



UNIVERSITI PUTRA MALAYSIA

***EFFECTS OF IMPLEMENTING FEEDING, BREEDING AND A HERD
HEALTH PROGRAM ON THE PERFORMANCE OF BOER GOAT
BREEDING FARM IN SABAH***

MOHD SHAHROM BIN SALISI

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**DOCTOR OF PHILOSOPHY
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By

MOHD SHAHROM BIN SALISI

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EFFECTS OF IMPLEMENTING FEEDING, BREEDING AND A HERD HEALTH PROGRAM ON THE PERFORMANCE OF BOER GOAT FARM IN SABAH

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MOHD SHAHROM BIN SALISI

December 2011

Chairman: Professor Mohd Zamri Saad, DVM, PhD

Faculty: Veterinary Medicine

The ruminant sector in Malaysia contributed 9% of the ex-farm value and the goat industry is relatively small in Malaysia, with approximately 247,000 – 350,000 heads mainly by smallholders. Currently, the goat industry supplies only 8% of the local demand for chevron. Therefore, Malaysia is spending approximately RM5.8 million (USD1.7 million) annually to import livestock products to fulfil the demand. In trying to reduce the bill for importation of livestock products, the Malaysian government decided in 2005 to enhance the livestock industry, particularly the cattle and goat industries. The first step toward enhancing these industries is to increase the cattle and goat populations to approximately 1 million head by 2010 through a breeding program respectively. Thus, importation of goats from various goat-producing countries, particularly from Australia to increase the number of breeders, particularly Boer goats had been initiated since 2006.

Culling and mortality are important factors that determine the success of a livestock farm. Losses from mortality and culling were at the rate of 36.6% and 14.5%, respectively while the causes of goat morbidity and mortality are usually related to the mismanagement. Therefore, a herd health program is extremely important to improve management. This study formulates, implement and evaluate a herd health program, which include feeding regimen, disease control and breeding protocol on the performance of a Boer goat farm in Sabah. Feeding regimen included feeding of an average of 2kg of cut grass/goat/day and supplemented with goat pellet at 300g, 400g and 500g/goat/day for maintenance, growth and pregnant and lactating goats, respectively. The disease control included brucellosis, mannhemiosis, haemonchosis, colibacillosis and coccidiosis while breeding program involved introduction of bucks at appropriate time.

The average monthly mortality in 2005 was significantly ($p < 0.05$) higher (10.1%) compared to that in 2006, 2007 and 2008 which was 3.8%, 3.9% and 2.5% respectively. It was found that implementation of herd health program significantly ($p < 0.05$) increased the average body weight gains in both adults and kids from 1.8g per kids and 0.6g per adults in 2006 to 3.7g per kids and 2.2g per adults in 2008. The percentage of adults with body scoring of < 3 was significantly ($p < 0.05$) reduced from 82.3% in 2006 to 77.6% in 2007 and 4% in 2008. Similarly, the annual mortality rate was significantly ($p < 0.05$) reduced from 6.5% among kids and 58.2% among adults in 2006 to 12.1% among kids and 10.4% among adults in 2007, and to 9.1% among kids and 1.1% among adults in 2008. Therefore, it was concluded that implementation of herd health program significantly improved the survival and performance of goats.

Following implementation of new feed and feeding regimen, there were significant ($p < 0.05$) improvement in the body score of breeder females. There was consistently significant ($p < 0.05$) yearly increase in the percentage of females with body score of >3 from prior to implementation (56% and 73% in 2006 and 2007, respectively) and post-implementation (81%, 98% and 99% in 2008, 2009 and 2010, respectively). Following implementation of the new feeding regimen, the average birth weight had shown significant ($p < 0.05$) improvements to 3.25 kg in 2008, 3.32 kg in 2009 and 3.43 kg in 2010. Prior to the implementation, average birth weights were only 2.93 kg in 2006 and 2.91 kg in 2007.

Similarly, following implementation of breeding program in January 2008, there was general improvement of pregnancy rate among Boer goats in the farm. The pregnancy rate in (the treated group) had significantly ($p < 0.05$) increased to 48%, 75% and 86% in 2008, 2009 and 2010, respectively compared during pre-implementation (control group) with 14% pregnancy rate of and 32% in 2006 and 2007, respectively. The farm had successfully managed to achieve the targeted pregnancy rate of more than 80% in year 2010. The kidding rate had significantly ($p < 0.01$) improved to 145% in 2008 and 2009 and 153% in 2010. This indicate that in 2008 and 2009, a breeder doe produced an average of 1.45 kids while an average of 1.53 kids was produced by a doe in 2010. During the pre-implementation period (control group), kidding rates were only 121% in 2006 and 122% in 2007 and had achieved 150% or 1.5 kidding rate in 2010, 2 years after the implementation of breeding program (control group).

