterized by co-variant risks, the farmer is able to stabilize inter-temporal flow of total daily incomes. It is also well known that integrated farming facilitates productive use and recycling of wastes.

In integrated farming systems (aquaculture-poultry), the protein content of animal manures is low, 10 – 20 % (Fang *et al.*, 1986), which makes its recovery difficult. Only when protein content of manures reaches 20%, as is often the case with chicken manure, can the manures be directly incorporated into feeds for other animals. However, the integrated farming system provides a mechanism for protein recovery from manure, as well as other low grade agriculture waste. The rate of conversion of manure based protein into fish protein by the integrated fish pond can be as high as 29% (Hepher, 1988).

Integrated faming system also low costs and high economic returns characteristic of this farming system not only reduce requirements for labor energy inputs, but also help to protect the environment. Through intensified research since 1980, it has been proven beyond doubt that integrated livestock-fish-crops are not only technically feasible but economically viable in Malaysia (Mohamed *et al.*, 1976; Tajuddin, 1980; Mohamad Hanif *et al.*, 1990).

The factors can be consider in determine the economics of the integrated poultry-prawn-vegetable production systems are physical factors like environmental conditions of the farm area needed, types of prawn and farm size. Another factor are stocking rate like stocking poultry and prawn for integrated production systems and the volume of manure per animal and the relation between prawn yield and manure load is available.

To obtain an efficient integrated production system, attention to physical factors, including environmental conditions of the farm area, is needed. Yields can vary in different topographies like source of water supply, water quality, type of soil, weather, etc.), types of fish pond (excavation, levee, water system, etc.), and farm sizes.

In this experiment, emphasis focuses on efficiency of the utilization by-product in which the waste of one subsystem (poultry) becomes an input to a second subsystem (prawn and vegetable). The integration of livestock with fisheries aquaculture has received considerable attention lately with emphasis on the incorporation of animal manures as fertilizer and nutrient for promotion of natural feed in fish ponds (Delmendo, 1980).

1.1 Objective

General Objective

i. To integrate broiler poultry (*Ross*) with fresh water prawn (*Macrobrachium rosenbergii*)

Specific Objective of the study is:

i. To determine capability usage of treated chicken dung as fertilizers.
ii. To assess the growth rate of prawn, growth performance, survival, and food conversion ratio (FCR) of broiler chicken in an integrated farming system.

CHAPTER 2

LITERATURE REVIEW

2.1 Integrated farming systems

'The word "integrated" is derived from the Latin "integrare" which means to make whole, to complete by addition of parts, or to combine parts into a whole' (Edwards *et al.*, 1988). Integrated farming systems cope with the changes farm level, in a manner that balances food production, profitability, safety, animal welfare, social responsibility and environmental care (Little and Muir, 2003). Integrated farming seeks to reinforce the positive influences of agricultural production whilst reducing its negative impacts. It is a means of achieving sustainable agriculture and a crucial part of sustainable development.

The term integrated farming has been used for integrated resource management which may not include either fish or livestock components of the farm (Little and Edwards, 2003). In Asia, many farmers have been practicing integrated farming through their experience over generations. It has been a traditional way of subsistence livelihood of small-scale farmers in Asia (Marten, 1986). Little and Muir (1987) distinguished simple from multi-component integrated systems; the former are characterized by only a single link such as crop and fish or livestock and fish and the later by containing three or more linked components, including the use of commercial inorganic fertilizers and nutritionally complete or formulated feed (Edwards, 1998). Patterns of integrated farming practiced in Asia include crop-livestock, livestock-fish, crop-fish, and crop-livestock-fish systems (Hutanuwatr, 1988; Little and Edwards, 2003). The many types of integrated farming systems are characterized by the term integrated agriculture-aquaculture (IAA) systems (Little and Muir, 1987; Little and Muir, 2003).

Evaluation of integrating farming systems presents options for improvement of Low External Input Agriculture (LEIA) which may pave the way for a sustainable agriculture (Pant, 2002). It is a challenge to build proper linkages among the sub-systems of small farms, especially for a poor family in a relatively less developed rural area. To do so, fish ponds need to be integrated as much as possible with existing farming activities (Wahab *et al.*, 1997).

The traditional integrated fish farm in China focuses on fish polyculture, combined with poultry, livestock and/ or crop production, as well as the "integrated" use of manure, grass and other crops as feeds and fertilizers (NACA, 1989). In such a complex system, it is an important yet challenging practical matter to assess the impact on eventual production of the various on-farm biological, economic, and management inputs.

Hopkins and Cruz (1982) studies integrated animal-fish farming system in the Philippines and conclude that livestock manure was a very important source of nutrients for fish cultivated in pond. In India, the integration of poultry birds with fish culture resulted in productions of 4,500 to 5,000 kg/ha (Anon, 1985). There are a number of traditional aquaculture systems in tropical Asia, such as the Indian major carp polyculture system, but until recently this systems was not an example of integrated farming because farm wastes were not used as fertilizer or feed inputs (Tripathi and Ranadhir, 1982). Chicken manures are a complete fertilizer with the characteristics of both organic as well as inorganic fertilizer with (Banerjee *et. Al.* 1979), and fish culture in this type of an integrated system uses free manure as pond fertilizer.

The integrated of aquaculture with poultry result in a more efficient use of resources than is possible with aquaculture farming alone. Other benefits of diversification include a reduction in the risk of total crop failure, additional sources of food and extra income for poor farmers. The costs associated with fish culture operations are reduced by about 70% (Gupta, 1987) when integrated with chicken, because fish farming recycles chicken wastes and spilled chicken feed as food and fertilizer for the fish.

Sharma (1988) recorded the fish yields at 6791, 4340 and 4665 kg/ha/yr through recycling of the excreta of pig, duck and poultry respectively without any supplementary fish feed and inorganic fertilizer. They also recorded gradual increase in nitrate, phosphate, organic carbon and total nitrogen contents. Higher values of dissolved oxygen (D.O) were also noted in some period even under organic loading which might be due to abundance of phytoplankton. The net returns over variable cost (expressed as percentage) were estimated to be 75, 69.3 and 50.3 in pig, duck and poultry combination respectively for the two species.

2.2 Integrated Aquaculture and Agriculture systems

Integrated agriculture-aquaculture (IAA) systems occur when an output from one subsystem in an integrated farming system, which otherwise might have been wasted, becomes an input into another subsystem resulting in a greater efficiency of output of desired products from the land or water and are controlled by a farmer (Little and Muir, 1987; Edwards *et al.*,1988). Integrated farming involving aquaculture defined broadly is the concurrent or sequential linkage between two or more activities, of which at least one is aquaculture (Little and Edwards, 2003). The concept of integrated aquaculture is not new, possibly started first in densely populated parts of Asia and Central Europe and has been recognized as having potential for improving the position of the rural poor (Little and Muir, 1987).

Integrated aquaculture can also be defined as fish culture closely integrated into the energy and nutrient pathways of conventional farming systems (Mathias *et al.*, 1998) and more broadly to link aquaculture with human activities other than agriculture (agronomy and animal husbandry) such as management of water resources, industry and sanitation (Ryther, 1983; Little and Muir, 1987; Wahab *et al.*, 1997).

The key characteristic of integrated agriculture-aquaculture systems is the flow of resource or synergisms among subsystem in such systems (Little and Muir, 1987; Lightfoot *et al.*, 1993; Prein, 2002). Integrated farming that includes aquaculture can be broadly defined as the concurrent or sequential linkages between two or more activities, of which at least one is aquaculture (Mukherjee, 1995). The advantages and purposes of the integration are increased diversification, intensification, improved natural resource efficiency, increased productivity and increased sustainability (Prein, 2002).

A wide range of integrated agriculture-aquaculture systems are practiced in south and South East Asia, for example in Malaysia, Bangladesh, China, India, Indonesia, Thailand and Vietnam (Little and Muir, 1987). Integrated fish systems, using grass and aquatic plants as fish feed, are commonly found in many parts of China (Yang *et al.*, 2001). Traditional Chinese IAA system follows the concept of ecological agriculture emphasizing the relationship between agro ecosystem with their natural and social environments (Luo and Han, 1990). In Africa, integrated farming systems can be found in Ghana and Malawi (Prein, 2002). In Europe IAA were developed and used in countries like Hungary and Germany (Sharma and Olah, 1986).

2.2.1 Integrated livestock-fish

Livestock-fish integration had received considerable attention in the past, though most livestock-fish integrated systems promotional programs failed to take into account the existing farming systems. For example, feedlot livestock-fish, poultry-fish, or pig-fish integration are often promoted uncritically as a means to improve the welfare of small-scale resource poor farms in Asia (Little and Edwards, 2003). Such systems virtually rely on costly formulated feed, and therefore, rarely succeed on small-scale resource-poor farms (Edwards *et al.*, 1996). On the other hand, livestock waste from non-feedlot traditional on-farms, 2003 systems are not generally used successfully for ponds as farmers often use ruminant manure for fuel, house building and also use to fertilize field crop (Little and Edwards, 2003). Collection of waste may also not be convenient, especially if animals are raised free-range, without a pen to contain their wastes (Prein, 2002; Little and Edwards, 2003).

