



UNIVERSITI PUTRA MALAYSIA

**A SIMULATED STUDY OF SMALLHOLDER DAIRY
PRODUCTION SYSTEMS**

R. DJOKO SOETRISNO

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**A SIMULATED STUDY OF SMALLHOLDER DAIRY
PRODUCTION SYSTEMS**

By

R. DJOKO SOETRISNO

**Thesis Submitted, in Fulfilment of the
Requirements for the Degree of Doctor of Philosophy
in the Faculty of Veterinary Medicine and Animal Science,
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Abstract of the Thesis Presented to the Senate of University
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By

R. Djoko Soetrisno

July 1989

Supervisor : Prof. Dr. Mohammed Mahyuddin bin Dahan

Faculty : Veterinary Medicine and Animal Science

Four experiments were conducted to investigate the productive performance of Sahiwal-Friesian cows under different feeding managements. Rotational grazing at stocking rate 6.25 milking cows(AU)/ha on Setaria splendida and stall-fed cut Panicum maximum (Guinea grass) both with high cost concentrate containing 5.0% fish meal supplementations (Experiment I) were done following split-plot in time design, followed by (Experiment II) comparing (t-test) the performance of cows grazed on splendida (rotationally) at low (4.0 AU/ha) and high SR (8.0 AU/ha) with low cost concentrate (LCF) supplementation for HSR group. A split-plot in time design was also used to determine the effect of type of concentrates formulated based on cost with cut Guinea grass on the performance of the cows (Experiment III), and to evaluate the effect of machine



milking with the presence and the absence of calves (Experiment IV).

Feeding systems did not significantly ($P>0.05$) affect milk yields, milk compositions and body weight change (BWC) of cows in all experiments, but there was a significant ($P<0.05$) effect of animals on milk protein content in presence or absence of calves (Experiment IV). However, using Duncan's new multiple range test (DMRT) the significant ($P<0.05$) difference was only found between cows No. 4 (3.13%) and No. 1 (4.09%) or and No. 2 (3.97%), but not with No. 3 (3.53%) of both groups.

Highly significant ($P<0.01$) effect of lactation periods were observed on dry matter intake (DMI), milk yield and BWC of the cows, except, in Experiment I where the effects on BWC were less significant ($P<0.05$). Generally, the amount of DMI tended to decrease, but increased when expressed as percent of BW. Average daily milk yield decreased significantly ($P<0.05$) as the lactation periods progressed (from 9.70 to 4.59kg in Experiment I; from 7.38 to 4.65kg in Experiment II and from 10.29 to 8.51kg in Experiment IV), but in Experiment III milk yield increased from 6.33kg in the first month to 7.11kg in the fifth month of lactation. However, in Experiment II there was an increased in milk yield until third month of lactation (from 7.38 to 8.02kg). Lactation periods interacted significantly ($P<0.05$) with animals in Experiment I and III to influence the milk yield, and with feeding systems to affect



the milk yield by cows in Experiment I, III and IV. Grazing cows in Experiment I, Group A (fed high cost concentrate) in Experiment III and suckling group (Group S) in Experiment IV have higher milk yield among the treatment groups. In Experiment II no significant ($P>0.05$) difference were found on the milk yield, milk composition and BWC of the treated cows. Due to slightly higher intake of metabolizable energy (ME) (101.2MJ vs 96.8MJ) and crude protein (CP) (1.7kg vs 1.5kg), but lower acid detergent fibre (ADF) (2.3kg vs 3.0kg). High stocking rate (HSR) cows in Experiment II yielded more milk (1,979.41kg vs 1,869.03kg), higher milk composition (fat 3.67% vs 3.60%, protein 3.79% vs 3.31% and TS 12.97% vs 12.27%), and higher gain in weight (3.30 kg vs -5.30kg/cow/month). Body weight change (BWC) decreased significantly ($P<0.05$) with increasing lactation periods. Grazing cows with high cost concentrate supplementation (Experiment I) gained more weight (5.0kg/cow/month) tended to have better reproductive performance, followed by HSR group in Experiment II, stall-fed with high (HCF) and low cost concentrate (LCF) both in Experiment III. The low reproductive performance of cows can be explained by the longer delay in postpartum ovarian activity due to the higher loss in BW of the cows as shown in milk progesterone analysis in Experiment IV.

