THE CHICKEN-OIL PALM INTEGRATION BY NESTLE MALAYSIA SDN BHD IN SUKAU SABAH: A CASE STUDY

EMYRUL SYAFIQ BIN HARUN

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELOR OF AGRICULTURE SCIENCE WITH HONOURS

LIVESTOCK PRODUCTION PROGRAMME
SCHOOL OF SUSTAINABLE AGRICULTURE
UNIVERSITI MALAYSIA SABAH
2014

UNIVERSITI MALAYSIA SABAH

BORANG PENGESAHAN TESIS

JUDUL: THE CHICKEN-OIL PALM INTEGRATION BY NESTLE MALAYSIA SDN BHD IN SUKAU SABAH: A CASE STUDY

IJAZAH: IJAZAH SARJANA MUDA SAINS PERTANIAN DENGAN KEPUJIAN PENGELUARAN TERNAKAN

SAYA: EMYRUL SYAFIQ BIN HARUN **SESI PENGAJIAN:** 2010/2014
(HURUF BESAR)

Mengaku membenarkan tesis *(LPSM/Sarjana/Doktor Falsafah) ini disimpan di Perpustakaan Universiti Malaysia Sabah dengan syarat-syarat kegunaan seperti berikut:-

1. Tesis adalah hak milik Universiti Malaysia Sabah.
2. Perpustakaan Universiti Malaysia Sabah dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (/)

☐	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di AKTA RAHSIA RASMI 1972)
☐	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☑	TIDAK TERHAD	

PERPUSTAKAAN
UNIVERSITI MALAYSIA SABAH

(TANDATANGAN PENULIS)

Alamat Tetap: NO 36 JALAN 3/3
TAMAN INTAN PERDANA 71050
PORT DICKSON NEGERI SEMBILAN
DARUL KHUSUS.

TARIKH: 17/1/2014

Disahkan oleh:
NURULAIN BINTI ISMAIL
LIBRARIAN
UNIVERSITI MALAYSIA SABAH

(TANDATANGAN PUSTAKAWAN)

PROF. MADYA DR. MD. SHAHIDUR RAHMAN
(NAMA PENYELIA)

TARIKH: 15/1/2014

Catatan:
*Potong yang tidak berkenaan.
*Jika tesis ini SULIT dan TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh tesis ini perlu dikelaskan sebagai SULIT dan TERHAD.
*Tesis dimaksudkan sebagai tesis bagi Ijazah Doktor Falsafah dan Sarjana Secara Penyelidikan atau disertai bagi pengajian secara kerja kursus dan Laporan Projek Sarjana Muda (LPSM).

DECLARATION

I hereby declare that this dissertation is based on my original work except for citation and quotation which have been duly acknowledged. I also declare that no part of this dissertation has been previously or concurrently submitted for a degree at this or any other university.

EMYRUL SYAFIQ BIN HARUN

BR10110017

17 JANUARY 2014

VERIFICATION

1. Assoc. Prof. Dr. Md. Shahidur Rahman
   SUPERVISOR

PROF. MADYA DR. MD. SHAHIDUR RAHMAN
PROFESOR MADYA/PENASIHAT AKADEMIK
SEKOLAH PERTANIAN LESTARI
UNIVERSITI MALAYSIA SABAH

2. Dr. Hadi Hajarian Latif
   EXAMINER

Dr. Hadi Hajarian
Senior Lecturer
School of [illegible] Agriculture
[illegible]

3. Dr. Abdul Rahim Awang
   EXAMINER

DR ABDUL RAHIM BIN AWANG
Pensyarah / Penasihat Akademik
Sekolah Pertanian Lestari
Universiti Malaysia Sabah

4. Assoc. Prof. Dr. Sitti Raehanah Bt Muhammad Shalleh
   DEAN of School of Sustainable Agriculture

ACKNOWLEDGEMENT

In the name of Allah, the most gracious, the most merciful, all the praises and thanks be to Allah, the Lord of the 'Alamin, The most gracious, the most merciful. The only owner of the day of Recompense, You (Alone) we worship and You (Alone) we ask for help, Guide us to the straightway, The way of those on whom You have bestowed Your grace, Not of those who earned Your anger, Nor of those who went astray.