There was an increasing pattern of annual expenditure and income in the 5-year study period of 2006 to 2010. The annual expenditure and income patterns led to an increasing pattern of the annual gross income with decreasing losses and eventually showed profit in 2010. Prior to the implementation of the herd health program, the total expenditure in 2006 was significantly ($p < 0.05$) lower than post-implementation periods of 2008, 2009 and 2010. This was mainly due to the significant ($p < 0.05$) increase in the operational costs following implementation of disease control, feeding regime and breeding programs. The capital, mainly associated with buying of new breeders, was significantly ($p < 0.05$) increased in 2008 but remained low once the breeders were stabilized. Following implementation of herd health program, however, the income showed significant ($p < 0.05$) increase from 2008 and remained high until the end of study period in 2010. The main source of the income remained the sale of goats, particularly post-implementation period between 2008 and 2010.

In conclusion, the implementation of feeding, herd health and breeding programs in this study has provided significant positive impact on livestock performance such as reducing the average monthly and annual mortality of livestock, increasing the average weight gain of the animal, increasing the percentage of adults with body score > 3 , pregnancy rates and birth rates of livestock. Although expenses (operating costs) is increasing but the gross profit through the sale of livestock and the reduction of livestock death losses in this farm has been achieved following the execution of all programs undertaken in this study.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

**KESAN MELAKSANA PROGRAM PEMAKANAN, PEMBIAKBAKAAN
DAN KESIHATAN GEROMPOK KE ATAS PRESTASI SEBUAH LADANG
KAMBING BOER DI SABAH**

Oleh

MOHD SHAHROM BIN SALISI

Disember 2011

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Sektor ruminan di Malaysia menyumbang sebanyak 9% nilai ladang. Ini adalah kerana industri kambing di Malaysia agak kecil dengan kira-kira 247,000 – 350,000 ekor kambing yang dipelihara oleh penternak kecil. Kini, industri kambing membekal cuma 8% daripada permintaan daging kambing tempatan. Oleh itu, Malaysia membelanjakan kira-kira RM5.8 juta (USD1.7 juta) setahun untuk mengimport hasil ternakan bagi memenuhi permintaan. Dalam usaha untuk mengurangkan pengimportan hasil ternakan, kerajaan Malaysia memutuskan dalam tahun 2005 untuk membangunkan industri ternakan, terutama industri lembu dan kambing. Oleh itu, langkah pertama ke arah pembangunan industri ini adalah dengan meningkatkan populasi lembu dan kambing sehingga mencapai bilangan 1 juta ekor menjelang tahun 2010 melalui program pembiak-bakaan. Maka, pengimportan kambing ke arah mempertingkatkan jumlah pembiak, terutama

kambing Boer bermula pada tahun 2006 yang melibatkan pengimportan dari Negara pengeluar kambing, terutama sekali dari Australia.

Namun, penakaian dan kematian merupakan faktor utama yang menentukan kejayaan sesuatu ladang ternakan. Kerugian disebabkan oleh kematian dan takai masing-masing adalah disekitar 36.6% dan 14.5%. Malah, kadar kambing yang sakit dan mati adalah berkait rapat dengan sistem pengurusan. Oleh itu, program kesihatan gerompok dilihat amat penting untuk memperbaiki pengurusan dan meningkat keuntungan. Kajian ini merangka, melaksana dan menilai program kesihatan gerompok, yang termasuk regim pemakanan, kawalan penyakit dan protokol pembiakan, ke atas prestasi sebuah ladang kambing Boer di Sabah. Regim pemakanan melibatkan pemberian purata 2kg rumput/kambing/hari dan ditambah dengan pemberian palet kambing pada kadar 300g, 400g dan 500g/kambing/hari bagi kambing peringkat asas, membesar, bunting dan menyusui. Kawalan penyakit melibatkan penyakit bruselosis, mannhemiosis, haemonkosis, kolibasiosis dan koksidiosis sementara program pembiakan melibatkan penggunaan pejantan pada waktu tertentu untuk pembiakan.