Based on the calculated net return for the various production systems for Sahiwal-Friesian cows, the following



options are recommended: (1). grazing on splendida pasture at SR of 6.25 AU/ha with concentrate containing 5.0% fish meal supplementation at the rate of 1.0 kg for every 2.5 kg milk produced, and (2). grazing on splendida pasture at SR 4.0 AU/ha without any concentrate supplementation. To maximize return, combination of machine milking and non suckling for cows after second gestation is also suggested provided proper calf management can be handled by the farmers.



Abstrak Tesis Yang Dikemukakan Kepada Senat
Universiti Pertanian Malaysia Sebagai Memenuhi Syarat
Keperluan Untuk Ijazah Doktor Falsafah

**KAJIAN UNTUK MERANGSANG SISTEM PRODUKSI LEMBU TENUSU
PETERNAK KECIL**

Oleh

R. Djoko Soetrisno

Julai 1989

Penyelia : Prof. Dr. Mohammed Mahyuddin bin Dahan

Fakulti : Kedokteran Veterinar dan Sains Peternakan

Empat kajian telah dikerjakan untuk menentukan produksi susu dan reproduksi lembu-lembu Sahiwal-Friesian yang diperlakukan dengan pengurusan yang berbeda.

Prestasi lembu yang meragut dengan muatan ternak 6.25 satuan ternak (AU)/ha di petak rumput Setaria splendida dan yang diberi makan rumput Panicum maximum (Guinea grass) di kandang dimana kedua kumpulan lembu ini juga diberikan makanan tambahan konsentrat yang mengandungi 5.0% tepung ikan telah dikerjakan mengikut rancangan percobaan 'split plot intime' (Kajian I), diikuti Kajian II membandingkan (t-test) prestasi lembu yang meragut rumput splendida dengan daya tampung rendah (LSR 4.0 AU/ha) dan daya tampung tinggi (HSR 8.0 AU/ha) yang diberikan makan tambahan konsentrat berharga murah. Rancangan percobaan 'split plot intime' juga telah dipakai untuk mengkaji



perbedaan prestasi lembu-lembu yang diberi konsentrat yang berlainan bersama rumput Guinea (Kajian III) dan untuk menilai pengaruh penyusuan anak lembu (pedet) pada induknya (Kajian IV).

Hasil susu, kandungan susu dan perubahan berat badan (BWC) tidak dipengaruhi ($P > 0.05$) oleh sistem pemakanan atau ada tidaknya anak diwaktu pemerahan, tetapi ada beda yang nyata ($P < 0.05$) pada kandungan protein susu lembu (Kajian IV), meskipun demikian, dengan menggunakan "Duncan's new multiple range test" (DMRT) perbedaan tersebut hanya dijumpai antara lembu No. 4 (3.13%) dengan No. 1 (4.09%) dan atau No. 2 (3.97%), bukan dengan lembu No. 3 (3.53%) dari kedua kumpulan perlakuan.

Jumlah bahan kering yang dimakan (DMI), hasil susu dan BWC dari lembu sangat dipengaruhi ($P < 0.01$) oleh saat laktasi, tetapi BWC lembu-lembu (Kajian I) hanya dipengaruhi pada peringkat $P < 0.05$. Pada umumnya purata hasil susu harian berkurang dengan meningkatnya laktasi (dari 9.29 menjadi 4.59kg pada Kajian I, dari 7.38 menjadi 4.65kg pada Kajian II dan dari 10.29 menjadi 8.51kg pada Kajian IV), walaupun demikian pada Kajian II ada peningkatan hasil susu hingga bulan ketiga (dari 7.38 menjadi 8.02kg). Interaksi antara laktasi dengan lembu juga mempengaruhi ($P < 0.05$) hasil susu lembu Kajian I dan III. Hasil susu ternyata dipengaruhi ($P < 0.05$) juga oleh interaksi antara laktasi dengan sistem pemakanan dan/atau dengan sistem