However, among all of the integrated systems, aquaculture-horticulture systems (rice-fish, pond-dike, grass-fish, hydroponics, fish pond-raised field systems etc) are probably most commonly practiced system in Asia. There has been considerable promotion of rice-fish culture in past two decades (Little *et al.,* 1996), though many efforts have been constrained by a lack of large-sized fingerlings and inadequate labour (Little *et al.*, 1996). In Vietnam, VAC (Vuon-Ao-Chuong=garden-fishpond-animal stall) integrated systems has been practiced by a large number of small-scale farmers in Red River Delta for ages (Chung *et al.*, 1995). These VAC systems, probably originated from China, are fascinating models of traditional IAA systems, as they are highly diversified, intensive, and strongly integrated. Hutanuwatr (1988) has listed quite a number of IAA systems practiced all over Asia whilst types and composition of these traditional systems are largely influenced by socioeconomic and biophysical settings, however, in general, bovine or swine–fish–crop systems and poultry–fish–crop systems are two major IAA systems practiced in Asia.

IAA systems have been most developed in parts of China. Various types of integrated 'fish pond-raised field systems' have been practiced by a large number of farmers in the Pearl River Delta of China. Delmendo (1980) stated that land and water resources planning in China, recognizing the role of pond in traditional integrated farms, has led to aquaculture being considered an integral component of agricultural development for many years. In the pond, polyculture of a number of herbivorous and omnivorous fish species was common, while a wide range of crops (fruits, vegetables, flowers or grasses) were grown in raised fields. The pond may provide various benefits to farms in addition to fish culture such as water storage and soil fertility management. Ponds can be used to process many forms of agricultural waste, including livestock and human manure and convert this manure into high-grade fish protein. Ponds and crops can be integrated using crops and crop residues as feeds and fertilizers for fish; and using pond sediments and water as crop 29 fertilizers and irrigation water, respectively (Little and Muir, 1987).

2.3 Waste recycling

Organic waste such as waste water and animal waste contain energy which may be recovered by physical, chemical and biological techniques, or combination of these. The objectives of organic waste recycling are to treat the waste and to reclaim valuable substances which include carbon, nitrogen, phosphorus, and other trace elements in the waste for possible reuse. The optimum use of resources and the integration of various waste recycling technologies which will serve as the raw material for another system should be considered (Pilly, 1992). The integrated systems that combine several aspects of waste recycling operation have been tested and are commercially implemented in some countries. The Rice Mill Complex (Kamol Kij Co.), Kirikan farm in Thailand, Maya Farms in Philippines, and Werribee Farm in Australia are some examples of the integrated systems that have been successfully operated on a commercial scale (Polprasert, 1996).

2.4 Chicken manure

Chicken manure, like other organic wastes, can be converted into quality fish food, by stimulating microbial activity in the water column and at the pond bottom and releasing the nutrients and minerals originally bound in relatively indigestible form (Pudadera *et al.*, 1986). These nutrients and minerals in turn provide the substrates for photosynthetic (autotrophic) and microbial (heterotrophic) production which can be utilized by fish (Schroeder, 1980).

Chicken manure is very high in nitrogen (N), potassium (K), and phosphorus (P) (Sims and Wolf, 1994). Under the conditions occurring during stockpiling in the poultry sheds, a substantial proportion of available nitrogen (Uric acid) is transformed to ammonia and lost as gas. However the ratio of carbon to nitrogen present during composting is still likely to be sufficiently low that nitrogen will be lost as gas or leached in excess water. The addition of material highs in biologically available organic carbon but low in N, P and K is required to capture the excess nitrogen (Mahimairaja *et al.*, 1994).

Fresh chicken manure contains 1.6% nitrogen, 1.5% phosphorus and 0.9% potassium (Woynarovich, 1979) and so increases the ponds fertility and primary productivity. Furthermore, the total proteins content of chicken manure is as high as 20 to 30%. About 80% of the manure represents undigested feed stuff with 25% dry matter content, which can be used directly by fish as feed. Olah (1986) stated that as much as 5 g $C/m^2/d$ organic matter could be processed in ponds as fertilizer. This corresponds to a fertilization rate of manure/ha/d, and a production rate in polyculture (common and silver carps) of 30 kg/ha, without feeding the fish.

2.5 Organic fertilizer

In aquaculture poultry manure (organic fertilizers) are applied to stimulate the heterotrophic food chains. According to Maclean *et al.* (1994) highest (marketable) prawn yield was achieved with fortnightly manure application in ponds. The effectiveness of manures depends on many factors such as composition, water temperature, pH, oxygen regime, pond soil structure and deposition, and fertility of the pond substrate.

Poultry manure also can be a complete fertilizer, combining the characteristics of both organic and inorganic fertilizers, and is has been observed that a large population of rotifers grows more quickly in chicken manure ponds than in ponds fertilized with animal manure (Jhingran and Sharma, 1980).

Manure would improve fish yields only under conditions of water and soil which are poor in essential nutrient minerals (e.g. carbonates or organic matter), or of a low pH, fish ponds receiving very "soft" waters deficient in minerals, or ponds with a low primary production (Wohlfarth and Schroeder, 1991) and manure may be ineffective in raising fish yields above the rates achieved by daily applications of mineral (N-P-K) fertilizers, under conditions when the fish pond is receiving daily applications of mineral fertilizers, or where fish ponds are highly productive with very fertile soil naturally-enriched with nutrient minerals and carbonates, or fish ponds with nutrient-rich waters resulting in a high concentration of algal based detritus organic matter (Schroeder *et al.*, 1990).

2.6 Waste Utilization

The maximum 30 percents dried manure may be included in the fish be feed to obtain equal growth with conventional fish feed pellets (Schroeder, 1980). The quality value of manure as a substrate for microbial growth is directly related to the feed the animal received. The concentrated feed gives the high value than the fibrous feed. Generally, the value of the manure, in increasing order is: cattle, sheep and goat, followed by pig, chicken and ducks.

2.7 Culture Freshwater prawn (*Macrobrachium rosenbergii*)

Freshwater prawn (*M. rosenbergii*) is high commercial value, and is cultured in various water bodies such as pond, garden ditch, rice field, river, etc. According to Phuong (2001), prawn can be farmed in rice field by integrating with summer-autumn rice, replacing summer-autumn rice or autumn-winter rice.

The culture of *M. rosenbergii* into inland freshwater bodies may reduce pressure on limited coastal resources and increase income generating activities throughout the country. Prawn culture (*M. rosenbergii)* in freshwater systems may represent a useful option to reduce risk of environmental imbalance from intensive or super intensive marine shrimp farming (Kiat, 1995; New *et al.*, 1995). Roy *et al.*, (1991) report that integrated prawn culture in deep water rice field with vegetable production and showed that rice production increased by the presence of fish and prawns in India. Freshwater prawns have been shown not to depress rice production in Puerto rice when grown together (New, 1995).

A variety of approaches are available to increase production of freshwater prawns *M. rosenbergii*. *M. rosenbergii* can be included in polyculture with several other species as mullet, catfish, tilapia, Chinese carps, Indian major carps, crayfish etc. The culture can be done in perennial ponds to small homestead seasonal ponds. (Brown, 1991). Freshwater prawns have been show not to depress rice production in Puerto Rico when grown together (New, 1995). Akand and Hasan (1992) reported that marine shrimp and freshwater prawn/fish and rice are being integrated in traditional 'Bheri culture'. The growth and adaption of potential of *M. rosenbergii* integrated with other production systems can be used to boost production, income and employment opportunities.

CHAPTER 3

MATERIALS AND METHODS

The study was conducted at hatchery complex of the University Putra Malaysia Bintulu Campus. This experiment used pond (KP2), which sizes ranging from 413.0 m^2 for prawn breeding. A chicken coop has been made near the pond to easy the application of chicken waste as fertilizer to the pond.

3.1 Breed of poultry

In this experiment, breed of *Ross* was used. This breed was selected because broiler chicks of the this breed should come from fast growing, well feathering, strain-bred and Ross-bred parents to convert feed into meat efficiently in shorter time. These breeds also have resistance to disease and should have broiler qualities. This breed is easy to get mostly at commercial broiler hatcheries.

3.2 Chicken coop

The chicken coop used the open chicken coop system. Woods, zincs and fine wire use as material to build chicken coop. The chicken coop builds on the pond bunds. The chicken coops built with good ventilation and should be able to maintain the temperature. The chicken coop made beside of the ponds and sizes of the chicken coop are 40 m^2 for 400 chickens per chicken coop are shown in Figure 3.0 and 3.1.

