UNIVERSITI PUTRA MALAYSIA

EVALUATION OF MILK PRODUCTION IN MURRAH BUFFALO COWS UNDER DIFFERENT FARM MANAGEMENT SYSTEM

NUR SYAHIRAH ZAINUDDIN

EVALUATION OF MILK PRODUCTION IN MURRAH BUFFALO COWS UNDER DIFFERENT FARM MANAGEMENT SYSTEM

NUR SYAHIRAH ZAINUDDIN

A project paper submitted to
Faculty of Veterinary Medicine, Universiti Putra Malaysia
In partial fulfilment of the requirement for the
DEGREE OF DOCTOR OF VETERINARY MEDICINE
Universiti Putra Malaysia
Serdang, Selangor Darul Ehsan.

MARCH, 2017

It is hereby certified that we have read this project paper entitled "Evaluation of milk production in murrah buffalo cows under different farm management system", by Nur Syahirah bt Zainuddin and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfilment of the requirement for the course VPD 4999 – Final Year Project.

_____

DR. NURHUSIEN YIMER

DVM (AAU), PHD (UPM),

Lecturer,

Faculty of Veterinary Medicine

Universiti Putra Malaysia

(Supervisor)

_____

PROF. DR. ABDUL WAHID HARON

DVM(UPM), PHD (UCD),

Lecturer,

Faculty of Veterinary Medicine

Universiti Putra Malaysia

(Co-supervisor)

ACKNOWLEDGEMENT

I would like to acknowledge first and foremost my supervisor, Dr.Nurhusien Yimer Degu for his knowledge and guidance, his patience and time throughout the completion of the project.

Thank you to my co-supervisor Prof.Dr. Abdul Wahid Haron for his knowledge and guidance which had helped me throughout the preparation of this project.

Thank you to all the five farmers and farm managers for their full cooperation and warm welcome throughout data collection and conducting this project.

Thank you to my family for being my strong hold and the one who had always supported me endlessly and encouraging me with endless love and care. Thank you as well for the motivation and warm prayers that kept me going in completing this project.

Lastly, thank you to my best of friends Nurin, Shaza, Fauzi, Huqmah, Nabil, Anggun, Naqib, AtiqahLi, Atirah, Melissa Yeow and DVM2017 for sharing this sweet journey and making this a fulfilling and unforgettable one.

CONTENTS

LIST OF TABLES Page

LIST OF FIGURES Page

ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999 – Projek Ilmiah Tahun Akhir

PENILAIAN PENGELUARAN SUSU LEMBU KERBAU MURRAH DI BAWAH SISTEM PENGURUSAN LADANG YANG BERBEZA

Oleh

Nur Syahirah Zainuddin

2017

Penyelia: Dr.Nurhusien Yimer Degu

Penyelia bersama: Professor Dr.Abd Wahid Haron

Kajian ini bertujuan untuk membandingkan hasil susu lembu kerbau yang diternak di bawah pengurusan yang baik (GM) dan di bawah pengurusan yang kurang baik (PM). Pengurusan ladang ini telah dinilai mengikut garis panduan standard pengurusan cekap pengeluaran kerbau tenusu (Thomas, 2008). Sejumlah lima (5) buah 'Ladang Angkat' Universiti Putra Malaysia telah dipilih: GM ladang terletak di Mukim Ulu Melaka, Langkawi dan Sungai Tangkas, Kajang manakala ladang-ladang PM terletak di Kuah Langkawi, Taman Sri Jelok Kajang dan Sungai Batangsi Semenyih. Sejumlah 30 dan 49 haiwan telah dipilih dari

ladang PM dan GM masing-masing dan jumlah hasil susu ke seluruh ladang telah direkod selama 3 hingga 5 hari berturut-turut. Rekod data lepas sehingga 3 bulan (sejak November 2016) juga diambil dari setiap ladang untuk menilai konsistensi hasil susu. Petani telah ditemuduga untuk mendapatkan maklumat berkaitan ladang mengenai prestasi reproduktif dan masalah kesihatan. Mastitis klinikal telah dinilai berdasarkan pemeriksaan kantung susu dan keabnormalan susu. Keputusan mendapati bahawa purata hasil susu harian lembu dari ladang GM 6.319 liter (sisihan piawai, SD = 1.2) dan dari ladang PM 4.421 liter (SD = 2.4), di mana hasil susu purata perbezaan adalah signifikan secara statistik (nilai t = 7.908, df = 229, $p < 0.05$). Masalah pembiakan klinikal telah dikenal pasti bagi kedua-dua ladang dan ianya didapati sama rata ($p > 0.05$). Kajian ini secara umumnya menunjukkan bahawa kerbau tenusu di ladang GM boleh mengeluarkan susu lebih baik berbanding dengan kerbau tenusu dari ladang PM.