pemerahan. Keadaan ini berlaku pula pada Kajian IV. Pada umumnya lembu yang meragut (Kajian I), yang mendapat konsentrat berharga tinggi di kandang (Kajian III) dan yang tidak disusu oleh anaknya diperah dengan mesin (Kajian IV) menghasilkan lebih banyak susu. Pada Kajian II didapati bahwa hasil susu, komposisi air susu dan BWC dari kedua kumpulan perlakuan tidak ada perbezaan yang nyata ($P > 0.05$). Kerana ada kelebihan pengambilan "metabolizable energy" (ME) (101.2 MJ vs 96.8 MJ) dan CP (1.7kg vs 1.5kg), tetapi rendah pengambilan "acid detergent fibre" (ADF) nya (2.3kg vs 3.0kg), maka HSR (Kajian II) menghasilkan susu lebih banyak (1,979.41kg vs 1,869.03kg) dengan komposisi yang lebih tinggi (lemak 3.67% vs 3.60%, protein 3.79% vs 3.31% dan "total solid" (TS) 12.97% vs 12.27%) dan BWC yang lebih besar (3.30kg vs -5.30kg/ekor/bulan). Pada umumnya BWC menurun ($P < 0.05$) dengan meningkatnya laktasi. Kumpulan lembu meragut yang diberi makanan tambahan konsentrat (Kajian I) memiliki BWC terbesar (5.0kg/ekor/bulan) juga mempunyai prestasi reproduksi yang lebih baik, diikuti oleh kumpulan HSR (Kajian II, kumpulan yang dikandangkan pada Kajian I, kumpulan LSR (Kajian II) dan yang terakhir berturut-turut oleh lembu yang dikandangkan yang diberi makanan tambahan konsentrat berharga tinggi (HCF) dan berharga rendah (LCF) pada Kajian III. Rendahnya prestasi reproduksi dapat dijelaskan kerana panjangnya waktu yang diperlukan untuk aktiviti indung telur setelah melahirkan akibat kehilangan berat badan yang terjadi selama diperah (Kajian IV).



Berdasarkan pada perhitungan hasil pendapatan bersih dari pelbagai sistem produksi untuk lembu Sahiwal-Friesian, maka pilihan berikut adalah disyorkan: (1). meragut pada padang ragutan rumput splendida dengan muatan ternak 6.25 AU/ha yang juga diberi makan tambahan konsentrat yang mengandungi 5.0% tepung ikan diberikan sebanyak 1.0 kg untuk setiap 2.5 kg susu yang dihasilkan, dan (2). meragut pada padang ragutan rumput splendida dengan daya tampung 4.0 AU/ha tanpa tambahan makan konsentrat. Untuk meningkatkan pendapatan, maka kombinasi penggunaan mesin pemerah dan penyapihan segera setelah anak lahir (umur 5 hari) dari induk sapi setelah kebuntingan yang kedua adalah juga digalakkan untuk dilaksanakan asalkan petani dapat mengurus dengan baik.



CHAPTER I

INTRODUCTION

McDowell (1972) reported that the Tropics and Subtropics (30° South to 30° North latitude) have a significant proportion of the world's total ruminant population which are as follows: cattle 55%, sheep 36%, goat 67%, buffaloes 80% and camels 86%. However, in some countries productivity is extremely low due largely not only to nutrition, but also to low reproductive rate, poor disease control and traditional system of management. Livestock production can be improved through an increase in output per animal and productivity per unit area.