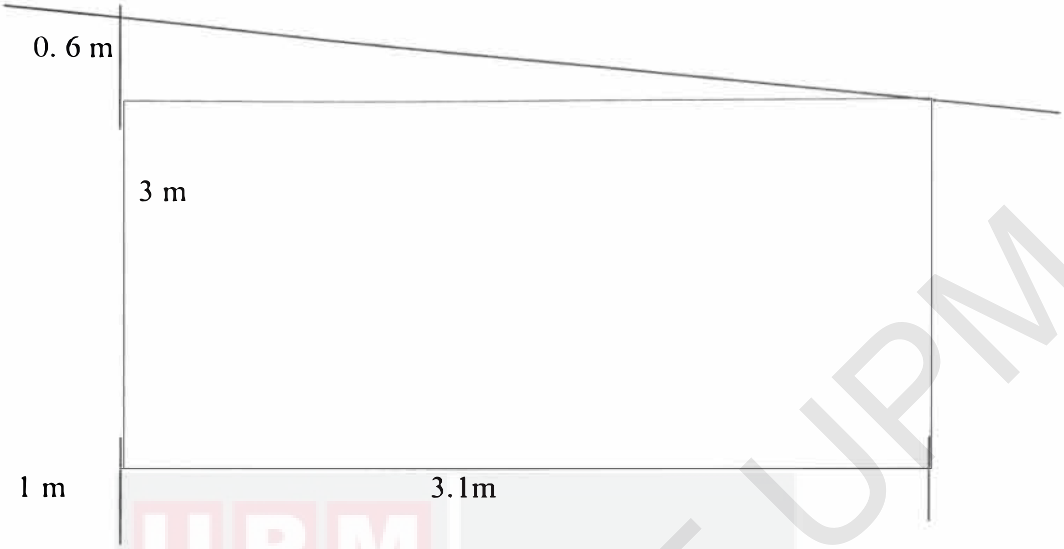

Figure 3. 0: Side view chicken poor

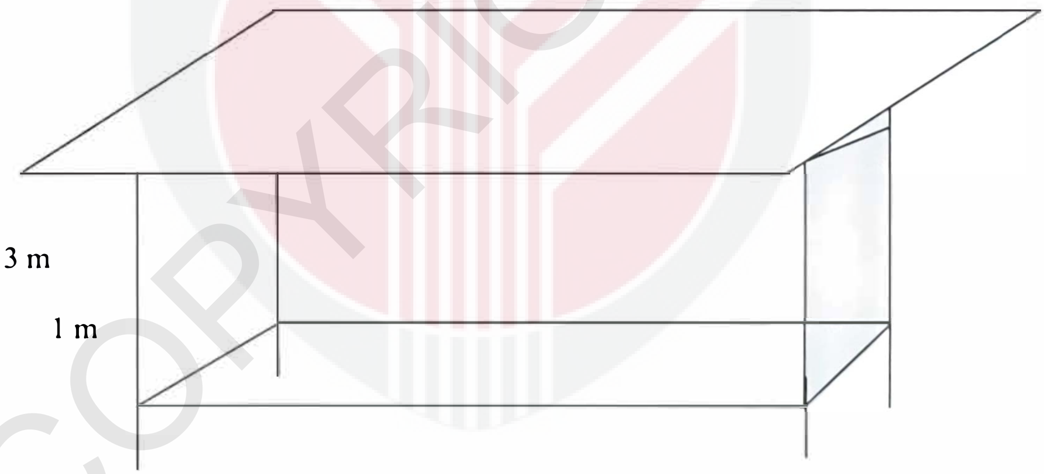

Figure 3. 1: Front view chicken poor

Diagrams showed chicken coop where width of the chicken coop is 3. 1 m and length of the chicken coop are 13. 1 m which height land to floor of the chicken coop are 1 m and length interior wall to roof of the chicken coop is 0. 6 m. The wall of the chicken coop built with fine wire 2. 54 cm x 1. 27 cm purpose to available good ventilation and zincs function as the roof of the chicken coop. Raised floor system used which wood size 2.54 cm x 1.27 cm used to make the floor and distance between slats is 1.0 cm. Purpose distance between slats is for allow the chicken drop. The chicken coop divide to 4 main parts with sizes for one part is 10x10 m^2. This is part for 4 replication which one replication for 100 chickens and 1 cycle for 400 chicken.

3.3 Chicken feed

Chicken was fed two times per days which are in the morning and evening. The chickens age from 0 to 3 weeks were fed by starter containing minimum 23% protein, 4% fat, 0.9% calcium, 0.7% phosphorus and maximum 3 % fiber, which containing 2,917 ME Kcal/kg energy. From age 4 to 8 were fed by finisher broiler containing minimum 19% protein, 4% fat, 0.8% calcium, 0.66% phosphorus and maximum 3% fiber, which containing 2,922 ME Kcal/kg energy.

Small feeder (Figure 3.2) and drinker used to keep the pallet for chicken from 1 to 2 week age, which one feeder and drinker to 10 to 15 chicks. Small feeder was used purposely to allow the chicks eat easily and get eat and drink at sufficiently. While, chickens age of 2 week above were used large feeder (Figure 3.3) and drinker. This purpose to giving a wide berth to sit during the time eats.

Table 3.0: Schedule feeding chicken during study period.

Age of chicken(week)	1	2	3	4	5	6
Food (g)/chicken/day	20	40	60	80	100	120

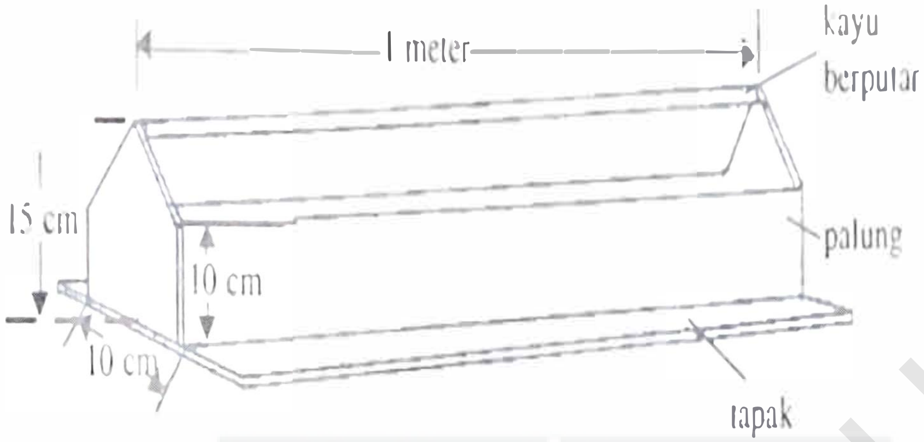

Figure 3.2: Small feeder

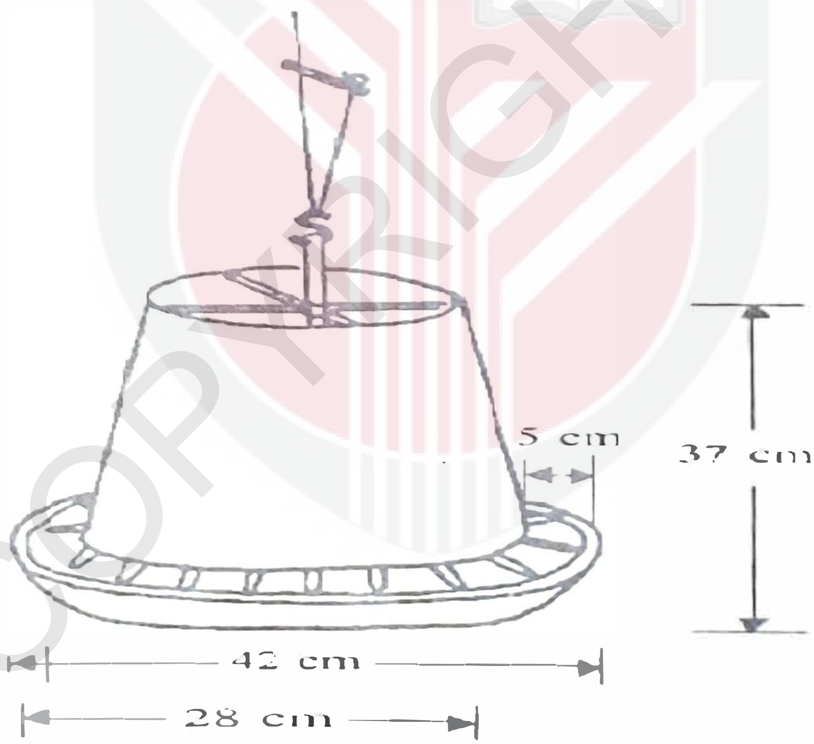

Figure 3.3: Large feeder

3.4 Processing Chicken Dung

The chicken dung produce from poultry was collected every day to determine quantity of chicken dung product every day. The chicken dung drop from chicken coop dehydrated and then sterilized with using oven at 60 ºC. This is to prevent contamination which was present problem to user prawn. This chicken dung process was applied to pond as fertilize to improve fertility of the pond and increasing the plankton in the ponds.

3.5 Apply treated chicken dung

Treated chicken dung has applied to pond as fertilizer during level preparing pond. Treated chicken dung applied to the pond minimum 31 kg and maximum 62 kg for sizes ranging of pond is 413.0 m^3. Rate of applying treated chicken dung are 750-1500 kg/ha or 75-150 g/m^2.

3.6 Chicken-prawn culture

After treatment, the chicken dung rich with nitrogen and phosphorous would enhance the fertility of the pond. The giant fresh water prawns *M. rosenbergii* are cultured in this study. The high-density monoculture system of *M. rosenbergii* were conducted. In this integrated system poultry wastes are used to produce fertilizers. Stocking densities for integrated culture of *M. rosenbergii* are showed in Table 3.2.