Perlaksanaan program kesihatan gerompok pada September 2007 menurunkan purata kematian bulanan kepada 2.5% pada tahun 2008 berbanding 10.1% pada tahun 2005, 3.8% pada 2006, 3.9% pada 2007, sebelum perlaksanaan. Perlaksanaan juga meningkatkan purata kenaikan berat badan kambing daripada sebanyak 1.8g bagi anak dan 0.6g bagi dewasa pada tahun 2006 kepada 3.7g bagi anak dan 2.2g bagi dewasa dalam tahun 2008. Peratusan kambing dewasa dengan skor badan <3 adalah berkurangan daripada 82.3% tahun 2006 kepada 77.6% tahun 2007 dan 4%

tahun 2008. Begitu juga dengan kadar kematian tahunan yang turut menurun daripada 6.5% dikalangan anak dan 58.2% di kalangan dewasa dalam tahun 2006 kepada 12.1% dan 10.4% dalam tahun 2007, dan kepada 9.1% dan 1.1% dalam tahun 2008. Oleh itu, adalah dirumuskan bahawa pelaksanaan program kesihatan gerompok telah memperbaiki kehidupan dan prestasi kambing.

Dengan melaksanakan regim pemakanan yang baharu, terdapat penambah-baikkan ketara pada skor badan pembiakan betina. Terdapat peningkatan yang konsisten dalam peratusan tahunan pembiak betina dengan skor badan >3 berbanding sebelum pelaksanaan (56% dan 73% tahun 2006 dan 2007) dan selepas pelaksanaan (81%, 98% dan 99% dalam tahun 2008, 2009 dan 2010). Dengan pelaksanaan regim pemakanan baharu, purata berat badan menunjukkan peningkatan ke 3.25 kg dalam tahun 2008, 3.32 kg dalam tahun 2009 dan 3.43 kg dalam tahun 2010. Sebelum pelaksanaan, purata berat badan adalah 2.93 kg dalam tahun 2006 dan 2.91 kg dalam tahun 2007.

Begitu juga, selepas pelaksanaan program pembiakan pada Januari 2008, terdapat peningkatan menyeluruh pada kadar kebuntingan kambing Boer. Kadar kebuntingan telah meningkat selepas pelaksanaan program pembiakan kepada 48%, 75% dan 86% dalam tahun 2008, 2009 dan 2010 berbanding jangkamasa sebelum pelaksanaan pada kadar 14% dan 32% dalam tahun 2006 dan 2007. Walau bagaimanapun, ladang cuma berjaya mencapai kadar kebuntingan yang disasarkan sebanyak 80% pada tahun 2010. Kadar beranak juga meningkat kepada 145% dalam tahun 2008 dan 2009 dan 153% dalam tahun 2010. Ini bermaksud yang tahun 2008 dan 2009, seekor pembiak betina menghasilkan purata 1.45 anak kambing

sementara purata 1.53 anak kambing dihasilkan oleh seekor pembiak betina pada tahun 2010. Sebelum pelaksanaan, kadar beranak adalah 121% tahun 2006 dan 122% tahun 2007 dan mencapai 150% atau 1.5 kadar beranak dalam tahun 2010, 2 tahun selepas pelaksanaan program pembiakan.

Terdapat peningkatan dalam corak perbelanjaan dan pendapatan tahunan dalam jangkamasa 5 tahun kajian dari 2006 ke 2010. Perbelanjaan tahunan dan corak pendapatan menunjukkan peningkatan ke atas pendapatan kasar tahunan dengan kadar kerugian yang kurang sebelum menunjukkan keuntungan dalam tahun 2010. Sebelum pelaksanaan program kesihatan gerompok, jumlah perbelanjaan tahun 2006 adalah lebih rendah daripada jangkamasa selepas pelaksanaan tahun 2008, 2009 dan 2010. Ini adalah disebabkan oleh peningkatan kos operasi selepas pelaksanaan program kawalan penyakit, regim pemakanan dan program pembiakan. Modal yang lazimnya berkaitan dengan pembelian pembiak baharu turut meningkat dalam tahun 2008 tetapi menjadi rendah apabila kambing pembiak mulai stabil. Walau bagaimanapun, pelaksanaan program kesihatan gerompok meningkatkan jumlah pendapatan sejak tahun 2008 dan kekal tinggi sehingga ke akhir jangkamasa kajian. Punca utama pendapatan masih lagi melalui penjualan kambing, terutama jangkamasa selepas pelaksanaan di antara 2008 dan 2010.