I would like to take this opportunity to express my gratefulness to Allah SWT for giving me the strength to finish this dissertation successfully. I would also like to convey my heartfelt gratitude towards my parents, Harun Bin Mat and Puspalaila Binti Arub, who have supported me either through their doa' and also by giving me mental support to finish this dissertation.

Special dedication to Assoc. Prof. Dr. Md. Shahidur Rahman, my supervisor for giving me continuous technical information and for leading me in the right path in completing this dissertation. Thanks for giving me a chance to gain invaluable knowledge through his own experiences in poultry sciences while I'm conducting my final year project. I am truly grateful to him for what he has changed me into; Insya Allah making me a better man in the near future.

I also wish to express my gratitude to my friends, Norashikin Bt Mohd Kheir, Nurdalila Bt Tabri, Ahmad Shafiq Adzham, Adibah Syahirah, Wan Mohd Izzat, Abdul Qadim, Wan Nur Azid, Khairul Ikhwan, and others that who has company me in doing this project together during the early preparation until the last step in finishing this dissertation. My utmost thanks for helping me either financially or mentally during the time period of this dissertation.

Apart from that, I would also like to express my gratitude to the villagers of Kampung Bilit, Sukau, Kinabatangan Sabah especially to Haji Awang who have helped to collect all the samples that I required to finish this study. My gratitude to all of you can only be expressed by Allah SWT blessings, Insya Allah. Thank you so much.

ABSTRACT

This case study was conducted from April 2013 to August 2013 at Sukau, Kinabatangan, Sabah and in the laboratory of the School of Sustainable Agriculture (SSA), Universiti Malaysia Sabah Sandakan Campus. It was carried out to document the technical and socioeconomic details of a model chicken-oil palm integrated farming under Nestle Malaysia Sdn Bhd in Sabah. This study was conducted through interviewing a model farmer and laboratory works. The interview was conducted to collect the socioeconomic and farm management information while the laboratory works were done to discover the nutritional status of the chicken reared in chicken-oil palm integrated system. Interviewed data showed that integrated farming were beneficial to the small-scale oil palm farmers, specifically to increase their income for supporting the daily family need and family's animal protein consumption, and also for controlling the weeds in oil palm plantation effectively and biologically. Gross analysis of the feed resources available to the integrated chicken showed that their feed consisted of 50.91% grain, 39.65% green grasses, 0.00% kitchen wastes and 9.44% other materials. Proximate analysis of the crop and gizzard contents of the integrated chicken indicated that they suffers from serious imbalance of nutrition and receive 18.68% crude protein, 10.06% crude fibre, 13.61% ether extract, 32.01% dry matter and 67.99% moisture. Overall findings suggested that the integrated farmers might increase their productivity and profitability if all the technical limitations are eliminated or minimized effectively. Therefore, standardization of all the technical aspects of integrated farming including feeding of the chicken is recommended before disseminating this model to the farmers living in different socioeconomic situation and agro-ecological zones.

Integrasi Ayam-Kelapa Sawit oleh Nestle Malaysia Sdn Bhd di Sukau, Sabah : Kajian Kes