Kata kunci: kerbau tenusu, hasil susu, prestasi pembiakan, mastitis

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfilment of the course VPD 4999 – Final Year Project.

EVALUATION OF MILK PRODUCTION IN MURRAH BUFFALO COWS UNDER DIFFERENT FARM MANAGEMENT SYSTEM

By

Nur Syahirah Zainuddin

2017

Supervisor: Dr.NurhusienYimer Degu

Co-supervisor: Professor Dr.Abd Wahid Haron

This aim of this study is to compare the milk yield of buffalo cows kept under good management (GM) practice and poor management (PM) practice. The management of the farm were assessed according to standard management guidelines for efficient dairy buffalo production (Thomas, 2008). A number of five (5) 'Ladang Angkat' Universiti Putra Malaysia farms were selected: GM farms were located in Mukim Ulu Melaka, Langkawi and Sungai Tangkas, Kajang whereas the PM farms were in Kuah Langkawi, Taman Sri Jelok Kajang and Sungai Batangsi Semenyih. A total number of 30 and 49 animals were selected from PM and GM farms respectively and the milk yield for the entire farm were recorded for 3 to 5 days

consecutively. Past records data of up to 3 months (since November 2016) were also taken from every farm to evaluate the consistency of milk yield. Farmers were interviewed for farm information on reproductive performance and health problems. Clinical mastitis was assessed based on udder and milk abnormalities. The results revealed that the average daily milk yield of cows from GM farm was 6.319 litres (standard deviation, SD=1.2) and cows from PM farm was 4.421 litres (SD=2.4), of which the difference average milk yield was statistically significant (t-value=7.908,df=229,$p<0.05$). The identified clinical reproductive problems for both farms were similar ($p>0.05$). This study generally suggests that buffalo cows in GM farm may perform better compared to cows from PM farm.

Keywords: Dairy buffalo, milk yield, reproductive performance, mastitis

1.0 INTRODUCTION

World milk production has doubled since the last few decades and in the last few years, it is noticeable that buffalo have supplied about 12% of the total world milk production (FAO, 2004).A study was carried out to evaluate the milk production in murrah buffalo cows under different farm management system; good management and poor management system. The guidelines of the farm management system are based on DeLaval (2008) and Nur Diyana (2015). Murrah buffalo is a domesticated Indian buffalo that can be found throughout Asia, India, Pakistan, Bulgaria, Mediterranian, Caucasia, Egypt and Nepal. Mostly, Murrah breed and Murrah cross breed are the chosen river type buffalo for milk production purpose in a farm. The adult male body weight is 450 – 800 kg while adult female weight is 350 – 700 kg (Smith, 1928). The average lactation duration of Murrah cow is 305 days with milk yield of 1800kg/lactation (FAO, 2005). Combination of various aspects of dairy buffalo management together for instance on nutrition, breeding, milking and improved housing, overall has been known to produce outstanding improvements in buffalo productivity (Sastry and Tripathi, 1988). Better animal welfare will be reflected in the normal behavioral activities and milk production.

However, according to Wahid (2011), due to limitations of feed resources, it is quite challenging to provide good feed and feeding as a requirement of buffalo husbandry. But with an improved management and proper breeding, the milk yield of a buffalo cow can be improved from 1500 to 5000 litre per lactation. Due to the fact that buffalo are more sensitive

to heat or surrounding temperature than cattle and the fact that buffalo has lower body temperature than cattle (38˚ and 38.6 ˚ respectively), thus the tendency for buffaloes to become heat stress is higher (ASPAC, 1975). Buffalo will seek water to immerse its body as a means of reducing the heat load (Mahadevan, 1992). Heat causes stress that lead to malnutrition due to lack of eating thus will overall decrease the milk yield. Thus, countering the heat problem is very crucial in a dairy buffalo management system in order to obtain higher milk yield.

This study aimed to compare the milk yield, selected reproductive performance indicators (i.e. age at first calving, calving interval and number of parity) and health problems such as clinical reproductive problems (i.e. prolapse, abortion, dystocia and repeat breeders) and clinical mastitis of buffalo cows kept under good management practice and poor management practice.

