UNIVERSITI PUTRA MALAYSIA

FEEDLOTTING OF CATTLE ON PALM KERNEL CAKE AND PINEAPPLE WASTE-POULTRY LITTER BASED DIETS

MOHANAKRISHNAN S/O B.P. MUTHUKRISHNAN

FEEDLOTTING OF CATTLE ON PALM KERNEL CAKE AND PINEAPPLE WASTE-POULTRY LITTER BASED DIETS

by

Mohanakrishnan s/o B.P.Muthukrishnan

An Animal Industry Project paper submitted
in partial fulfilment of the requirements for the
award of the degree of Doctor of Veterinary Medicine
at the Faculty of Veterinary Medicine and Animal Science
Universiti Pertanian Malaysia
Serdang, Selangor, Malaysia

April 1987

Dedicated to

MY FATHER AND MOTHER

for their unfailing support,

encouragement and love

throughout my academic pursuits.

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation and gratitude to Dr. Zainal Aznam Mohd Jelan for his close supervision and invaluable guidance throughout the course of this project. His encouragement and cordial friendship has not only made this project a meaningful educational exercise for me, but also a throughly rewarding and enjoyable experience as well.

I am also extremely grateful to my co-supervisor, Dato Dr. P. Candiah, the Johor State Veterinary Director, for his supervision, encouragement and constructive comments while carrying out this project in Johor Bahru. It was actually his idea at the onset that laid the basis for this project.

My special thanks to Dr. Mohd Safaruddin Md Dawam, Dr. Indra Sekaran and En. Tunku Abd Rahman of the State Veterinary Department for their invaluable insight and encouragement.

To En. Mohd Naser Mohd Yusoff, all the staff and especially the farm hands of FIMA-TLP Feedlot Sdn.Bhd. goes my sincere appreciation and heartfelt thanks for their kind assistance and co-operation throughout my stay there.

A note of thanks and appreciation is due to En. Hashim Mahmud of Kumpulan FIMA Bhd. for granting me access to the farm records, and to Mr. Lai of Lee Pineapple Co.(Pte) Ltd. for his kindness in permitting us to take photographs of the cannery.

Last but not least, my deep appreciation and gratitude to MissThilagam for typing the tables, and to Dr. Nadzri Salim for being magnanimous in allowing the use of his computer terminal for this project.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

A feeding trial was conducted to study the performance of beef cattle when the feeding system was altered. Ten Australian Commercial Crossbred bulls which were being fattened on pineapple waste-poultry litter (PW-PL) based ration and of average body weight of 190.5 kg were randomly divided into two groups of five animals each. One group was offered ad lib expeller palm kernel cake (PKC-E), while the other group was continued on ad lib PW-PL based ration.

The average daily fresh feed and dry matter intakes were significantly higher ($P<0.05$) for the group fed PW-PL. The animals whose diet was changed to PKC lost an average of 0.67 kg/day, while the other group maintained its body weight(-0.03 kg/day).The average weight loss for the group fed PKC was 21.4 kg while the group fed PW-PL ration lost about 1.0 kg. This indicated that growth performance was affected when the diet was suddenly changed presumably due to alteration of the rumen microbial ecosystem.

Economic evaluation and animal performance in mini-feedlots and in a commercial feedlot were also assessed. Mini-feedlots based on PKC had lower annual gross returns than commercial feedlotting system based on PW-PL. Profitability of mini-feedlot cattle could have been increased if the fattening period had not exceeded 120 days.

ABSTRAK

Suatu percubaan pemakanan telah dijalankan untuk mengkaji prestasi lembu pedaging apabila sistem pemakanan ditukar. Sepuluh ekor lembu jantan Australian Commercial Crossbred yang sedang digemukkan dengan campuran makanan bahan sisa nenas dan najis ayam (PW-PL) serta mempunyai purata berat badan 190.5 kg dibahagikan secara rawak kepada dua kumpulan. Satu kumpulan diberi makanan bungkil kelapa sawit ekspeller (PKC-E), manakala kumpulan yang lain pula terus diberi makanan PW-PL.