ABSTRAK

Kajian kes ini telah dijalankan dari April 2013 hingga Ogos 2013 bertempat di mukim Sukau, Kinabatangan, Sabah dan Makmal Sekolah Pertanian Lestari (SPL) di Universiti Malaysia Sabah Kampus Sandakan. Kajian ini dijalankan untuk didokumentasikan maklumat tentang teknik-teknik dan nilai sosio-ekonomi yang ada pada model penternakan integrasi ayam-kelapa sawit yang di ilhamkan oleh Nestle Malaysia Sdn Bhd di Sabah. Kajian ini dijalankan dengan berasaskan sesi temu ramah bersama pengusaha modul integrasi dan kerja analisa didalam makmal. Sesi temu ramah dijalankan bagi mendapatkan maklumat sosio-ekonomi pertani dan pengurusan ladang yang di amalkan manakala kerja analisa didalam makmal untuk mendapatkan status nutrisi pemakanan ayam yang dipelihara dalam model integrasi ayam-kelapa sawit ini. Hasil daripada sesi temu ramah bersama pertani menunjukkan bahawa model integrasi ayam-kelapa sawit ini telah memberi manfaat kepada permilik kelapa sawit berskala kecil khususnya dalam penambahan pendapatan bulanan bagi menampung keperluan seharian keluarga dan kadar pengambilan protein haiwan dalam keluarga dan mengawal tumbuhan rumpai di dalam ladang kelapa sawit dengan berkesan secara biologi. Hasil daripada analisa kasar terhadap pemakanan ayam dalam sistem integrasi ini menunjukan bahawa ayam memperolehi sebanyak 50.91% bijirin, 39.65% rumput hijau, 0.00% sisa makanan dapur and 9.44% daripada bahan yang lain. Analisa kandungan hasil daripada kantung makanan dan pedal menunjukkan bahawa ayam yang dipelihara dibawah sistem integrasi ini mendapat kadar nutrisi yang tidak seimbang dan menerima 18.68% protein mentah, 10.06% serat mentah, 13.61% ekstrak eter, 32.01% bahan kering and 67.99% lembapan. Daripada hasil penemuan keseluruhan mencadangkan bahawa para pertani yang mengamalkan sistem integrasi ayam-kelapa sawit mungkin mampu meningkatkan hasil produktiviti dan keuntungan jika mereka dapat menyelesaikan atau mengurangkan segala masalah dan kekurangan yang menjadi faktor penghalang. Oleh itu, penyeragaman aspek-aspek teknikal dalam sistem pertanian integrasi ini khususnya dalam pemakanan ayam adalah amat penting sebelum model pertanian secara integrasi ini dapat dikembangkan dan di amalkan oleh pertani-pertani kelapa sawit berskala kecil yang taraf hidup sosio-ekonomi dan zon ekologi pertanian yang berbeza bersesuian dengan keadaan setempat.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS, UNITS AND ABBREVIATIONS

%	Percent
CF	Crude Fibre
CGC	Crop Gizzard Content
CP	Crude Protein
DM	Dry Matter
EE	Ether Extract
FAO	Food and Agriculture Organization
ft	feet
g	gram
ha	hectare
IPM	Integrated Pest Management
Kg	Kilogram
m^2	Meter squares
mg	mili gram
mm	mili meter
MPOB	Malaysia Palm Oil Board
NRM	Natural Resource Management
°C	Degree Celcius
RM	Ringgit Malaysia
SFRB	Scavengable Feed Resources Base
SSA	School of Sustainable Agriculture

LIST OF EQUATION

CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays, Integration approach in the agricultural sector has been a hot issue. Integration involves various components, namely crops, animals, land and water. Integrated system refers to approaches that link the components to economic, social and ecological perspectives. The processes are holistic, dynamic, interactive, and multi-disciplinary and promote efficiency in natural resource management. The integration of various crops and animals enable synergistic interaction and results in a greater additive and total contribution than the sum of their individual effects (Edwards *et al*, 1988). Mainly expert in agriculture have been in integration agriculture has been in favour of approach due to increase productivity and profitability while decreases the diversity risks. It promotes sustainability in agriculture and it refers to agricultural production and distribution system that achieves the integration of utilization of natural feeds and natural biological cycle and control (Raman, 2006).

There has been many studies on agricultural integration. Due to land that only be used for the purpose of crop farming is potential to been integrated with livestock animal to achieve sustainable agriculture. For an example, poultry species that have been studied in integration system such as integrated between fish-duck farming that utilizes the waste of poultry and agriculture by products for fish production. About 40-50 kg of organic manure can produce 1 kg of fish (Edward, 1983). It shows good potential in China, Hungary, East German, Poland, Russia and India. Some practices of integration between chicken and fish also been practices in West Jawa Indonesia (Susanto et al., 2002). In Peninsular Malaysia, under Malaysia Palm Oil Board (MPOB), some have tried to rear free-range chicken under the oil palm plantation and shows good potential of this model (Awaludin, 2003).