2.0 LITERATURE REVIEW

2.1 Buffalo farm management

There are a number of important herd management factors that should be considered in order to improve milk production in buffalo. The factors include nutritional management of the dam around calving, both pre- and post-partum hygiene, balanced ration of feed for every cows throughout the year, good milking management, detection of oestrus , breeding management either through natural mating or artificial insemination, improved housing and heat stress management. There was a study on production performances of Murrah buffalo in a tied up housing and loose housing and the result proved that loose housing was more profitable with increased in milk yield (Jagatjit et al., 1993). The animals should be protected from the hot and humid temperature in places like Malaysia. An earlier study reported that higher in conception rate of 80% was obtained from buffalo cows when they were showered regularly and provided with wallowing facilities (Raizada et al., 1972).

Guidelines to be considered as part of good management practice in buffalo farming were described by DeLaval (2008) which include (1) feeding, watering and milking placed at shaded area, (2) wallowing facilities provided and cleaning is done regularly, (3) shades are provided for the buffalo to avoid heat stress, (4) no walls provided to allow adequate ventilation, (5) showering of the buffalo at least for 3 minutes, twice a day, (6) partitions are

provided to avoid trampling, injuries and fighting and (7) drinking water is provided in shaded area near the wallowing area. Another criterion to be considered is the type of flooring. According to Nur Diyana (2015), the usage of rubber flooring in dairy farms instead of cemented floor can be beneficial to the buffalo as well as the farmer as this improves milk yield while decreasing the number health complications such as lameness and clinical mastitis. These 8 criteria were used as guideline in evaluating the farm management and classifying it as good or poor.

The increasing demand for buffalo milk have encouraged buffalo farmers to increase buffalo milk production through the improvement of management and feeding conditions (FAO, 2004). This statement has clearly shown that by improving the farm management and the feeding regime, the milk production of buffalo can be significantly increased. The average milk production of milk recorded buffaloes for the normal lactation is over 2 100 kg milk and in a good management farm, the number can go up to 5000 kg (ANASB, 2003). According to Di Palo (2002), the improvement in buffalo milk production is mainly due to new feeding system, changed in diets and rearing conditions and selective breeding.

2.2 Impact of nutrition and climate on reproductive performance

Studies have proven that manipulation of nutritional and environmental factors could reduce the age of first calving and calving interval in buffaloes (Qureshi *et al.*, 2002; Drost, 2007). According to Zicarelli (2006), delayed age at first calving is not a distinguishing character

of a species, it is however highly dependable on the nutritional management of the growing animals. This problem could be reduced if the buffaloes are fed to gain higher body weight (Qureshi *et al*., 2002). Pre-weaning and post-weaning feeding management can cause early growth rate, early age at first conception and early calving in buffaloes. Thus, in order to ensure a good growth of the buffaloes, heifer management needs to start from birth. Zicarelli (1997) reported that a random number of buffalo cows became acyclic due to sudden climatic changes such as a sudden reduced in temperature, exposure to cold wind and environmentally hot weather without any possibility of bathing or sheltering from the sun. Higher oxidative stress during hot weather or high temperature as Malaysia is the primary cause of reproductive failure in buffaloes. Overall in ruminants, poor nutrients supply resulted in a low ovulation rate associated with decreasing reproductive performances (Sarwar et al., 2009). Another report by Sarwar et al. (2009) says that feeding 1.5% of sodium bicarbonate to early lactating buffaloes during hot weather can help in reducing services per conception. They also explained that lactating buffaloes had higher metabolic rate that tended to make the cellular environment acidic due to more CO2production. A high sodium bicarbonate diet, due to high Na content, is alkalogenic in nature and reduces the extent of that acidity and thus increases cellular glucose uptake and DM intake (Block, 1994).

According to Borghese et al. (2005), domesticated buffalo that are cared under good management system and fed properly with balanced nutrient requirements may gain early puberty. Puberty is highly affected by management factors. Furthermore, he quoted that size is

more crucial than age, and a Murrah heifer should weigh around 325 kg at insemination or mating and 450 to 500 kg at her first calving.

2.3 Milk production

Buffalo is the 2nd largest source of milk supply in the world (FAO, 2004). Of the 38.5 million tons of world milk production, India produces 23.6 million and Pakistan 10.5 million tons (FAO, 1991). In India and Pakistan, buffalo milk is marketed through a network of milk cooperatives and as for the farmer, a stable price of milk is guaranteed throughout the year. Lactation duration of Murrah Cow is about 300 days and the milk yields range from 1500-1800 kg during the first lactation. It will steadily increase and peaked during the fourth lactation and it will maintain at the peak level throughout until the ninth lactation. Thus, a buffalo could be retained in the farm until up to the ninth lactation (16 years of age). However, reasonable economic returns are to be achieved even though the buffalo cows are used up to the ninth lactation (Wahid et al., 2011). Buffalo are also better at converting poor-quality roughage into milk and meat (Mudgal, 1988) besides containing twice the amount of butterfat found in cow milk. Products that are manufactured from buffalo milk are butter, cheese such as mozzarella, ghee, several kinds of traditional sweets and ice creams, full cream milk powder, skim milk powder, and infant milk powder.