Kumpulan yang diberi makanan PW-PL menunjukkan penambahan berkesan ($P<0.05$) dari segi pengambilan purata makanan segar dan bahan kering harian. Kumpulan lembu yang ditukar makanannya kepada PKC kehilangan berat badan 0.67 kg/hari, manakala kumpulan lain pada amnya mengekalkan berat badan (-0.03 kg/hari). Purata penurunan berat badan untuk kumpulan yang diberi PKC ialah 21.4 kg, manakala kumpulan yang diberi PW-PL kehilangan berat badan 1.0 kg. Ini menunjukan bahawa penukaran sistem pemakanan secara mendadak membawa kesan buruk terhadap pembesaran, kemungkinan disebabkan terganggunya ekosistem mikrobial rumen.

Penilaian ekonomi dan prestasi lembu di dalam feedlot mini dan feedlot komersial dikaji. Feedlot mini berasaskan PKC mempunyai keuntungan tahunan kasar yang lebih rendah daripada feedlot komersial yang berasaskan PW-PL. Keuntungan dari sistem feedlot mini dapat ditingkatkan jikalau masa penggemukkan tidak melebihi 120 hari.

1. INTRODUCTION

In many parts of the tropical region, there are abundant crop residues which are potentially suitable as ruminant feeds. Hence, in recent years, much attention and effort has been chanelled towards the utilisation of agro-industrial by-products as cheap, but nutritive animal feeds.

Malaysia has been traditionally dependent on imported raw materials to meet the rapid development of the livestock industry. Beef production systems based on pasture seem uneconomical due to the high cost of pasture development and maintenance. However, feedlotting of cattle based on agricultural by-products is becoming popular. Consequently, animal productionists are optimistic of the success of local beef production systems based on palm kernel cake and other carbohydrate rich by-products such as pineapple waste. The successful use of locally available by-products would generate more participation of people in beef cattle farming which could become cheap and profitable.

The objectives of this study were:

1. To briefly study the performance of beef animals when their feeding system was changed.
2. To evaluate the economics and animal performance of the mini-feedlot project and a commercial feedlot operation.

2. LITERATURE REVIEW

2.1 Potential of Beef Farming in Malaysia

Beef cattle production in tropical regions is generally low as compared to temperate zones (Jasiorowski, 1973). This also applies to Malaysia, where beef production is almost entirely in the hands of the smallholder. Only about 5% of beef cattle are kept in farms larger than 50 hectares. (Ismail et al., 1982). Malaysia is only 57% self-sufficient in beef (Farrell, 1984) although she produces about 11,000-16,000 tonnes of beef per year and imports about 8,000 tonnes annually mainly from India and Australia (Mahyuddin and Wolf, 1982). The traditional European system of cattle rearing on grass has been shown to be uneconomical in Malaysia due to the high costs of pasture establishment and maintenance. With an internal rate of return (IRR) usually below 8% and a break-even point of 12-15 years, such projects are not economically viable. Other systems of cattle production must therefore be considered that will suit the conditions of this country. One alternative is to use agro-industrial residues, a considerable number of which could become valuable cattle feeds (Bacon and Anselmi, 1984).

2.2 Use of By-products

It has been estimated that various agricultural wastes and residues associated with the major crops such as rice, pineapple, sugar cane,oil palm and cassava account for some 3 million tons of useable crop by-products produced annually in Malaysia. The utilisation of such products offers cheap sources

of feed when harnessed and processed into suitable feed formulations to achieve the desired self-sufficiency in feeds and economic livestock production (Chandapillai and Selvarajah, 1977). The justification for increasing the use of these by-products is associated with offsetting the high cost of feeding animals, notably from imported feedingstuffs, and the potential possibilities of increasing the productivity and contribution of livestock as a whole. During the last decade, research on the use of agro-industrial by-products has shown that such residues can play a major role in helping to develop the animal industry in the near future (Sastradipraja and Sutardi, 1977; Tinnimit, 1977; Devendra, 1980).

2.2.1 Use of Pineapple Waste

Pineapple waste, which accounts for approximately 60-80% of the total pineapple weight, provides good scope for increasing animal feed production in Malaysia. It has been estimated that the total available waste from canneries in Johore alone amount to nearly 200,000 tonnes/annum (Anon, 1972). Pineapple waste includes all those parts which are discarded during the canning process; the base and the apex portions, the central core, the skin and the trimmings immediately beneath the skin, as well as under-sized and over-ripe fruits (Senik and Idrus, 1977).

Raghavan (1974) showed that the waste is palatable and is readily consumed by lactating cows, beef cattle, buffaloes and small ruminants. Digestibility trials with livestock showed that pineapple waste was utilized by as much as 70-75% (Raghavan, 1977). Since its protein content is low, it must be supplemented

with a good source of protein. It has also been shown that the 'crown' of the pineapple fruit is a good source of feed for fattening beef cattle (Hutagalung, 1977).