There are numerous benefits of chicken-oil palm integration such as biological control of weed by chicken that can replace the labor requirement for weeding, chicken dropping are good source of organic fertilizer and chicken can utilize the natural grass and insects available in oil palm plantations that reduce the pressure on feed sources (Awaludin, 2003). This type of integration also promotes the holistic, interactive, multi-disciplinary and natural resource management. Chicken and crops integration system plays multiple roles that have socio-economic, ecological and environmental implications. In integration, low inputs are used and are associated with demonstrable sustainability and sustainable production system (Devendra, 2011). This can increase the animal production and income towards the farmers.

Oil palm plantation in Malaysia is a controversial agriculture sector in terms of nature degradation. Until the year 2012, Malaysia had about 5.1 million hectares of oil palm plantation distributed in Peninsular and East Malaysia. It accounts also with large companies and small holdings (MPOB, 2013). The rearing of chicken integrating with oil palm in Peninsular Malaysia is still under investigation to standardize the efficiency and productivity.

Integration of chicken in oil palm plantation is done under the free-range concept. The product of this type of integration is comparable with the organic chicken. Organic chicken that are fed with sufficient amount of organically-produced ingredients and conventional ingredients acceptable under the current and proposed organic standards is a significant issue (Lampkin, 1997). The feed ingredients to oil palm chicken are whatever they get from the environment, often offal and insects or seeds (Pandey et al. 1992). In Malaysia this integration has a good prospect if practiced by all categories of oil palm producers, because free range chicken has a good demand at local and export market for free range chicken.

This model of farming seems to benefit the oil palm farmers offering side income from poultry production. In case of world's oil palm price drop, they can still diversify their risk of income generation on chicken farming. In Sabah, the study of model chicken-oil palm integrated farming is very limited. There is no local literature on this issue. Currently, Nestle Malaysia Sdn Bhd is trying to adopt the integration of chicken farming with oil palm plantation at smallholding farmers' level under their company's "Creating Shared Values" program. This integration project is still at initial

stage in Peninsular Malaysia. However, the ins and outs characteristics of this type of integration approach in East Malaysia has not yet been studied by scientific community nor documented by any party. Meanwhile, the Agro-Sectorial Manager of Nestle Malaysia Sdn Bhd recently made a request to be furnished with an expert opinion on their current chicken-oil palm integrated farming model being undertaken by them. In time with this request, this study will be implemented.

1.2 Justification

This study hopefully will be able to provide with sufficient explanation on whether the integration model being practiced by smallholder farmers under the care of Nestle Malaysia Sdn Bhd care were logical, ideal and sustainable, or vice versa? This study would provide a detailed information on management practices adopted by the practicing farmers, apart from a sufficient look into the current issues of free-range chcicken, chicken breeds for integrated system, exploitation of natural livestock feed resources, marketing system, economical profitability, sustainability, farmers perceptions and social and national impacts of this integrated system. The model which had been practiced by Nestle Malaysia Sdn Bhd would be compared with integration models suggested by Sabah Department of Veterinary Services & Animal Industry (DVSAH). Hence the shortcomings would be identified, and necessary solutions would be proposed for strengthening the chicken-oil palm integration under the Nestle Malaysia Sdn Bhd supervision satisfying the socio-economic and environmental situation in Sabah.

1.3 Research Objectives

The objectives of the study were the following:

a) To document the management practices and socio-economic impacts of the of chicken-oil palm integration model being used by the Nestle Malaysia Sdn Bhd at Sukau in Sabah.

b) To gauge the nutritional status of the integrated chicken under the Nestle Model of chicken-oil palm integration.

c) To study the problems and prospects of this integration model.

1.4 Hypotheses

H_o : The chicken-oil palm intergration model by Nestle Malaysia Sdn Bhd in Sukau, Sabah is appropriate and logical.

H_a : The chicken-oil palm intergration model by Nestle Malaysia Sdn Bhd in Sukau, Sabah is not ideal and need standardization.