Kesimpulannya, pelaksanaan program pemakanan, pembiakbakaan dan kesihatan gerompok terhadap ladang kambing Boer di dalam kajian ini telah memberikan kesan positif yang begitu ketara terhadap peningkatan prestasi ternakan yang merangkumi penurunan purata kematian bulanan dan tahunan ternakan,

peningkatan purata kenaikan berat badan kambing dan peratusan kambing dewasa dengan skor badan > 3, peningkatan menyeluruh pada kadar kebuntingan dan kadar beranak ternakan. Walaupun perbelanjaan (kos operasi) adalah meningkat namun keuntungan kasar melalui penjualan ternakan dan pengurangan kerugian akibat kematian ternakan telah berjaya diperolehi ladang ini selepas pelaksanaan kesemua program yang dijalankan di dalam kajian ini.



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I certify that a Thesis Examination Committee has met on 19th December 2011 to conduct the final examination of Mohd Shahrom bin Salisi on his thesis entitle “Effects of implementing feeding, breeding and a herd health program on the performance of Boer goat breeding farm in Sabah.” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The Committee recommends that the student be awarded the degree of Doctor of Philosophy.

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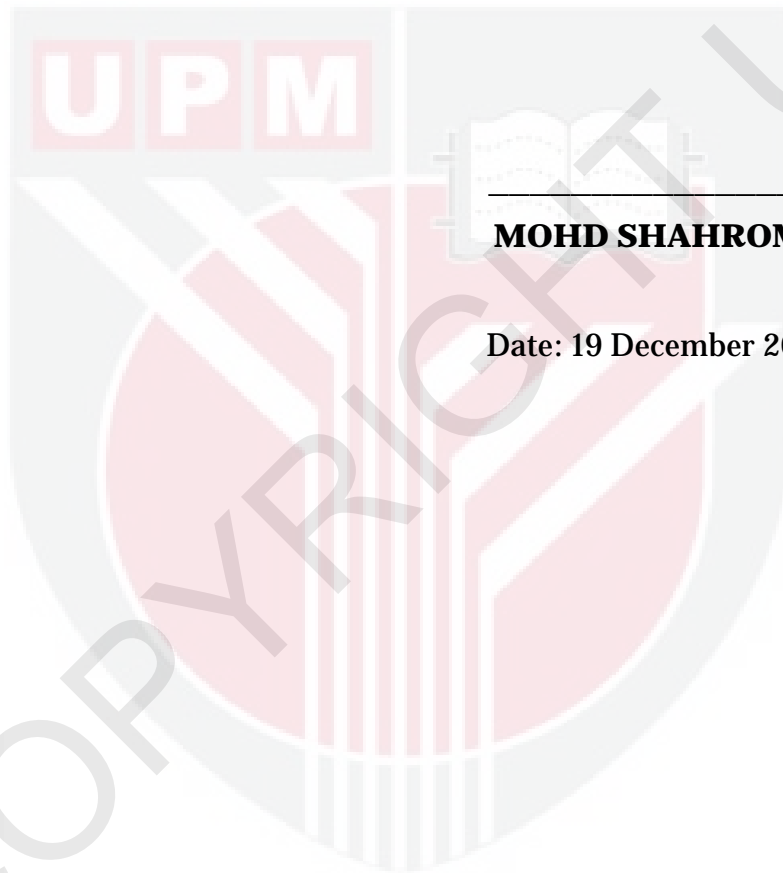
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DECLARATION

I declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



MOHD SHAHROM BIN SALISI

Date: 19 December 2011

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LIST OF ABBREVIATIONS

%	Percentage
β	Beta
λ	Lambda
°C	degree celcius
μg	microgram
μl	microliter
μm	micronmeter
μM	micromolar
BHI	brain heart infusion
BSA	bovine serum albumin
cfu	colony forming unit
DDT	dithiothreitol
DMSO	dimethylsulfoxide
<i>E. coli</i>	<i>Escherichia coli</i>
EDTA	Ethylene-diamine-tetraacetic acid (disodium salt)
ELISA	enzyme linked immunosorbent assay
G	gram
H ₂ O	water
i.e.	in example
IgA	immunoglobulin A
IgG	immunoglobulin G
<i>in vitro</i>	in an experimental situation outside the organism..
<i>in vivo</i>	in a living cell or organism
L	liter
mg	miligram
Min	minutes
ml	milliliter
mm	milimeter
NaH ₂ PO ₄	sodium di-hydrogen peroxide
NaOH	sodium hydrogen peroxide
OD	optical density
OMP	outer membrane protein
PBS	phosphate buffer saline
PCR	polymerase chain reaction
pH	puissance hydrogen (Hydrogen-ion concentration)
<i>P. multocida</i>	<i>Pasteurella multocida</i>
rpm	rotation per minute
U	unit
UV	ultra-violet