2.2.2 Use of Poultry Litter

The average bird produces about 90 grams of faeces per day. Crude fibre, cell wall, lignin and mineral contents are the main contaminants of poultry litter which limit its use. In the formulation of poultry litter-based rations, the level of these contaminants must be strictly observed. Poultry litter, particularly from broiler production units, has been a cheap source of protein for ruminants (Fontenot et al., 1971; Bull and Reid, 1971). It can be used up to 30-40% in ruminant rations (Devendra, 1975). Dehydrated poultry waste has a lot of intact protein and uric acid which could form a dietary source for ruminants (Tinnimit et al., 1972; Thomas et al., 1972).

It is known that poultry excreta comprises about 60-90% of urinary nitrogen as uric acid, and 9-13% as ammonium salts (Shannon et al.,1973). Uric acid is slowly degraded by rumen micro-organisms to ammonia during digestion; the ammonia released poses little or no toxicity problems (Raghavan,1976).

2.2.3 Use of Palm Kernel Cake (PKC)

The production of PKC was about 500,000 tons in 1983 and nearly 90% of this was exported especially to the EEC countries. (Hutagalung et al.,1984). PKC is produced at the rate of about 0.2 tonne/ha. The protein is of medium quality but the fibre content is relatively high (Devendra, 1975). PKC is valuable in

supplying both energy and protein. It is however, looked upon mainly as a supplementary protein feed. The poor palatability and high fibre content makes it less suitable for feeding non-ruminants. Consequently, it is more commonly fed to ruminants (Devendra, 1977).

3. MATERIALS AND METHODS

3.1 Feeding trial

3.1.1 Animals and Management

A short feeding trial was conducted at FIMA-TLP Feedlot Sdn.Bhd. in Skudai, Johor for 32 days. Ten imported Australian Commercial Crossbred (A.C.C.) bulls averaging 190.5 kg and about 2 years old were randomly chosen and divided into two groups, viz. Group I and II with average starting body weight of 193.8 and 187.2 kg, respectively. They were individually penned with individual feeding facilities. The animals were from a batch of cattle that had arrived at the farm in early October 1986 from Nothern Territory, Australia. Until the commencement of the trial in mid-November 1986, all the animals were fed pineapple waste mixed with dried poultry litter (PW-PL).

3.1.2 Feeding

Animals in Group I were offered ad lib expeller PKC, while animals in Group II were offered ad lib PW-PL daily. The PW-PL ration was composed of pineapple waste 80-85%, dried poultry litter 10-15% and 5% mixture of urea, minerals, vitamins and common salt. Water was freely available at all times.

3.1.3 Performance

Daily feed intake for each animal was measured by offering weighed fresh rations and collecting the residues every morning. Samples of both offered feed and residues were oven-dried for 48 hours at 60C to determine the daily dry matter intake (DMI) for each animal. The animals were weighed weekly before morning feeding. Growth was assessed by average daily gain (ADG). The performance data was analysed statistically using the t-test for unpaired samples as outlined by Steel and Torie (1980).

3.2 Analyses of Records

3.2.1 Animals and Management

The Mini-feedlot project was initiated by the Johor State Government, through the State Veterinary Department. Three pioneer farmers were selected in Gelang Patah. All financial transections regarding purchase and marketting of crossbred cattle were administered by the Department. The farmers were involved on a part-time basis with minimal labour input.

In contrast,FIMA-TLP Feedlot Sdn.Bhd.is a commercial feedlot operation set up in 1976 between Majuternak (now FIMA Sdn.Bhd.), Times Publishing Bhd. and Lee Pineapple Sdn.Bhd. Their animals (all A.C.C.) were purcased in batches from Australia.

3.2.2 Feeding

In mini-feedlot, each farmer had his animals group-penned and expeller PKC was offered ad lib daily with some common salt added. For the commercial feedlot, the cattle were also group-penned. Pineapple waste mixed with dried poultry litter was offered ad lib daily using mechanised feeders.

3.2.3 Parameters

3.2.3.1 Growth

The mini-feedlot animals were weighed monthly by Veterinary Department personnel. Their growth was assessed by ADG and monthly weighings. The growth of commercial feedlot animals was assessed by their ADG and market weight.