2.4 Reproductive performance

In order to operate a dairy farm, reproduction is a crucial process as milk production will only begin after calving. According to Drost (2007), fertility in water buffalo is considerably lower than that of cattle. Delayed first calving age, longer calving interval, seasonal estrous behavior and poor estrus expression in buffaloes have been reported by many authors (Qureshi et al., 2002; Patro et al., 2003; Rakshe, 2003). According to McDowell (1995), the average first lactation milk yield in Murrah (1540 kg) was higher than the averages production by Bhadawari, Mehsana, Pandharpuri and Surti buffalo (926-1375 kg). This proportion of high milk yield in buffalo was suggested as reasonable opportunity for selection of dams to produce bulls. Ideally, a buffalo cow's reproductive life starts at 24-36 months or when the female weighs 250 – 275 kg for the first pregnancy, with gestation period approximately 305 to 320 days, and to produce two calves in three years. The period of first lactation is 200 - 300 days with milk yield of 1500 – 1800 kg. Usually, breeding females will be kept in the herd until about the ninth lactation (Wahid *et al.,* 2011). Prior calving, the first estrus and ovulation will occur at approximately 60 and 90 days in a good management practiced farm. According to Taneja (1999) subsequent calving intervals were shorter (430-547 days) compared to the first calving interval. Usually, longer calving intervals are associated with higher lactation yield. Due to that association, it was expected that prolonged calving intervals were the result of long lactation period, probably due to late conception. This factor can be directly influenced by feeding, management and heat detection practices. The genetic variability in calving interval was negligible; hence the

reduction in calving interval can be achieved through better management, nutrition and feeding.

Reproductive efficiency is the primary factor affecting productivity in female buffalo; it is highly affected by the late attainment of puberty, seasonality of calving, long postpartum anoestrus and subsequent calving interval. However, artificial insemination (AI) is not commonly performed due to the poor expression of oestrus and the variability of oestrus length, which makes it difficult to detect oestrus (Barile, 2005). According to Perera (2011), buffalo shows less overt signs of oestrus than in cattle and the duration of oestrus is 5-27h with ovulation occurs around 24 – 48 h (mean 34h) prior to onset of oestrus. However, in many farming systems prolonged postpartum anoestrus is the main problem and the causes include poor nutrition and body condition, and stress due to harsh climates and improper management system. Majority of buffaloes in Malaysia are bred through natural mating. Only a small percentage of them are bred through AI particularly in Buffalo Park, Pulau Langkawi (Quaza et al., 2013).

2.5 Heat Stress

Buffalo suffers from poor heat tolerance capacity mainly due to low sweat gland density (Das et al., 1999). Under extreme thermal loads of heat and work, buffaloes demonstrate moderate levels of sweating to open mouth panting as it became worsen. Past studies on buffaloes shows that they have been adapted to the extent of changes in physiological

reactions. Based on Fuquay et al. (2011), domestic buffalo has less than one-tenth the density of sweat glands than of cattle and this causes the ability to sweat and lose heat through evaporative cooling is significantly reduced. In addition, their dark body coat causes heat to be absorbed from the direct sun ray and the thick epidermal layer inhibits heat dissipation through conduction and radiation. They added that the domestic buffalo is more sensitive than cattle in terms of exposure to direct solar radiation and high ambient temperatures during the hot weather months. This thermal stress may lead to higher calf mortality, lesser milk yields, slow growth, and depressed signs of estrus.

Thermal stress can be reduced by providing cooling facilities such as shade and wallows and sprinkling water on to the skin during the hotter part of the day especially from 1 pm to 3 pm in a hot humid weather like Malaysia, and feeding roughage during the night.

2.6 Health problem

2.6.1 Clinical Mastitis

Mastitis risk in a poorly managed buffalo farms is often associated with lack of even the simplest hygiene routines. The bacteria which cause mastitis on a poorly managed farms, fecal and soil bacteria, maybe is a sign that the standards of hygiene could be improved. Mastitis seems to be more frequent in animals with high milk yield, whether individuals, herds, breeds or species. This may have to do with the higher stress that the udder is exposed to when yielding more milk. It is quite clear however, that buffalo are less susceptible to mastitis than cattle might be due to the anatomical and physiological reason.