Table 3.1: Stocking density for *M. rosenbergii*

Macrobrachium rosenbergii N/m^2	Growth rate	Survival %	FCR
20/ m^2	-	-	-

N: number; FCR : Food Conversion Ratio

3.7 Data collection

3.7.1 Average weight

Average weight of poultry recoded every weekly using UWA-030 with accuracy ±1 gram.

3.7.2 Ambient temperature

During the study period, the ambient temperature parameter was measure daily with thermometer ±1 ^{0}C.

3.7.3 Survivability

Number of survivability of the broiler chicken recoded every day during the period study.

3.7.4 Food consumption

The food consumption for one broiler chicken recoded every day during the period study.

3.8 Data Analysis

3.8.1 Calculation of Growth Performance

Weights are the most common parameter and were measure in these experiments. Plotting and recording changes in mean or average weight was evaluated each week.

$$AW = \frac{W}{N}$$

Where;

AW = Average weight
W = Weight of chicken sample
N = No. of chicken sample

3.8.2 Calculation of FCR

The food conversion ratio for chicken was calculate for determine rate of the feed convert to meet and to determine rate of grown. The mean of food conversion ratio are measure of an animal's efficiency in converting feed mass into increased body mass chicken. The food conversion was calculating every 5 day start from age 1 day to harvest. Rations were corrected daily for growth based on a similar growth-ration model (Storebakken and Austreng, 1987; Hung *et al*., 1995). The following relations were used:

$$FCR = \frac{TFC}{WC}$$

Where;

FCR = Food conversion ratio
TFC=Total Feed Consumption
WC= Weight current

CHAPTER 4

RESULT

In this study, data collected such as growth performance of broiler chicken and *M. rosenbergii* were analyzed. Weekly mean values growth performance, survivability, feed conversion ratio (FCR), total production of chicken dung and growth performance of prawn are presented in Table 4.0, 4.1, 4.2, 4.3 and 4.4.

The analyzed data shows the growth performance of broiler chicken in integrated farming system for cycle 1 and cycle 2. From the statistical analysis, the T-TEST analysis showed that there are significant differences ($p < 0.05$) among the weeks LSD test used to compare the mean variation between the cycles. Except on week 6, where no significant different ($p>0.05$, $t=0.3058$) (Table 4.0).

Table 4.0: Weekly mean values (mean ± SD) for growth performance of broiler chicken for cycle 1 and 2 from week 1 to week 6.

	Cycle		
Week	1	2	t value
1	167.50 ± 8.39	133.80 ± 5.21	0.0005
2	434.80±29.24	332.30±33.94	0.0038
3	735.30±24.37	635.80±43.84	0.0074
4	1105.10±67.08	964.40±49.59	0.0149
5	1460.20±61.46	1362.20±32.84	0.0306
6	1848.50±91.32	1792.00±16.30	0.3058

For the feed conversion ratio (FCR), the TTEST showed that there is significant different ($p < 0.05$, t=0.0027) between the cycles in week 1. However, there is no significant different ($p > 0.05$) between both cycles on week 2 to week 6 (Table 4.1 and Figure 4.0).

Table 4.1: Weekly means values (mean ± SD) for feed conversion ratio of broiler chicken in cycle 1 and 2 from week 1 to week 6.

Week	Cycle 1	Cycle 2	t value
1	0.88±0.05	1.08 ±0.07	0.0027
2	1.04±0.08	1.29±0.29	0.1542
3	1.40±0.11	1.39±0.10	0.8244
4	1.53±0.20	1.61±0.17	0.5892
5	1.98±0.15	1.86±0.04	0.1862
6	2.12±0.12	1.95±0.08	0.0651

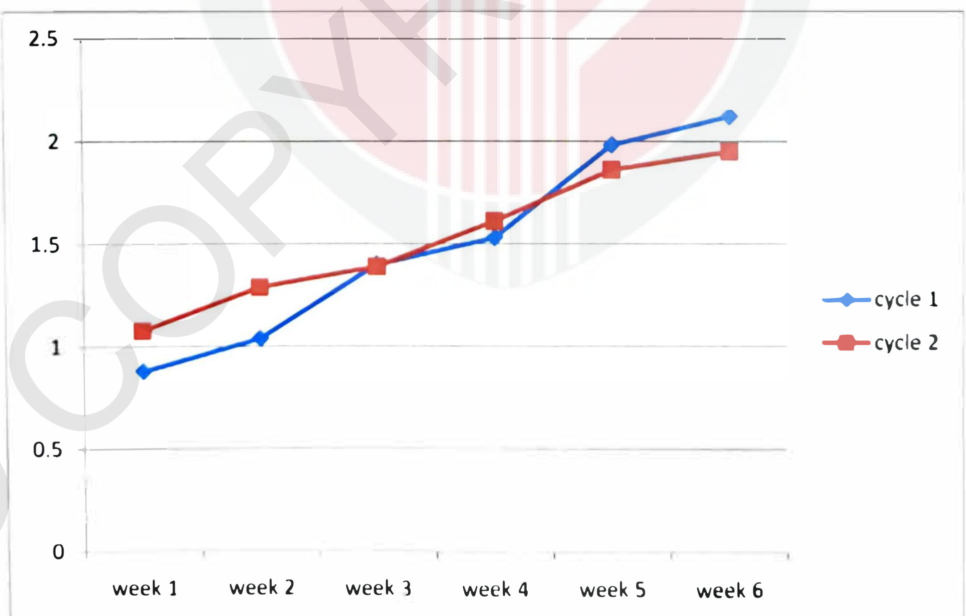

Figure 4.0: Graph showed mean of FCR per week

For the survivability of broiler chicken from week 1 to week 6, result showed there are not significantly different ($p > 0.05$) between cycle 1 and cycle 2. However, for the overall weeks from week 1 to week 6, the survivability of the broiler chicken in cycle 2 is higher than broiler chicken in cycle 1.

Table 4.2: Weekly means values (mean ± SD) for survivability of broiler chicken in cycle 1 and 2 from week 1 to week 6.

Week	Cycle		t value
	1	2	
1	99.25 ± 0.96	47.5 ±3.10	6.83
2	98.00±1.15	96.25±3.09	0.3302
3	97.50±1.29	95.50±3.31	0.3040
4	97.00±3.31	94.50±1.15	0.2044
5	96.75±0.95	93.75±2.98	0.0939
6	96.5±1.29	93.25±3.09	0.1007

Result shows the production of chicken dung per week in integrated farming system (Table 4.3). TTEST analysis shows that there is no significant different ($p > 0.05$) between cycle 1 and cycle 2 from week 1 until finishing week (week 6). However, the total chicken dung production per week for cycle 1 is higher compare to cycle 2.

Table 4.3: Weekly means values (mean ± SD) for chicken dung production in cycle 1 and 2 from week 1 to week 6.

Week	Cycle 1	Cycle 2	t value
1	0.36 ± 0.10	0.26 ±0.02	0.1290
2	0.99±0.21	0.88±0.18	0.4681
3	1.68±0.22	1.56±0.17	0.4585
4	2.90±0.35	2.88±0.06	0.8873
5	4.32±0.37	4.18±0.27	0.5509
6	6.22±0.33	6.12±0.25	0.6739

Result on the feed intake per week of broiler chicken in the integrated farming system present in Table 4.4. TTEST analysis shows that there is significant different ($p < 0.05$) between cycle 1 and cycle 2 on week 1. However, starting from week 2 until week 6, there are no significant different have been showed by the TTEST analysis.

Table 4.4: Weekly means values (mean ± SD) for feed intake of broiler chicken in cycle 1 and 2.

Week	Cycle 1	Cycle 2	t value
1	110.00± 0.00	100.50± 2.40	0.0042
2	276.20±4.35	274.30±1.60	0.4561
3	420.00±0.00	420.00±0.00	-
4	560.00±0.00	560.00±0.00	-
5	700.00±0.00	700.00±0.00	-
6	840.00±0.00	840.00±0.00	-

Macrobrachium rosenbergii released into the pond with mean length of 17.21 mm and weight of 0.01 g (Table 4.5). Result on growth performance of *M. rosenbergii* cannot be recorded because of the weather problems. Due to the bid pond, prawn cannot be harvested for measured. No data recorded on growth performance on *M. rosenbergii* until end of the study.

Table 4.5: Mean weight and length of prawns (*Macrobrachium rosenbergii)*

	Initial	Sampling 1	Sampling 2	Sampling 3
Mean Weight (g)	0.01	-	-	-
Mean Length (mm)	17.21	-	-	-

Result on the ambient temperature (^{0}C) during study period presented in Table 4.6. The highest temperature recorded in cycle 2 with the range value of 34 -35 ^{0}C, while in cycle 1, the temperature range from 25 – 30 ^{0}C.