CHAPTER 2

LITERATURE REVIEW

2.1 Integrated System in Agriculture

Integrated crop-livestock farming systems continue to dominate in agriculture. Integration involves various components, namely crops, animals, land and water. Integrated system refers to approaches that link the component of economic, social and ecological perspectives. These processes are holistic, dynamic, interactive, and multi-disciplinary and promote efficiency in natural resource management (NRM). The integration of various crop and animal enable synergistic interaction and resulted in a greater additive and total contribution than the sum of their individual effects (Edwards et al, 1988).

Integrated systems are especially well developed in East and South Asia. There had been overview on this integrated system on their potential, importance and relevant to small farm holder in Asia and distinctive characteristic has been reported (Devendra, 1995; 1996). Integrated system plays important role and its important features is the involvement of resources poor small family and communities through Asia. Integrated systems are involved many things between human, animal, crops and the environment.

This system makes the full utilization of land that can produce maximum productivity. The system of integrated animal with crop production must be comprehensive by taking all components into consideration (Edwards *et al*, 1988). The models of integrated agriculture are also depended on the space, climatic condition and independent of specific species that have been uses in crops and animal. Integrating livestock and crop production in conservation of agriculture means shifting from the traditional systems focusing exclusively the livestock or crop alone to a new

approach which sustainably combines both (Paulet, 2010). A good rotation in integrated system is also a key towards production that can break up cycle of weeds, pests and diseases. Integrated system also shows the concern of people towards agricultural practices.

2.2 Integration and Sustainable Agriculture

The concept of sustainablity in agrculture has initially been focused on enviromental aspects, but now has been expanded to include socio-economic and political elements. In ecology, it has seem focused more on enviromental protection to enhance ecosystem resources and prservation of biodversity. In socio-economic aspects, it is concerned with the value and management of the resources, their enhancement, socially acceptable technology towards the farmers and cooperative organizations to improve the farmers' lives (Devendra, 2011).

Sustainable agriculture refers to an agricultural system that is ecologically sound, economically viable, and socially just. The central objective of both organic and integrated farming systems is the attainment of sustainability. These sustainable farming systems are striving to make the environment an integral part of the production process so as to give priority to issues regarding the proper use of natural resources and to offer assurances for the quality of produced foodstuffs (Thocharopoulos *et al*, 2012)

To achieve sustainability in agriculture, farmers should be aware of the short, mid and long-term consequences of management decisions. Organic agriculture is a sustainable way of farming without chemical inputs during cultivation whereas integrated farming system is a sustainable way of farming which falls somewhere in between the conventional and the organic farming system. Organic and integrated agriculture are the sustainable farming systems that have been developing noticeably during the last decade (Thocharopoulos *et al*, 2012).

2.3 Advantages of Integrated System

Integrated farming system had been proven to have some advantages in their peformance. The advantages of integrated system are:

i. Diversified and integrated use of the production resources, mainly crop and animal.
ii. Animal and crop play multi purpose roles in integrated system.
iii. The proceess are holistic, interactive, multi disciplinary and promote Natural Resources Management
iv. Crop – animal – soil interactions are varied and have socio-economic, ecological and enviroment implications.
v. Low inputs are used by traditional method.
vi. Related to demonstrable sustainability and sustainable production system.
vii. Biological control of weeds
viii. Animal can replace labour costs for weeding and can save 100% cost for weeding
ix. Chicken droppings can be used as organic fertilizer to the crops
x. Opportunities as side income to the farmer
xi. Increase family's nutritional consumption
xii. Production of meat are at level as the organic meat
xiii. Save cost on feeding the animal

2.4 Integration Practices in Asia

Asian agriculture is characterised by mixed farming activites. Farming in Malaysia is characterised by small farm system, small farmers and poor people. Mixed farming in Asia is synonymous with crop animal system, varied and integrated in varies ways. With the increasng demand for food, this type of farming is seemed likely to be important in Asia and would continue to be dominant in the region (Devendra, 2011).