3.0 Methodology

3.1 Farm and animal

Five buffalo farms were selected from the 'Ladang Angkat' Universiti Putra Malaysia (UPM) : GM farms are located in Mukim Ulu Melaka Langkawi and Sungai Tangkas Kajang whereas the PM farms are in Kuah Langkawi, Taman Sri Jelok Kajang and Sungai Batangsi Semenyih. Number of buffalo cows that are selected in each farm is highly dependable on the number of lactating buffaloes at that moment. Several interview sessions with the farmer were conducted to obtain data on monthly milk yield, reproduction performances and health problems. The buffaloes are all of Murrah breed with ranging age of 3 to 11 years old. Both herds from GM and PM are milked twice daily but only 1 farm from PM practiced linear milking system while the rest of the farm practiced hand milking system. Both farms from GM farm and 2 farms from PM practiced a semi-intensive system and the buffaloes were let out for wallowing during hot days while another farm in PM practiced an intensive system and wallowing facilities are not provided.

3.2 Data collection

Individual cow milk production was recorded daily for 3 to 5 consecutive days and past record of over 3 months were recorded as well. The numbers of buffalo cows from each farm are as follow:

No	Farm	Animal selection	Sample size
1	Farm A	Lactating buffalo cows	45
2	Farm B		4
3	Farm C		8
4	Farm D		20
5	Farm E		2

Table 1: Sample size from each farm

The evaluation of the farm were based on the guidelines stated by DeLaval (2008) and Nur Diyana (2015) are as follow :

1. The feeding, watering and milking place should always be shaded
2. Cool wallow either from a clean river or earthen pit, to help the animals in maintaining their temperature. Water troughs should always be placed in the shade
3. No harmful object that can cause injuries to the buffaloes
4. In hot humid climates (Malaysia) it is better not to have walls

5. Clean water is provided, not far from the farm wallow

6. Showering the buffalo with cool water for three minutes twice a day

7. Partitions are provided between buffalo to reduce the number of injuries

8. Rubber flooring is provided as to avoid slippery floor and provide comfort to the buffalo

During evaluating the farm, the methods of scoring that were used for each farm were as below:

Score	Criteria %	Farm management	Total number of cows
1	Didn't follow any of the criteria	Poor	30
2	Follow 30% of the criteria		
3	Follow 50% of the criteria		
4	Follow 80% of the criteria	Good	49
5	Follow 100% of the criteria		

Table 2 : Methods of scoring farms

3.3 Data analysis

The data were organized and analyzed in SPSS IBM® version 22. Descriptive statistics of the mean milk yield for each buffalo cow per day, each farm per day and the overall mean milk yield for the total number of days of collection were generated. Independent samples t-test was performed to analyze the mean difference of milk yield between GM and PM.

4.0 Results

4.1 Representative pictures of some of the management criteria found in the farms

Figure 1 : PM Farm - Feeding is not located at the shaded area

Figure 2 : PM Farm - Showering once a day, no wallowing facilities provided

Figure 3 : PM Farm - No rubber flooring and partition between buffalo provided

Figure 4 : PM Farm - Sharp objects located nearby

Figure 5 : GM Farm - Feeding is located at shaded area

Figure 6 : GM Farm - Partition provided to separate the buffalos

Figure 7 : GM Farm - Wallowing facilities provided

Figure 8 : GM Farm - Rubber flooring is provided

4.2 Milk yield

The average milk yield (litre/cow/day) was significantly higher ($p<0.05$) in GM than in PM (Table 3). The GM farms recorded an average of 6.319 litres of milk per cow per day (range of 5.28– 7.08 litres), while the PM farm recorded an average daily production per cow of 4.421 litres (range of 1.99–8.8 litres). The difference between the two farms was significantly different (t-value=7.908, df=229, $p<0.05$)

Table 3: Descriptive statistics of daily milk yield in buffalo cows from GM and PM farms.

FARM	N	Mean	SD
GOOD MANAGEMENT (GM)	135	6.319	1.2196
POOR MANAGEMENT (PM)	96	4.421	2.3854

The milk produced (in litres) for 3 months by the buffalo cows from each farm is shown in Table 4. Within each farm, there was no significant difference in milk yield between month 1 to month 3 ($p>0.05$). However, the daily mean milk yield between GM farms (farm A and B) with overall mean of 6.25 litres and PM farms (farm C,D and E) with overall mean of 5.34 litres which was statistically significant ($p<0.05$).