Table 4.6: Range of ambient temperature

Cycle	Range of Ambient temperature (^{0}C)
1	25 - 30
2	34 - 35

CHAPTER 5

DISCUSSION

5.1 Poultry farming

5.1.1 Growth performance

In integrated farming system, the chickens fed control diet with starter pellet during the starter period (day 1-day 21) and grower pellet during the finishing period (day 22-day 42). The growth performance of the broiler chicken between cycle 1 and 2 are proportional. The growth performance of the broiler chickens in cycle 1 has significant different with cycle 2. The growth performance of broiler chicken in cycle 1 is highest than cycle 2. This is because the broiler chickens have different mature body weights at different ages. Ross (2005), report that, two poultry strains could have the same mature body weight but their growth may differ because they reach maturity at different ages. At the last period (week 4 to week 6) the weight gains of broiler chicken have different between distinct chicken in coop 1 and 2.

According to Tona *et al.* (2004) which they reported that d-old chicks with different or similar weights begin, respectively, to converge to similar body weights or to diverge in body weights from the end of week 3 of rearing. Ricklefs (1985) reported that there is increase in exponential growth rate during the first two weeks after hatching. The depression in the growth performance at cycle 2 might be increasing the environmental temperature. Environmental temperature at the cycle 1 are range 25 ^{0}C to 30 ^{0}C and at the cycle 2 increase to range 30 ^{0}C to 35 ^{0}C.

Table 4.0 showed that broiler chicken at cycle I where the ambient temperature range 25 ^{0}C to 30 ^{0}C had significantly ($p<0.05$) higher growth performance than cycle 1 where the ambient temperature range 30 ^{0}C to 35 ^{0}C. The above results showed that growth rate of broilers was significantly ($p<0.05$) reduced by increasing the environmental temperature. These results are in agreement with the previous researches (Harris *et al.,* 1977; Reece and Lott, 1983; Cerniglia *et al.*, 1983; Deaton *et al.*, 1984; Simmons and Deaton, 1989; Smith, 1993; Zulkifieli *et al.*, 1994; Njoya, 1995; Yahav *et al.,* (1996). Harris et *al.* (1977) found that the best environmental temperatures for optimum performance of broilers from 3 to 8 weeks of age were a constant 24 ^{0}C or diurnal cyclic from 18 to 24 ^{0}C.

The similar finding was recorded by Deaton *et al.* (1984) who found that lowering the portion of the temperature cycle from 26.7 to 21 ^{0}C during 24-hr period significantly increased broiler body weight at 48 days of age. Yoon *et al.* (1995) also found that the growth performance of 4-week broiler chicken reared at 21 ^{0}C was significantly ($p<0.05$) higher than those reared at 27 ^{0}C. Hacina *et al.* (1996) found that the growth performance of broiler chicken reared at 32 ^{0}C was significantly less than at 22 ^{0}C by 47 %. Yahav *et al.* (1996) found that the growth performance of Cobb broilers was reduced by 18 and 10 % when kept at 30 ^{0}C and cycling temperature ranged between 10 and 30 ^{0}C from 4-8 weeks of age, also they found that, the body weight of broilers kept at 35 ^{0}C reduced by 33 % compared with its corresponding groups reared at 25 ^{0}C.

5.1.2 Feed conversion ratio (FCR)

Environmental factor during brooding period in cycle 2 cause the significant different in feed conversion ratio on week 1 for the broiler poultry farming. The ambient temperature at the brooding period in cycle 2 is higher than cycle 1. The range of the temperature is 30°C to 35°C at cycle 2 and 25 ^{0}C to 30 ^{0}C at cycle1. At the height temperature, feed intake by broiler chicken is less compare to low temperature. Leeson *et al.* (1992) reported that the best values of feed efficiency and feed conversion for broiler chicken are obtained under optimum environmental temperature (12.7-26.7 ^{0}C), meanwhile decreasing or increasing the environmental temperature from the optimum is associated with decrease in feed efficiency utilization and increase in feed to gain ratio.

The feed efficiency utilization was found to increase with ambient temperature and reach the maximum at 27 ^{0}C and then decreased between 27 and 34 ^{0}C (Hurwitz *et al.*, 1980). Also, Meltzer (1986) reported that ambient temperature above 28 ^{0}C had a negative effect on feed gain ratio of broiler chicken while Reece and Lott (1983) reported a similar feed to gain ratio of broiler chicken reared at a temperature of 28 ^{0}C compared to those reared at 21 ^{0}C.

However, Washburn and Ebernhart (1988) found that feed conversion ratio was significantly lower at 31 ^{0}C than at 20 ^{0}C but the feed conversion ratio of birds at 33.5 ^{0}C was significantly higher than at 22 ^{0}C. It could be concluded from the results of this experiment that broilers reared at 30 or 35 ^{0}C need longer time (4-11 days) to reach the same slaughter weights of the birds reared at 25 ^{0}C thus the market age at 30 and 35 ^{0}C will be longer compared with those at 25 ^{0}C. Howlider and Rose

(1989) also found that broiler chicken kept at 31 ^{0}C took longer time to reach the same slaughter weight of those at 21 ^{0}C; they took 33, 42, 53, 65 and 81 days to reach the body weight of 1, 1.5, 2, 2.5 and 3 kg, while the broilers kept at 21 ^{0}C took 32, 40, 48, 56 and 67 days to reach the same slaughter weights, respectively. The poor conversion ratio obtained at 35 ^{0}C in this experiment might be related to decrease feed consumption, decreased feed utilization (insufficient digestion). Previous researchers reported that high ambient temperatures caused a reduction in the efficiency of utilization of feed energy for productive purposes. (Deaton *et al.*, 1978; Hurwitz *et al.*, 1980; Alfataftah, 1987; Hacina *et al.*, 1996; Yahav *et al.*, 1996). McDowell (1972) explained the reason for reduced feed efficiency at high ambient temperature by saying "in warm climates, generally, chemical costs for a unit of production are higher than cooler climates because a portion is siphoned off for the process required to dissipate body heat".

Figure 4.1 showed graph FCR increase from the 1 week to 6 week of age. This shows FCR of the birds increase with age of the birds. This finding was supported by Tona *et al.* (2004) they reported that FCR were related with broiler age. Rise of FCR also because of feed utilization by broiler chicken. This finding is also supported by Alam *et al.* (2003). They reported that feed conversion was increased due to better feed utilization by birds.

5.1.3 Feed intake

There is no significant difference in feed consumed among broiler fed between the cycles. This is because feed consumption in this experiment was controlled at the optimum capacity for broiler chicken growing. The modem broiler has been selected to eat at full capacity (Marks, 1980), and intake did not appear to be limiting factor in this experiment.

5.1.4 Survivability

Overall the survivability of broiler chicken between cycle 1 and cycle 2 has no significant different. However, the survivability of the broiler chicken in cycle 1 is higher than cycle 2 as the survivability for cycle 1 is 96.5 % and cycle 2 is 93.5%. This situation is due the different of environment during brooding period in cycle 1and 2, where there was rainfall in almost every day in cycle 1. But in cycle 2 environmental is hot. This show on the low temperature survivability is higher than high temperature.

The results obtained in this experiment are in agreement with the findings reported by previous researchers. (Alfataftah, (1987); Smith, (1993); Yoon *et al.*, (1995); Wiernusz and Teeter, (1996). High mortality of broilers in hot environments might be due to inefficient evaporative cooling which lead to accumulation of heat inside the body. This accumulation of heat caused continuous increase in the body temperature until it reached the lethal level, where birds die from heat prostration. This heat prostration death might be due to cardiovascular failure or adrenal cortical insufficiency or imbalance of ions (sodium, chloride, potassium, calcium, phosphate, sulfate and magnesium) in the blood (Deaton *et al.*, 1984).

5.1.5 Chicken dung

The total chicken dung production per week has no significant different. However, the total chicken dung production per week for cycle 1 is higher than chicken dung cycle 2 starting from week 1 to week 6. Production of chicken dung depends on the feed intake of the broiler chicken. According to Woynarovich (1979) total feed intake by broiler chicken produce 80% of the manure represents undigested feed stuff with 25% dry matter content.

5.2 Integrated poultry-prawn

Growth performances were recorded for the freshwater prawn in pond batter at the first three week. This shows that culturing freshwater prawn in pond with applying treated chicken dung are good for develop. The application of treated chicken dung in pond as fertilizer introduces a lot of nutrients to promote growth performance fresh water prawn. (Boyd, 1995; Korn, 1996) Fertilizers and feeds are applied to ponds to promote shrimp and fish production, and normally, no more than 25% to 30% of the nitrogen and phosphorus applied to ponds as fertilizers and feeds is recovered in fish or shrimp at harvest.

The growth performance for freshwater prawn in this experiment has decreased after 45 days because environmental factor and technical problem occur during the experiment. These problems cause stress of oxygen the pond. Stress of oxygen is due to malfunction of paddle wheel from 13 January 2009 to 16 January 2009. After this situation, most of prawns in the pond were dead and data can't be recorded.

CHAPTER 6

CONCLUSION

As the conclusion, the potential use of treated chicken dung in integrated farming system as fertilizer applied in pond is not so convincing due to lack of data. This is because the growth rate and survival of the giant Malaysian prawn, *M. rosenbergii* can only be observed after 45 day. However, broiler chicken farming in this integrated has great performance which survivability broiler chicken in this experiment more than 90 % and body weight for broiler chicken in this integrated with diet control are 1.8 kg to 2.0 kg. The production of treated chicken dung in this experiment is also good where as the production in cycle 1 was 65.72 kg. This amount can be used to fertilizing the pond for two cycles.