CHAPTER 1

INTRODUCTION

In the last decade, livestock industry in Malaysia has grown significantly at an average of 5.4% annually (Aziz et al., 2011). In 2010, the livestock industry produced RM11.26 billion of total ex-farm value of livestock products with RM1.04 billion from beef, mutton and milk. With the consumption of livestock products in Malaysia showing a steady increase which accompanies the rapid growth of the economy and rising household income, the self-sufficiency for ruminant products remained below 30%. Therefore, Malaysia relies heavily on the importation of live animals, beef, mutton and dairy products to meet the demand for domestic consumption, valued at RM6.61 billion in 2009. The major import items include dairy products (65.7%), meat and meat products (31.2%) and live animals for slaughter and breeding (3.1%) with importation of animal feed ingredients valued at RM5.3 billion (Aziz et al., 2011).

Although the ruminant sector in Malaysia contributed 9% of the ex-farm value, the goat industry is relatively small in Malaysia, with approximately 247,000 – 350,000 head that are kept mainly by smallholders. Currently, the goat industry supplies only 8% of the local demand for chevron (Aziz, 2007). Therefore, Malaysia is spending approximately RM5.8 million (USD1.7 million) annually to import livestock products to fulfil the demand (Aziz, 2007). In trying to reduce the bill for importation of livestock products, the Malaysian government had

decided in 2005 to enhance the livestock industry, particularly the cattle and goat industries. The first step toward enhancing the industry is to increase the cattle and goat populations to approximately 1 million head each by 2010 through breeding programs (Ibrahim et al., 2006). Thus, importation of goats to increase the number of breeders, particularly Boer goats was started in 2006 from various goat-producing countries, particularly from Australia. Nevertheless, Malaysia has traditionally been an important live export market for the Australian goat industry but 90% of the goats exported to Malaysia were destined for slaughter.

Although the livestock industry, particularly ruminants has indicated positive growth, it has not reached its real potential since technical parameters such as breeding performance, growth rate, feed conversion and losses due to disease and mortalities have not shown much improvement (Aziz et al., 2011). Regardless to the fact that the livestock industry has evolved in the past decades through innovations in products, technology, systems, methods, models, processes and services, the majority of ruminant livestock owners are still practicing traditional farming, owning small herds with low input and minimal technology application. Meanwhile, research activities have developed methods and technologies, but major concern on animal nutrition, breeding, disease control and husbandry that directly affect production and profitability has not been properly understood by the farmers and entrepreneurs (Aziz et al., 2011). Therefore, the gap between traditional livestock farming and successful modern practices remains huge and needs rectification through research and innovation. Therefore, a paradigm shift

in the agricultural setting and technology transfer to target groups need to be enhanced (Azizan et al., 2011).

This study was conducted with a general hypothesis that implementing a proper herd health program that includes a feeding regime, disease control and breeding protocol will produce a positive impact on the performance of Boer goats kept under a semi-intensive system. The general objective of this study was to determine the effects of implementing a newly formulated feeding regimen (Chapter 3), herd health and breeding protocol on the performance of Boer goat farm. Therefore, the specific objectives of this study were:

1. To determine the impact of new feeding regimen on the performance of Boer goats
2. To access the implementation of herd health program on the general health status of Boer goats
3. To evaluate the use of a breeding protocol on reproductive performance of Boer goats
4. To calculate the financial impact of herd health implementation in a Boer goat farm

The limitations of this study were:

1. This study was carried out in a commercial Boer goat breeder farm that had experienced difficulties, particularly the high mortality in the few years of operation and assessment of the farm had revealed several main

problems particularly the feeding regime, disease control and breeding protocol. Suggestions of complete herd a health protocol were presented for implementation that should be followed up by monitoring, which were agreed upon by the farm.

2. The farm requested that implementation of herd health and monitoring must involve all animals in the farm and refused to have control unimplemented group for fear of further losses.
3. Therefore, it was agreed that this study used the performance of unimplemented period of 2006 to 2007 as control group, whereas the implemented period of 2008 to 2010 as treated group.
4. It was understood that the study looked at the performance of the whole herd/farm rather than the conventional performance of certain group, which was more practical-oriented than experimental oriented.
5. The farm performance during the study periods may not be influenced only by the implemented herd health protocol since this uncontrolled study allowed other factors to play a role.
6. Although we believed that the implemented herd health protocol gave the most significant impact to the farm performance, other factors, such as weather and farm management also played a minor role in the overall farm performances during the study period.

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