2.4.1 Fish – Chicken Integration

Integrated farming systems are probably as old as farming itself if the broadest definition of integrated farming is accepted. According to this, integration occurs when outputs (usually by-products) of one production sub-system are used as inputs by another, within the farm unit. Theoreticians used to differentiate it from mixed farming, in which production subsystems of a farm are not mutually supportive and do not depend on each other (Csavas, 1991).

Figure 2.1: Fish-chicken integration
Source: (Anon, 2013).

The integrated farming of chickens and fish is only practiced in a few countries in Asia (Philippines, China, Indonesia, and Thailand). Trials of chicken integrated with fish farming have also been conducted in Africa (Central African Republic, Cote d'Ivoire, Gabon and Madagascar), in Latin America (Ecuador, Panama) and in the USA. Not all the results of these experiments have been published (Vincke, 1991).

Chicken (broilers or layers) are reared in pens beside or over the ponds. In Indonesia, in monoculture of *Puntius gonionotus* in a 400 m^2 pond integrated with 6,000 layers/ha during a culture period of 3 months, the extrapolated yield was 5.1 ton of fish/ha/year (Widayati, 2002).

2.4.2 Fish – Duck Integration

Integrated fish farming is generally considered particularly relevant to benefit the rural poor. In Asia, fish farming has been a part-time activity of peasant farmers, who developed it as an efficient means of utilizing farm resources to the maximum capacity (Vincke, 1991). As presently practiced, the combination of duck and fish farming is

considered as a means of reducing the cost of feed for ducks and a convenient and inexpensive way of fertilizing ponds for the production of fish (Pillay, 1980). In this integrated system, ponds provide living and foraging areas for the ducks and fish.

Figure 2.2: Duck-Fish integration in Hanoi, Vietnam

Source: FFTC Annual Report 2007, page 38 (2007)

The aim of integrated farming is the recycling of animal wastes (faeces, urine and spoiled feeds) to serve as fertilizers, and sometimes as food for fish raised in ponds, enclosures and cages. According to Pillay (1980), the basic principles involved in integrated farming are the utilization of the synergetic effects of inter-related farm activities, and the conservation, including the full utilization, of farm wastes. It is based on the concept that "there is no waste", and "waste is only a misplaced resource which can become a valuable material for another product.

The fish – duck integration has been practiced in classical Chinese systems and it is widely practiced within its original geographical range to China, Hong Kong, Philippines and Taiwan (Csavas, 1991).

2.5 Oil Palm Industry in Malaysia

Oil palm plantation in Malaysia is a controversial agriculture sectors in terms of nature degradation. Until the year 2012 (refers to Table 2.1), Malaysia had about 5.1 million hectare of oil palm plantation distributed in Peninsular and East Malaysia. It also consists of large plantation and small holdings (MPOB, 2013). The oil palm industry has

transformed Malaysia into a commercial powerhouse in tropical agribusiness. The industry continues to be an important pillar in the economy and remains a pivotal aspect in socio-political landscape of the country. Going forward, the industry has been identified as one of the key drivers towards achieving the national key economic aspiration. Many key challenges continue to confront the oil palm commodity industry such as rising cost of production, pest and diseases, constraints in human resource, talent management and managing socio-environmental issues (Joseph, 2012).

Table 2.1: Oil Palm Planted Area by Category as in December 2012 (Hectares)

Category	Hectares	%
Private Estates	3,126,990	61.6
FELDA	706,069	13.9
FELCRA	167,361	3.3
RISDA	78,634	1.5
GOVT./STATE AGENCIES	306,187	6.0
Independent Smallholders	691,688	13.6
MALAYSIA	**5,076,929**	**100.0**

Source: Malaysia Palm Oil Board, MPOB, (2013)

The oil palm plantation keeps widely distributed and achieving towards national economic key. When a plantation is opened, many diversity and natural habitat need to be scarified. There is some evidence that both landscape and local complexity can have positive impacts on biodiversity in the oil palm habitat. We urgently need to carry out rigorous experimental research that will establish whether maintaining diversity supports economically and ecologically important processes in oil palm, without at the same time compromising yield. By intelligent manipulation of habitat complexity, it could be possible to enhance not only the number of species that can live in oil palm plantations, but also their contribution to the healthy functioning of this exceptionally productive and widespread landscape (William *et al*, 2012).