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APPENDICES

Appendices A

Data collection weekly cycle 1 and 2

Cycle 1

Chicken Coop 1

Week	Survival	Growth Performance (g)	Total Feed/ Chicken	FCR	Chicken Dung (kg)	Range Ambient temperature (^{0}C)
1	98	178.03	110.00	0.82	0.92	28-29
2	97	464.07	276.96	0.97	1.12	27-30
3	96	758.13	420.00	1.43	1.84	26-28
4	96	1121.93	560.00	1.54	3.06	25-27
5	96	1456.47	700.00	2.09	4.60	26-30
6	96	1809.20	840.00	2.38	6.50	28-29

Chicken Coop 2

Week	Survival	Growth Performance (g)	Total Feed Intake/ Chicken	FCR	Chicken Dung	Range Ambient temperature (^{0}C)
1	99	170.30	110.00	0.86	0.25	28-30
2	97	423.80	277.92	1.09	0.75	27-30
3	97	752.00	420.00	1.28	1.53	26-30
4	96	1182.60	560.00	1.30	2.56	25-28
5	96	1548.00	700.00	1.92	4.10	26-28
6	96	1985.00	840.00	1.98	5.95	28-29

Chicken Coop 3

Week	Survival	Growth Performance (g))	Total Feed/ Chicken	FCR	Chicken Dung (kg)	Range Ambient temperature (°C)
1	100	162.18	110.00	0.92	0.29	28-30
2	99	452.25	280.00	0.97	0.89	27-30
3	98	725.49	420.00	1.54	1.45	26-30
4	98	1095.26	560.00	1.51	2.68	25-28
5	98	1424.16	700.00	2.12	3.92	26-28
6	98	1792.34	840.00	2.28	5.91	28-29

Chicken Coop 4

Week	Survival	Growth performance (g)	Total Feed Intake/ Chicken (g)	FCR	Chicken Dung	Range Ambient temperature (°C)
1	100	159.48	110.00	0.93	0.46	28-30
2	99	398.98	269.97	1.13	1.22	27-30
3	99	705.54	420.00	1.37	1.90	26-30
4	98	1020.76	560.00	1.78	3.33	25-28
5	97	1412.14	700.00	1.79	4.69	26-28
6	97	1807.43	840.00	2.13	6.52	28-29

D.O.C BWT = 41.34g
BWT = Body Weight
FCR = Food Convention Ratio

Cycle 2

Chicken Coop 1

Week	Survival	Growth Performance (g)	Total Feed/ Chicken	FCR	Chicken Dung (kg)	Range Ambient temperature (^0C)
1	98	126.87	100.67	1.17	0.331	29-32
2	96	315.27	275.13	1.46	1.025	30-32
3	95	622.33	420.00	1.36	1.830	30-32
4	94	942.00	560.00	1.74	2.952	32-34
5	93	1319.00	700.00	1.80	4.592	31-33
6	93	1770.80	840.00	1.85	6.481	32-35

Chicken Coop 2

Week	Survival	BWT	Growth Performance	Total Feed/ Chicken	FCR	Chicken Dung	Range Ambient temperature (^0C)
1	93	136.73	95.53	103.72	1.09	0.297	29-32
2	92	308.75	185.33	275.88	1.60	0.614	30-32
3	91	583.47	284.74	420.00	1.53	1.456	30-32
4	90	908.20	414.73	560.00	1.35	2.886	32-34
5	90	1385.20	377.00	700.00	1.85	4.001	31-33
6	89	1806.70	421.50	840.00	1.99	5.997	32-35

Chicken Coop 3

Week	Survival	Growth performance (g)	Total Feed/ Chicken (g)	FCR	Chicken Dung (kg)	Range Ambient temperature (^0C)
1	99	132.78	99.34	1.08	0.355	29-32
2	98	322.65	272.16	0.97	0.993	30-32
3	98	650.33	420.00	1.28	1.502	30-32
4	97	985.64	560.00	1.67	2.892	32-34
5	97	1354.36	700.00	1.89	4.112	31-33
6	97	1789.80	840.00	1.93	6.012	32-35

Chicken Coop 4

Week	Survival	Growth Performance	Total Feed/ Chicken	FCR	Chicken Dung	Range Ambient temperature (^0C)
1	100	138.67	98.12	1.01	0.349	29-32
2	99	382.50	274.18	1.12	0.925	30-32
3	98	687.12	420.00	1.38	1.478	30-32
4	97	1021.56	560.00	1.67	2.796	32-34
5	95	1390.11	700.00	1.90	4.015	31-33
6	95	1801.63	840.00	2.04	5.913	32-35

D.O.C BWT = 41.20 g
BWT = Body Weight
FCR = Food Convention Ratio

Appendices B

Analysis week 1

The SAS System 05:45 Friday, March 27, 2009 1

The TTEST Procedure

Variable: gp

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	167.5	8.3933	4.1967	159.5	178.0
cy2	4	133.8	5.2077	2.6039	126.9	138.7
Diff (1-2)		33.7350	6.9846	4.9388		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		167.5	154.1	180.9	8.3933	4.7547	31.2949
cy2		133.8	125.5	142.0	5.2077	2.9501	19.4173
Diff (1-2)	Pooled	33.7350	21.6501	45.8199	6.9846	4.5008	15.3805
Diff (1-2)	Satterthwaite	33.7350	21.0482	46.4218			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	6.83	0.0005
Satterthwaite	Unequal	5.0117	6.83	0.0010

The SAS System 05:45 Friday, March 27, 2009

The TTEST Procedure

Variable: gp

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	2.60	0.4538

Variable: fcr

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	0.8825	0.0519	0.0259	0.8200	0.9300
cy2	4	1.0875	0.0655	0.0328	1.0100	1.1700
Diff (1-2)		-0.2050	0.0591	0.0418		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		0.8825	0.7999	0.9651	0.0519	0.0294	0.1934
cy2		1.0875	0.9833	1.1917	0.0655	0.0371	0.2443
Diff (1-2)	Pooled	-0.2050	-0.3072	-0.1028	0.0591	0.0381	0.1301
Diff (1-2)	Satterthwaite	-0.2050	-0.3086	-0.1014			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	-4.91	0.0027
Satterthwaite	Unequal	5.7007	-4.91	0.0031

```
                         Equality of Variances

              Method        Num DF     Den DF     F Value     Pr > F

              Folded F          3          3         1.59     0.7109


                              Variable:  cd

       cy               N        Mean      Std Dev     Std Err     Minimum     Maximum

       cy1              4      0.3550      0.1008      0.0504      0.2500      0.4600
       cy2              4      0.2625      0.0299      0.0149      0.2300      0.3000
       Diff (1-2)              0.0925      0.0744      0.0526
                                The SAS System          05:45 Friday, March 27,
2009    3

                            The TTEST Procedure

                              Variable:  cd

    cy           Method                Mean       95% CL Mean        Std Dev      95% CL Std
Dev

    cy1                              0.3550     0.1946    0.5154     0.1008       0.0571
0.3759
    cy2                              0.2625     0.2150    0.3100     0.0299       0.0169
0.1113
    Diff (1-2)   Pooled              0.0925    -0.0362    0.2212     0.0744       0.0479
0.1637
    Diff (1-2)   Satterthwaite       0.0925    -0.0616    0.2466

                Method           Variances          DF     t Value     Pr > |t|

                Pooled           Equal               6        1.76       0.1290
                Satterthwaite    Unequal        3.5222        1.76       0.1630

                         Equality of Variances

              Method        Num DF     Den DF     F Value     Pr > F

              Folded F          3          3        11.40     0.0758


                              Variable:  fit

       cy               N        Mean      Std Dev     Std Err     Minimum     Maximum

       cy1              4       110.0            0           0       110.0       110.0
       cy2              4       100.5       2.4084      1.2042     98.1200       103.7
       Diff (1-2)              9.5375       1.7030      1.2042

    cy           Method                Mean       95% CL Mean        Std Dev      95% CL Std
Dev

    cy1                               110.0      110.0     110.0           0            .
.
    cy2                               100.5    96.6301     104.3      2.4084       1.3644
8.9800
    Diff (1-2)   Pooled              9.5375     6.5909   12.4841      1.7030       1.0974
3.7502
    Diff (1-2)   Satterthwaite       9.5375     5.7051   13.3699

                Method           Variances          DF     t Value     Pr > |t|

                Pooled           Equal               6        7.92       0.0002
                Satterthwaite    Unequal             3        7.92       0.0042

                         Equality of Variances

              Method        Num DF     Den DF     F Value     Pr > F
```

Folded F	3	3	Infty	<.0001

Analysis week 2

The SAS System 06:07 Friday, March 27, 2009 1

The TTEST Procedure

Variable: gp

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	434.8	29.2421	14.6211	399.0	464.1
cy2	4	332.3	33.9499	16.9749	308.8	382.5
Diff (1-2)		102.5	31.6836	22.4037		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		434.8	388.2	481.3	29.2421	16.5654	109.0
cy2		332.3	278.3	386.3	33.9499	19.2323	126.6
Diff (1-2)	Pooled	102.5	47.6627	157.3	31.6836	20.4167	69.7693
Diff (1-2)	Satterthwaite	102.5	47.3696	157.6			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	4.57	0.0038
Satterthwaite	Unequal	5.8711	4.57	0.0040