In Malaysia, dairying was introduced by Indian migrants. The dairy animals mainly of Sahiwal and Sindhi breeds were of Bos indicus type, which were brought from Southern India mainly used for the supply of their own fresh milk requirement and for pulling carts. Over the years, the government took an active role in the importation program resulting in more animals being brought in from the Indian subcontinent. More recently (two decades ago) various Bos taurus dairy breeds were introduced into the country from Australia, New Zealand and United State of America. These were Friesian, Jersey, Australian Illawara Shorthorn (AIS) and later Australian Milking Zebu (AMZ) animals. Frozen semen of AMZ, Australian Friesian Sahiwal (AFS)



and Friesian had been imported also since 1972. However according to Mustaffa (1982) local annual milk production (25 million kg) was not able to satisfy the annual milk demand (418.2 million kg) in the country. He projected that the annual demand for milk in 1990 will increase up to about 536 million kg, while the supply is expected to satisfy only 20% of the requirement. To satisfy this target the Malaysian Government, through the Department of Veterinary Services, has placed firm orders for approximately 25,000 Sahiwal-Friesian heifers having 50 to 62.5% Bos taurus blood from Australia and New Zealand. By the end of 1984, 22,713 Sahiwal-Friesian heifers had been landed and had been distributed to the farmers in this country. According to Thuraisingham (1977), these cows do not produce large milk yields, but they do tolerate the hot, local conditions and are relatively tolerant of local ticks and associated diseases. In contrast pure bred Friesian and Jersey (Bos taurus), are not as tolerant of either the heat or ticks. Consequently they are successful only in the higher altitude such as in the Northern part of Malaysia. With this background and with some evidence to suggest that Friesian X local Indian dairy (LID) crossbred cows can produce quite well under local condition, the logical way to increase the cow population is to inseminate imported Friesian semen into local cows. The resultant crossbred heifers should be reasonably suitable dairy cows. But this procedure would take very long time. It was therefore decided to import large numbers of crossbred heifers from Australia and New Zealand. The importation of these cows,



inspite of increasing milk supply, is also for economic uplifting and restructuring of the dairy industry in the country, and for narrowing the income gap between the rich and the poor.

A typical smallholder dairy farm has four to six crossbred cows (Bos taurus X Bos indicus) and their calves. They are tethered in sheds located close to the farmer's house and the feeding system depends on the availability of grazing land and labour (Jainudeen, et al., 1985), and was estimated to contribut an incomes of about M\$ 250.00 (Thuraisingham, 1977).

With the introduction of Sahiwal-Friesian cows into the country, the Division of Veterinary Services, through the Milk Collecting Centre (MCC) scheme, encourages the Malaysian dairy smallholders to cultivate improved forage species. Among various forage species Setaria splendida seems to have potential for grazing , while Panicum maximum and Pennisetum purpureum for greenchop. This research has therefore, been conducted.

Although many report on the productive performance of Sahiwal-Friesian cows in the country are available, however, some basic information especially with the use of introduced forage species as the feed either for grazing or stall feeding with or without supplementation with other ingredients, and the effect of early weaning to the cow is still lacking in the literature. Therefore, this research has been conducted.



Objectives

The main objective of this study was to simulate the productive performance of Sahiwal-Friesian cows raised under different feeding managements prevailing in smallholder dairy production systems, while the specific objectives are summarized as follows:

To determine

- i. the productive performance of Sahiwal-Friesian cows fed corn-soybean based diet containing fish meal under stall fed with Panicum maximum (Guinea grass) or grazing on Setaria splendida (splendida grass) pasture.
- ii. the effect of concentrate supplementation on milk yield of Sahiwal-Friesian cows grazing at a high stocking rate on Setaria splendida pasture.
- iii. the productive performance of Sahiwal-Friesian cows fed Guinea or splendida grass with a concentrate based diet of corn-soybean diet or a wheat bran-brewers dried grain diet.
- iv. the effect of suckling and non suckling on milk production and the rate of resumption of ovarian activity of Sahiwal-Friesian cows.