2.5.1 Livestock Feed Resources in Oil Palm Plantation

Scavenging chickens start roaming the fields in the morning to search for feeds such as earthworms, beetles, spiders and scorpion, grasshoppers, centipedes, lizards, grass and legume seeds, berries, green leaves and others. According to Sonaiya (2004), the Scavengable Feed Resources Base (SFRB) includes:

i. Household cooking waste
ii. Cereal and cereal by-products
iii. Roots and tubers
iv. Oilseeds
v. Trees, shrubs (including *Leucaena, Calliandra* and *Sasbenia)* and fruits
vi. Animal proteins
vii. Aquatic plants (*Lemna, Azolla* and *Ipomoea aquatica*)
viii. Commercially prepared feed

The feed ingredients to oil palm chicken are whatever they get from the environment such as often offal and insects, forage, weeds, insect, earth worm, fruit from oil palm, insect and others in the oil palm plantation (Pandey et al. 1992).

2.6 Chicken-Oil Palm Integration in Peninsular Malaysia

In Peninsular Malaysia, the Malaysia Palm Oil Board (MPOB) has been running the chicken – oil palm integration since 2003. In this integration system, free ranged chicken or village chicken has been used to be integrated with oil palm plantation. The village poultry would probably enjoy more freedom of movement. They are owned by individual households and maintained under a scavenging system, with little or no inputs for housing, feeding and health care. Therefore, the concept of free range chickens integrated with oil palm has been recommended.

Such a project has been proven suitable for mature oil palm above five years old, where the excessive undergrowth cover in oil palm area had been cleared and the locations for the construction of coops were marked. Paddocks and fencing were strategically constructed. Strong and cheap materials had been choosen for fencing.

REFERENCES

Anonymous. 2001. Department for Environment, Food and Rural Affairs, The Welfare of Hen In Free-Range Systems. London. pp: 16-18

Anonymous. 2007. FFTC Annual Report 2007, page 38

Anonymous. 2013. Poultry – Fish Culture. Kerala Agricultural University Agri – InfoTech.... http://www.celkau.in/Fisheries/CultureFisheries/Intergrated%20Fish%20Farming/poultry_fish_sys.aspx. Acces on 28 April 2013.

AOAC, 1990. Official Methods of Analysis. 15thedn. Association of Official Analytical Chemists, Washington. ARC, 1975. Agricultural Research Council of the United Kingdom. Cited by W. Bolton and R. Blair in Poultry Nutrition. 4th improvement,

Awaludin R. 2003. Integration of Free Range Chickens with Oil Palm. MPOB Information Series No **181**

Ayob M.A., Haji Kabul M.A., 2009. *Cattle Integration in Oil Palm Plantation through Systematic Management.* The 1st International Seminar on Animal Industry 2009, Faculty of Animal Science, Bogor Agricultural University. pp: 66-73.

Csavas I. 1991. Regional Review on Livestock Production System in Asia. FAO/IPT Workshop on Integrated Livestock-Fish Production Systems (1991 Kuala Lumpur)*Integrated Livestock-Fish Production Systems* : proceedings of the FAO/IPT Workshop on Integrated Livestock-Fish Production Systems

Devendra C. 2011. Invited Review-Integrated Tree Crops-ruminants Systems in South East Asia: Advances in Productivity Enhancement and Environmental Sustainability. Asian-Aust. J. Anim. Sci. Vol. 24, No. **5** : 587 – 602

Devendra, C. 1995. Mixed farming and intensification of animal production systems in Asia. Proc. ILRI/FAO Roundtable on livestock development in low income countries, (Ed. R. T.Wilson, S. Ehui and S. Mack) International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia, pp. 133-144.

Devendra, C. 1996. Overview of integrated animals-crops-fish production systems: achievements and future potential. Proc. Symp. on Integrated systems of animal production in the Asian region, Tokyo, Japan. (Ed. H. Hayakawa, M. Sasaki and K. Kimura). FAO, Rome. Italy, pp. 9-22.