The SAS System 06:07 Friday, March 27, 2009 2

The TTEST Procedure

Variable: gp

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	1.35	0.8120

Variable: fcr

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	1.0400	0.0825	0.0412	0.9700	1.1300
cy2	4	1.2875	0.2923	0.1461	0.9700	1.6000
Diff (1-2)		-0.2475	0.2147	0.1518		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		1.0400	0.9088	1.1712	0.0825	0.0467	0.3075
cy2		1.2875	0.8224	1.7526	0.2923	0.1656	1.0898
Diff (1-2)	Pooled	-0.2475	-0.6190	0.1240	0.2147	0.1384	0.4729
Diff (1-2)	Satterthwaite	-0.2475	-0.6955	0.2005			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	-1.63	0.1542
Satterthwaite	Unequal	3.4746	-1.63	0.1891

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	12.56	0.0665

Variable: cd

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	0.9975	0.2123	0.1062	0.7500	1.2200
cy2	4	0.8875	0.1887	0.0944	0.6100	1.0200
Diff (1-2)		0.1100	0.2009	0.1421		

The TTEST Procedure

Variable: cd

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		0.9975	0.6596	1.3354	0.2123	0.1203	0.7917
cy2		0.8875	0.5872	1.1878	0.1887	0.1069	0.7037
Diff (1-2)	Pooled	0.1100	-0.2376	0.4576	0.2009	0.1295	0.4424
Diff (1-2)	Satterthwaite	0.1100	-0.2388	0.4588			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	0.77	0.4681
Satterthwaite	Unequal	5.9186	0.77	0.4685

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	1.27	0.8510

Variable: fit

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	276.2	4.3508	2.1754	270.0	280.0
cy2	4	274.4	1.6268	0.8134	272.2	275.9
Diff (1-2)		1.8500	3.2845	2.3225		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		276.2	269.3	283.1	4.3508	2.4647	16.2221
cy2		274.4	271.8	277.0	1.6268	0.9216	6.0657
Diff (1-2)	Pooled	1.8500	-3.8329	7.5329	3.2845	2.1165	7.2327
Diff (1-2)	Satterthwaite	1.8500	-4.7179	8.4179			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	0.80	0.4561
Satterthwaite	Unequal	3.8228	0.80	0.4722

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	7.15	0.1404

Analysis Weeks 3

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                                     The SAS System          06:19 Friday, March 27,
2009   1

                                  The TTEST Procedure

                                     Variable:  gp

             cy                N          Mean      Std Dev      Std Err      Minimum      Maximum

             cy1               4         735.3      24.3721      12.1860        705.5        758.1
             cy2               4         635.8      43.8358      21.9179        583.5        687.1
             Diff (1-2)                99.4775      35.4653      25.0778

    cy             Method               Mean        95% CL Mean        Std Dev       95% CL Std
Dev

    cy1                                735.3       696.5     774.1     24.3721      13.8065
90.8724
    cy2                                635.8       566.1     705.6     43.8358      24.8325
163.4
    Diff (1-2)     Pooled            99.4775     38.1144     160.8     35.4653      22.8536
78.0969
    Diff (1-2)     Satterthwaite     99.4775     33.7236     165.2

                        Method           Variances        DF    t Value    Pr > |t|

                        Pooled           Equal             6       3.97      0.0074
                        Satterthwaite    Unequal      4.6929       3.97      0.0121

                                     The SAS System          06:19 Friday, March 27,
2009   2

                                  The TTEST Procedure

                                     Variable:  gp

                                 Equality of Variances

                           Method      Num DF    Den DF    F Value    Pr > F

                           Folded F         3         3       3.23    0.3607

                                     Variable:  fcr

             cy                N          Mean      Std Dev      Std Err      Minimum      Maximum

             cy1               4        1.4050       0.1091       0.0545       1.2800       1.5400
             cy2               4        1.3875       0.1044       0.0522       1.2800       1.5300
             Diff (1-2)                 0.0175       0.1068       0.0755

    cy             Method               Mean        95% CL Mean        Std Dev       95% CL Std
Dev

    cy1                               1.4050      1.2314    1.5786      0.1091       0.0618
0.4067
    cy2                               1.3875      1.2214    1.5536      0.1044       0.0591
0.3891
    Diff (1-2)     Pooled             0.0175     -0.1672    0.2022      0.1068       0.0688
0.2351
    Diff (1-2)     Satterthwaite      0.0175     -0.1673    0.2023