Table 4: Milk yield (in litres) produced by the buffalo cows each from GM and PM farms over the 3 months of record

Management	Farm	Month 1	Month 2	Month 3	Mean	Overall Mean
Good	A	6.64	6.47	5.84	6.32	6.25
	B	0	5.28	7.08	6.18	
Poor	C	1.99	2.13	3.31	2.43	
	D	3.76	5.10	5.67	4.84	5.34
	E	8.75	8.8	8.7	8.75	

According to Figure 9, the distribution of mean milk yield by cow showed that the mean milk yield of cows from PM (a) was lower compared to cows from GM (b).

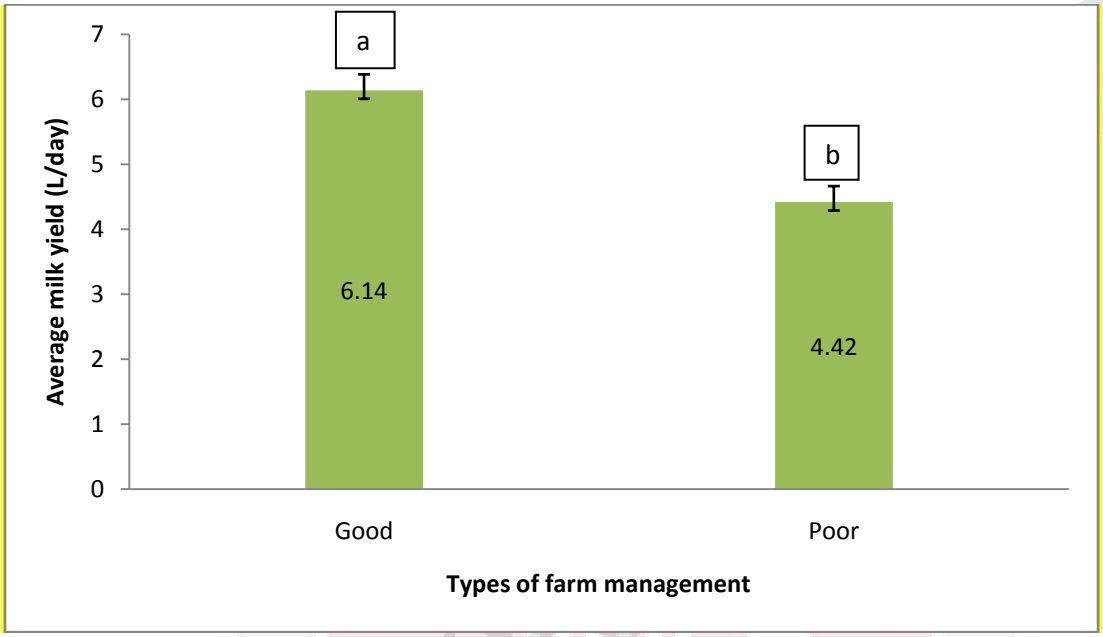

Figure 9 : The mean milk yield of GM and PM

4.2 Reproductive performance

The reproductive parameters calculated for each farm including pregnancy rate, calving interval, number of parity as well as days in milking are shown in Table 5 below.

There was no significant difference between the parameters of selected reproductive performance (Table 5). The reproductive performance of all cows was similar between the two farms groups (p-value>0.05).

Table 5: Results of the selected reproductive performance for GM and PM farms

Parameters(Average)	Good Management	Poor Management
Pregnancy rate (%)	96.5	89
Calving interval (months)	<18 months	>18 months
No. of parity	1 – 8	1 – 8

4.3 Clinical reproductive problems

Based on the data obtained, the number of cases of clinical reproductive problems for GM and PM were similar with just one case per year (Table 6). However for prolapse, GM has 1 case compared to PM with 2 cases. There was no significant difference of clinical reproductive problems between the two groups under different management ($p>0.05$).

Table 6: Annual number of cases of clinical reproductive problems

Farm	Number of cases per year			
	Prolapse	Dystocia	Repeat breeder	Abortion
GM	1	1	1	0
PM	2	1	2	1
Total	3	2	3	1

5.0 DISCUSSION

Based on this study, the mean milk yield for the 3 months revealed that there was a significant difference of milk yield between GM and PM farm. GM farm cows were producing more milk daily compared to PM cows. A multivariate statistical analysis was used to eliminate the confounding factors such as lactation status and number of parity; that can interrupt the result of milk yield between GM and PM farm. Thomas (2008) reported that the shape of the lactation curve depends on factors such as feed, management, milking frequency and diseases. Good management farm showed higher lactation curve compared to the poor management farm.