Edwards P., Pullin R. S. V. and Gartner J. A.. 1988. Research and education for the development of crop-livestock-fish farming systems in the tropics. ICLARM Studies and Reviews *No.* **16**:53.

Edwards, P. 1983. The future potential of integrated farming systems in Asia. Proc. V World. Conf. Anim. Prod., Vol. **1**: 273–281.

Elini E., Serin T., Sukir S., Ali A. K. 2010 *Kos dan Pulangan Bagi Penternakan Ayam Kampung,* Economic and Technology Management Review, Vol. **5** pp: 41-49

George A. 2007. NSW Biosecurity Guidelines For Free-Range Poultry Farm. New South Wales. pp: 2-6

Google Maps 2013. Sukau Kota Kinabatangan Malaysia. https://maps.google.com/ . Access on 30 April 2013.

Lampkin N. 1997. Organic Poultry Production: Final Report to MAFF

Moreki J.C, 2006. POU0601 Family Poultry Production. Poultry Section, Animal Production Division, Department of Animal Production, Botswana. pp. 1-11

MPOB (Malaysian Palm Oil Board). 2013. Malaysian oil palm statistic 2009, 26 Edn. (Mimeograph), Economic and Statistic Development Division, Bangi, Selangor, Malaysia

Mukherjee, J.K., ed. 1992 *Integrated livestock-fish production systems.* Proceeding of an FAO/IPT workshop on integrated livestock-fish production system, 16-20 Dec 1991, Institute of Advanced Studies, Universiti Malaysia, Kuala Lumpur, 148.

Neale P.,Thapa S., Boyce C. 2006. Preparing A Case Study: A guide for Designing and Conducting a Case Study for Evaluation Input. USA. pp: 9-10

Neufeld L. 2002. *Consumer Preferences for Organic/ Free Range Chicken.* Master Thesis, Department Agricultural Economics, Kansas State University. United State, pp: 1-23

Pandey V S, Demey F and Verhulst A. 1992. Parasitic diseases: A neglected problem in village poultry in Sub-Saharan Africa. In V S Pandey and F Demey (eds.). *Village poultry production in Africa.* Rabat Morocco, 136–141.

Paulet R. 2010. The Integration of Livestock and Cropping in High Rainfall Zone. Nuffield Australian Project No **1004**, Australia pp. 11-34

Pillay, T.V.R., 1980. Aquaculture. Principles and Practices. Fishing News Books, London. pp: 92-110.

Raman S. 2006. Agricultural Sustainability – Principles, Processes and Prospects. Food Products Press, New York.

Sonalya E. B., Swan S. E. J. 2004. FAO Small-Scale Poultry Production Technical Guide, Rome. pp: 23-27

Susanto K.and Widayati R. 2002. Memelihara Ikan Bersama Ayam-Cetakan **20**-Jakarta

Theocharopoulos A., Aggelopoulos S., Papanagiotou P., Melfou K. and Papanagiotou E. 2012. Sustainable Development-Education, Business and Management-*Architecture and Building Construction-Agriculture and Food Security* No. **249**: 249-271

Vincke M.M.J. 1991. Integrated Farming of Fish and Livestock: Present Status and Future Development. FAO/IPT Workshop on Integrated Livestock-Fish Production Systems (1991 Kuala Lumpur) *Integrated Livestock-Fish Production Systems* : proceedings of the FAO/IPT Workshop on Integrated Livestock-Fish Production Systems

Vries, H. de; (2000). Observations On Behaviour And Feed Intake Of Chickens Kept On Free Range In Muy Muy, Nicaragua. Data presented on a poster on the World Poultry Congress of Montreal, 2000

William A.F., Edgar C.T., and Jake L.S. 2012. Maintaining Biodiversity and Ecosystem Function in the Landscape of South east Asia. Journal of Oil Palm and The Enviroment 2012, **3**:58

World Weather Online. 2013. Sukau Monthly Climate Average, Malaysia http://www.worldweatheronline.com/Sukau-weather-averages/Sabah/MY.aspx Access on 3 December 2013.