                        Method           Variances        DF    t Value    Pr > |t|
```

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	0.23	0.8244
Satterthwaite	Unequal	5.9883	0.23	0.8244

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	1.09	0.9437

Variable: cd

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	1.6800	0.2232	0.1116	1.4500	1.9000
cy2	4	1.5675	0.1758	0.0879	1.4600	1.8300
Diff (1-2)		0.1125	0.2009	0.1420		

The TTEST Procedure

Variable: cd

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		1.6800	1.3249	2.0351	0.2232	0.1264	0.8321
cy2		1.5675	1.2878	1.8472	0.1758	0.0996	0.6553
Diff (1-2)	Pooled	0.1125	-0.2350	0.4600	0.2009	0.1294	0.4423
Diff (1-2)	Satterthwaite	0.1125	-0.2397	0.4647			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	0.79	0.4585
Satterthwaite	Unequal	5.6877	0.79	0.4601

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	1.61	0.7044

Variable: fit

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	420.0	0	0	420.0	420.0
cy2	4	420.0	0	0	420.0	420.0
Diff (1-2)		0	0	0		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		420.0	420.0	420.0	0	.	.
cy2		420.0	420.0	420.0	0	.	.
Diff (1-2)	Pooled	0	0	0	0	.	.
Diff (1-2)	Satterthwaite	0	0	0			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	.	.
Satterthwaite	Unequal	6	.	.

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	.	.

Analysis week 4

The SAS System 06:23 Friday, March 27, 2009 4

The TTEST Procedure

Variable: gp

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	1105.1	67.0809	33.5405	1020.8	1182.6
cy2	4	964.4	49.5937	24.7968	908.2	1021.6
Diff (1-2)		140.8	58.9889	41.7115		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		1105.1	998.4	1211.9	67.0809	38.0006	250.1
cy2		964.4	885.4	1043.3	49.5937	28.0943	184.9
Diff (1-2)	Pooled	140.8	38.7232	242.9	58.9889	38.0121	129.9
Diff (1-2)	Satterthwaite	140.8	36.5585	245.0			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	3.38	0.0149
Satterthwaite	Unequal	5.5251	3.38	0.0170

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The TTEST Procedure

Variable: gp

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	1.83	0.6321

Variable: fcr

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	1.5325	0.1965	0.0983	1.3000	1.7800
cy2	4	1.6075	0.1748	0.0874	1.3500	1.7400
Diff (1-2)		-0.0750	0.1860	0.1315		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		1.5325	1.2198	1.8452	0.1965	0.1113	0.7328
cy2		1.6075	1.3293	1.8857	0.1748	0.0990	0.6518
Diff (1-2)	Pooled	-0.0750	-0.3968	0.2468	0.1860	0.1198	0.4096
Diff (1-2)	Satterthwaite	-0.0750	-0.3979	0.2479			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	-0.57	0.5892
Satterthwaite	Unequal	5.9195	-0.57	0.5895

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	1.26	0.8519

Variable: cd

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	2.9075	0.3532	0.1766	2.5600	3.3300
cy2	4	2.8800	0.0616	0.0308	2.8000	2.9500
Diff (1-2)		0.0275	0.2535	0.1793		

The TTEST Procedure

Variable: cd

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		2.9075	2.3455	3.4695	0.3532	0.2001	1.3170
cy2		2.8800	2.7819	2.9781	0.0616	0.0349	0.2298
Diff (1-2)	Pooled	0.0275	-0.4112	0.4662	0.2535	0.1634	0.5583
Diff (1-2)	Satterthwaite	0.0275	-0.5250	0.5800			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	0.15	0.8831
Satterthwaite	Unequal	3.1826	0.15	0.8873

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	32.83	0.0171

Variable: fit

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	560.0	0	0	560.0	560.0
cy2	4	560.0	0	0	560.0	560.0
Diff (1-2)		0	0	0		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		560.0	560.0	560.0	0	.	.
cy2		560.0	560.0	560.0	0	.	.
Diff (1-2)	Pooled	0	0	0	0	.	.
Diff (1-2)	Satterthwaite	0	0	0			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	.	.
Satterthwaite	Unequal	6	.	.

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	.	.

Analysis week 5

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                                        The TTEST Procedure

                                          Variable:  sur

           cy              N        Mean     Std Dev     Std Err     Minimum     Maximum

           cy1             3      1.3333      0.5774      0.3333      1.0000      2.0000
           cy2             4      0.5000      0.5774      0.2887           0      1.0000
           Diff (1-2)             0.8333      0.5774      0.4410

    cy          Method              Mean       95% CL Mean        Std Dev      95% CL Std
Dev

    cy1                           1.3333     -0.1009   2.7676      0.5774       0.3006
3.6285
    cy2                           0.5000     -0.4187   1.4187      0.5774       0.3271
2.1527
    Diff (1-2)  Pooled            0.8333     -0.3002   1.9669      0.5774       0.3604
1.4160
    Diff (1-2)  Satterthwaite     0.8333     -0.3432   2.0099

                   Method           Variances        DF    t Value    Pr > |t|

                   Pooled           Equal             5       1.89      0.1174
                   Satterthwaite    Unequal      4.4545       1.89      0.1245

                                       Equality of Variances

                        Method      Num DF    Den DF    F Value    Pr > F

                        Folded F         3         2       1.00    1.0000


                                          Variable:  gp

           cy              N        Mean     Std Dev     Std Err     Minimum     Maximum

           cy1             4      1460.2     61.4584     30.7292      1412.1      1548.0
           cy2             4      1362.2     32.8414     16.4207      1319.0      1390.1
           Diff (1-2)            98.0250     49.2732     34.8414

    cy          Method              Mean       95% CL Mean        Std Dev      95% CL Std
Dev

    cy1                           1460.2      1362.4   1558.0     61.4584      34.8155
229.2
    cy2                           1362.2      1309.9   1414.4     32.8414      18.6043
122.5
    Diff (1-2)  Pooled           98.0250     12.7712    183.3     49.2732      31.7513
108.5
    Diff (1-2)  Satterthwaite    98.0250      5.9624    190.1

                   Method           Variances        DF    t Value    Pr > |t|

                   Pooled           Equal             6       2.81      0.0306
                   Satterthwaite    Unequal      4.5841       2.81      0.0412

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                                        The TTEST Procedure

                                          Variable:  gp
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Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	3.50	0.3307

Variable: fcr

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	1.9800	0.1543	0.0771	1.7900	2.1200
cy2	4	1.8600	0.0455	0.0227	1.8000	1.9000
Diff (1-2)		0.1200	0.1137	0.0804		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		1.9800	1.7345	2.2255	0.1543	0.0874	0.5752
cy2		1.8600	1.7877	1.9323	0.0455	0.0258	0.1695
Diff (1-2)	Pooled	0.1200	-0.0768	0.3168	0.1137	0.0733	0.2504
Diff (1-2)	Satterthwaite	0.1200	-0.1159	0.3559			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	1.49	0.1862
Satterthwaite	Unequal	3.5171	1.49	0.2193

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	11.52	0.0748

Variable: cd

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	4.3275	0.3757	0.1879	3.9200	4.6900
cy2	4	4.1800	0.2775	0.1387	4.0000	4.5900
Diff (1-2)		0.1475	0.3303	0.2335		

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The TTEST Procedure

Variable: cd

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		4.3275	3.7297	4.9253	0.3757	0.2128	1.4009
cy2		4.1800	3.7385	4.6215	0.2775	0.1572	1.0346
Diff (1-2)	Pooled	0.1475	-0.4239	0.7189	0.3303	0.2128	0.7273
Diff (1-2)	Satterthwaite	0.1475	-0.4361	0.7311			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	0.63	0.5509
Satterthwaite	Unequal	5.5224	0.63	0.5529

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	1.83	0.6310

Variable: fit

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	700.0	0	0	700.0	700.0
cy2	4	700.0	0	0	700.0	700.0
Diff (1-2)		0	0	0		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		700.0	700.0	700.0	0	.	.
cy2		700.0	700.0	700.0	0	.	.
Diff (1-2)	Pooled	0	0	0	0	.	.
Diff (1-2)	Satterthwaite	0	0	0			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	.	.
Satterthwaite	Unequal	6	.	.

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	.	.

Analysis week 6

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The TTEST Procedure

Variable: growth performance

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	1848.5	91.3189	45.6595	1792.3	1985.0
cy2	4	1792.0	16.3061	8.1530	1770.0	1806.7
Diff (1-2)		56.4600	65.5936	46.3817		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		1848.5	1703.2	1993.8	91.3189	51.7312	340.5
cy2		1792.0	1766.1	1818.0	16.3061	9.2372	60.7979
Diff (1-2)	Pooled	56.4600	-57.0318	170.0	65.5936	42.2681	144.4
Diff (1-2)	Satterthwaite	56.4600	-86.2700	199.2			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	1.22	0.2692

Satterthwaite	Unequal	3.1911	1.22	0.3058

TTEST Procedure

Variable: gp

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	31.36	0.0183

Variable: fcr

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	2.1200	0.1241	0.0620	1.9800	2.2800
cy2	4	1.9525	0.0818	0.0409	1.8500	2.0400
Diff (1-2)		0.1675	0.1051	0.0743		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		2.1200	1.9225	2.3175	0.1241	0.0703	0.4627
cy2		1.9525	1.8223	2.0827	0.0818	0.0463	0.3050
Diff (1-2)	Pooled	0.1675	-0.0143	0.3493	0.1051	0.0677	0.2314
Diff (1-2)	Satterthwaite	0.1675	-0.0214	0.3564			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	2.25	0.0651
Satterthwaite	Unequal	5.1931	2.25	0.0719

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	2.30	0.5114

Variable: cd

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	6.2200	0.3354	0.1677	5.9100	6.5200
cy2	4	6.1275	0.2502	0.1251	5.9100	6.4800
Diff (1-2)		0.0925	0.2959	0.2092		

The TTEST Procedure

Variable: cd

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		6.2200	5.6864	6.7536	0.3354	0.1900	1.2504
cy2		6.1275	5.7293	6.5257	0.2502	0.1418	0.9331
Diff (1-2)	Pooled	0.0925	-0.4194	0.6044	0.2959	0.1907	0.6516
Diff (1-2)	Satterthwaite	0.0925	-0.4297	0.6147			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	0.44	0.6739
Satterthwaite	Unequal	5.5503	0.44	0.6751

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	1.80	0.6425

Variable: fit

cy	N	Mean	Std Dev	Std Err	Minimum	Maximum
cy1	4	840.0	0	0	840.0	840.0
cy2	4	840.0	0	0	840.0	840.0
Diff (1-2)		0	0	0		

cy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
cy1		840.0	840.0	840.0	0	.	.
cy2		840.0	840.0	840.0	0	.	.
Diff (1-2)	Pooled	0	0	0	0	.	.
Diff (1-2)	Satterthwaite	0	0	0			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	6	.	.
Satterthwaite	Unequal	6	.	.

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	3	3	.	.

Appendices c


Plate 1


Plate 2

Plate 3

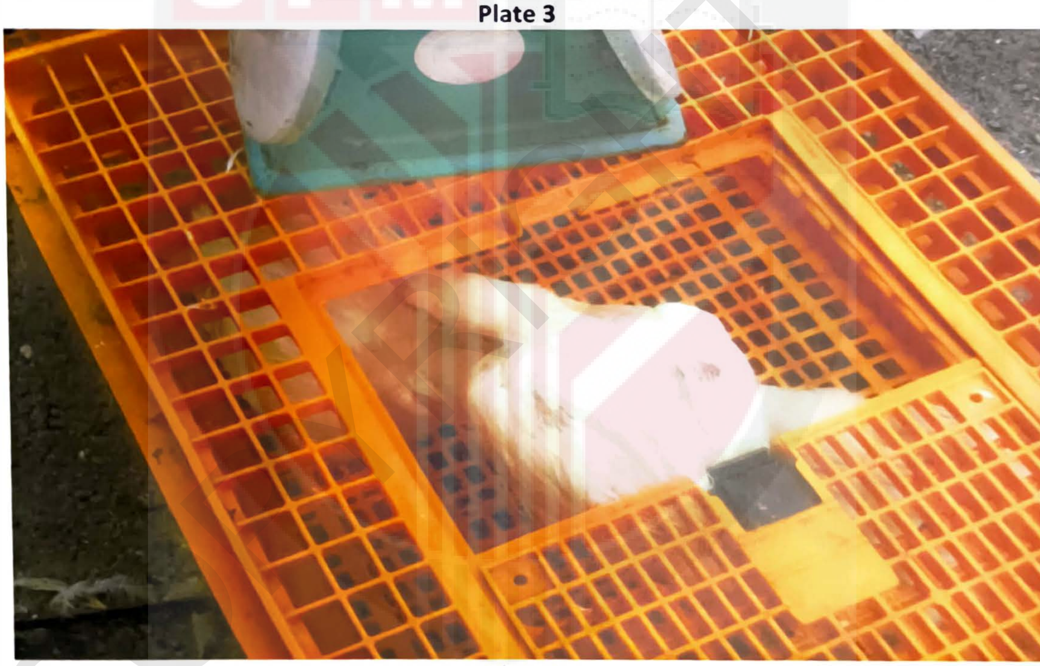

Plate 4

PUBLICATION OF THE PROJECT UNDERTAKING

This is to certify that I have no objection to publish the project entitled "**Potential of Poultry Rearing in an Integrated Farming System**" by the supervisor in a joint authorship. However, it has to be evaluated by the Faculty of Agriculture and Food Sciences, Universiti Putra Malaysia Bintulu Sarawak Campus and published in the form approved by the Faculty.

MUHAMMAD KHALID OMAR

Date: 7/5/09.