Buffaloes that are located in local farm should be protected from the hot and humid temperature of Malaysia. A study by Raizada et al. (1972) proved that higher in conception rate of 80% obtained from buffalo cows when they were showered regularly and wallowing facilities provided in the farm. This criterion is highly important as buffalos suffer poor heat tolerance capacity mainly due to low sweat gland density (Das et al., 1999). Furthermore, dark body coat of the buffaloes causes heat to absorb the direct sun heat and the thick epidermal layer inhibits heat dissipation through conduction and radiation. A study was done by De Rosa et al. (2009) where they separated 2 groups of buffalo cows into 2 barns which one without or no pool (NP) and the other one with pool (WP) barn. The NP is a free stall open-sided barn with concrete

floor with 10 m^2/head as space allowance and WP is similar barn, but had access to an outdoor yard (36 m^2/head) and a concrete pool of 208 m^2**.** The result shows that WP has higher milk yield compared to NP (12.01 vs. 11.06 kg/d, respectively). The result from De Rosa et al. (2009) study is parallel to this study which GM with wallowing pool and PM without wallowing pool show a significant difference between the milk yields. GM farm with wallowing pool at a distance of approximately 150 – 350 m from the farm and the buffaloes were let out for at least once a day for 2 hours shows higher milk yield of 5.66kg/day compared to PM farm without wallowing pool and cooling was only done once a day for 2 minutes with milk yield of only 2.48 kg/day.

These results suggest that provision of pool channel a positive effect on the milk yield when the surrounding temperature is high. According to Safie (1985), the climatic comfort zone for buffaloes are around 15°C - 20°C. Thus, the increased milk yield observed in the GM with pool may be due to increased ability of the animals when the pool is provided in hot, humid conditions such as in Malaysia. In buffaloes, high ambient temperatures were highly associated with less feed intake, reduced metabolic rate and reduced daily milk yield, which denote strategies to maintain normal body temperature (Kadzere et al., 2002). Zicarelli et al. (2005) suggest that more space allowance offered to the WP buffaloes may have played a role in milk yield.

This study revealed that GM farm had a lower level of clinical mastitis thus more milk yield is expected from a non-diseased cow compared to those in PM farm. This could be due to

the presence of rubber flooring (RF) in the GM farm compared to those in PM farm with concrete flooring (CF). This can be explained due to RF can be easily cleaned which improves hygiene condition of the buffalo cows and subsequently the udder compared to CF. According to Platz et al. (2008), it was concluded that rubber mated flooring provides a labour-saving self-cleaning management system and a buffalo-friendly flooring. This statement is supported by a study by Kivaria et al. (2007) which states that factors such as herd size, parity, the body condition score, days in milk and dirty barn floor, has a significant association with the occurrence of clinical mastitis. Dairy cows that are housed under condition of sub-optimal hygiene have been shown to be associated with high incidence of clinical mastitis (Radostits et al., 2000).

Poor reproductive performances in the farm can be due to several reasons within the PM farm. As mentioned earlier, buffalo have poor thermal tolerance in consequence of an under developed physiologically thermo-regulatory system and are incapable in getting rid of excess body temperature. If the housing is not designed to take care of this distinctive species-specific requirement for adequate shade and ventilation, it will affect production and reproduction (Ramesh et al., 2002).As with other farm animals, nutrition plays a major role in the reproductive performance of buffalo cows. However there is always a misunderstanding that the consequences of the poor nutrition are interpreted as seasonality of breeding in buffalo. Malnutrition can be due to under feeding, over feeding, unbalanced feeding and feed with deficiencies in minerals, vitamins or trace elements. This will cause reduced fertility in the

buffalo cow. A poor body condition score at calving affects fertility, characterized by prolonged post-partum intervals, reduced conception rates, and more services per conception. Low consumption of protein diet can cause cessation of oestrus (Agrawal, 2003).Another reason that buffalo suffer from long post-partum anoestrus is because their natural unhygienic behaviour of rolling in dirty water pools, and unhygienic shed conditions. This can cause buffalo to suffer from a high incidence of endometritis. Buffalo also suffer from uterine prolapse and retention of the fetus. This is due to loose broad uterine ligaments and rolling in water cause torsion of uterus cases in buffalo. All these lead to uterine infections, delayed involution of the uterus and endometritis in buffalo resulting in the need for repeat breeding.

6.0 CONCLUSION AND RECOMMENDATIONS

In conclusion, good management practise does increase the milk production of the buffalo cows compared to those under poor management. It is important to ensure and apply good welfare for the buffalo to ensure longevity of the buffalo productivity and reproductive life. It is also serves an important economical part of the farm as this can be the main source of income to the farm. With ensuring the farm in a good manner with all the good farm management applied, it does and will increase the milk yield of the buffalo, reduces the risk of health problem and improves reproductivity of the buffalo cows. The reproductive performance shows a significant difference in these 2 farms ; GM and PM farm. However, the clinical reproductive problems were similar between GM and PM farm. Generally, this study provides an insight of the potential benefits of practicing good management system in a farm.

Further work on comfort level and preferences of the buffalo cow to be reared on either fully intensive system with wallowing pool inside and semi-intensive with wallow the outside is recommended. Besides that, diagnosis and detection of mastitis case should also be investigated further. The subclinical mastitis occurrence between the two farm management should be further studied as well. Based on the findings from this study, the good management

in buffalo farms might be beneficial to improve the milk yield, reduced occurrence sub-clinical and clinical mastitis and improve reproductive performances of the buffalo cow.

One of the limiting factors in this study was the lack of recording system of the farm itself especially the PM farm. A practical and detail recording system should be established so that the farm performance can be monitored more objectively and improvements can be made.

REFRENCES

1. Thomas, C. S. (2008). Efficient dairy buffalo production. *De Laval International AB, Tumba, Sweden*.
2. Tripaldi, C., De Rosa, G., Grasso, F., Terzano, G. M., & Napolitano, F. (2004). Housing system and welfare of buffalo (Bubalus bubalis) cows. *Animal Science*, *78*(03), 477-483.
3. De Rosa, G., Grasso, F., Braghieri, A., Bilancione, A., Di Francia, A., & Napolitano, F. (2009). Behavior and milk production of buffalo cows as affected by housing system. *Journal of dairy science*, *92*(3), 907-912.
4. Griffiths, M. W. (Ed.). (2010). *Improving the Safety and Quality of Milk: Improving Quality in Milk Products*. Elsevier, *Cambridge.*
5. Sarwar, M., Khan, M. A., Nisa, M., Bhatti, S. A., & Shahzad, M. A. (2009). Nutritional management for buffalo production. *Asian-Aust. J. Anim. Sci*, *22*(7), 1060-1068.
6. Jamuna, V., & Chakravarty, A. K. (2016). Evaluation of fertility in relation to milk production and productivity of Murrah buffaloes. *Animal Reproduction Science*, *171*, 72-80.
7. Borghese, A., & Mazzi, M. (2005). Buffalo population and strategies in the world. *Buffalo production and research*, *67*, 1-39.
8. Mohd Tahir, N.D. (2015). Comparison of milk yield, selected reproductive performance and health problems between a dairy farm on concrete and another on rubber mat flooring, 2-30. Retrieved January 7, 2017.
9. Taneja, V. K. (1999). Dairy breeds and selection. *Smallholder dairying in the tropics*, 71, *Nairobi, Kenya.*

10. .Barile, V. L. (2005). Improving reproductive efficiency in female buffaloes. *Livestock Production Science*, *92*(3), 183-194.
11. Perera, B. M. A. O. (2011). Reproductive cycles of buffalo. *Animal Reproduction Science*, *124*(3), 194-199.
12. Das, S. K., Upadhyay, R. C., & Madan, M. L. (1999). Heat stress in Murrah buffalo calves. *Livestock Production Science*, *61*(1), 71-78.
13. Kadzere, C. T., Murphy, M. R., Silanikove, N., & Maltz, E. (2002). Heat stress in lactating dairy cows: a review. *Livestock production science*, *77*(1), 59-91.
14. De Rensis, F., & Scaramuzzi, R. J. (2003). Heat stress and seasonal effects on reproduction in the dairy cow—a review. *Theriogenology*, *60*(6), 1139-1151.
15. Fox, P. F., McSweeney, P. L., & Fuquay, J. W. (2011). *Encyclopedia of dairy sciences*.
16. Ranjhan, S. K., & Pathak, N. N. (1979). *Management and feeding of buffaloes*. Vikas Pub. House., *India.*
17. Kundu, S. S., Misra, A. K., & Pathak, P. S. (2004). *Buffalo production under different Climatic regions*. International Book Distributing Co., *Cornell University.*