3.2.3.2 Economics

For both commercial and mini-feedlots, their past records were analysed to determine the economics of their operations.

4. RESULTS AND DISCUSSION

4.1 Feeding trial

4.1.1 Chemical Analyses of Rations

The chemical analyses of experimental rations is shown in Table 1. The PW-PL based ration had lower dry matter content than the other ration because it comprised about 85% moisture; this would cause storage problems. Hence the ration was fed immediately as soon as it arrived from the cannery. The PKC based ration had higher crude protein content. In contrast, the PW-PL based ration comprised higher crude fibre and total ash contents.

TABLE 1. CHEMICAL ANALYSIS OF EXPERIMENTAL RATIONS (% Dry Matter basis)

Items	Ration	
	PKC based	PW-PL based
Dry matter, %	91.60	14.40
Crude protein, %	14.00	8.51
Crude fibre, %	20.23	22.40
Total ash, %	5.00	10.40

4.1.2 Performance

FIG. 1. PERFORMANCE OF ANIMALS FED PALM KERNEL CAKE (PKC) RATION

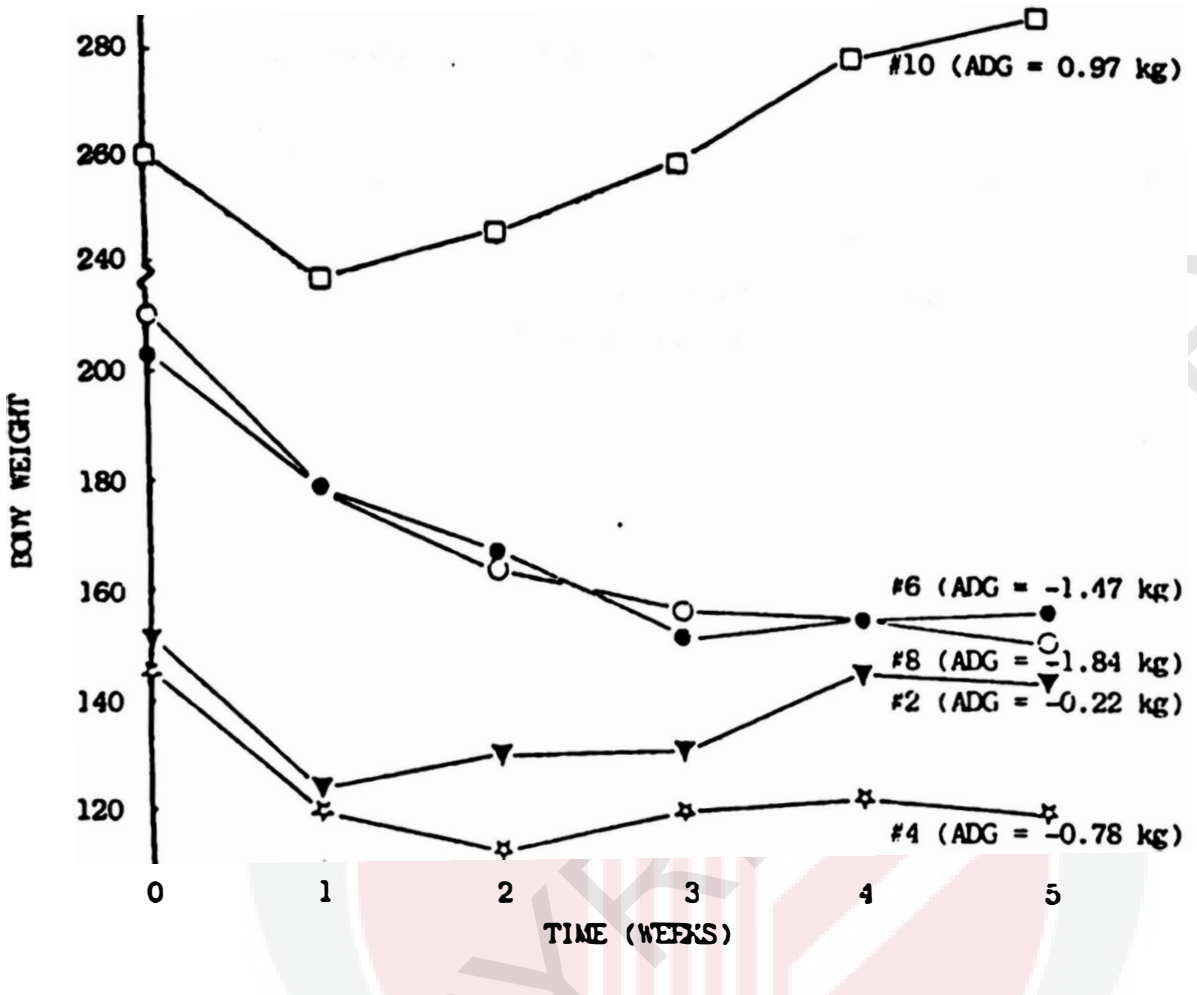
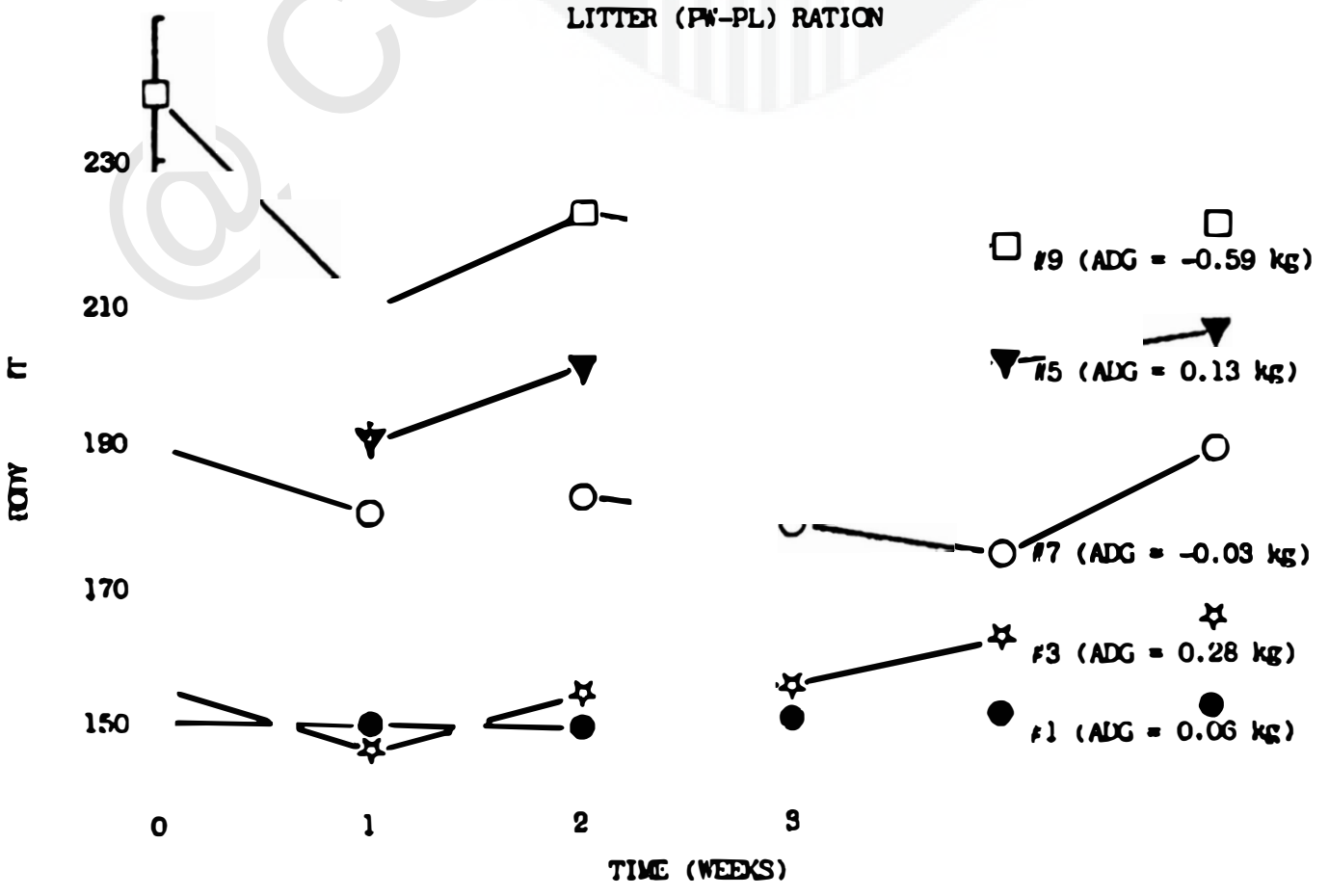


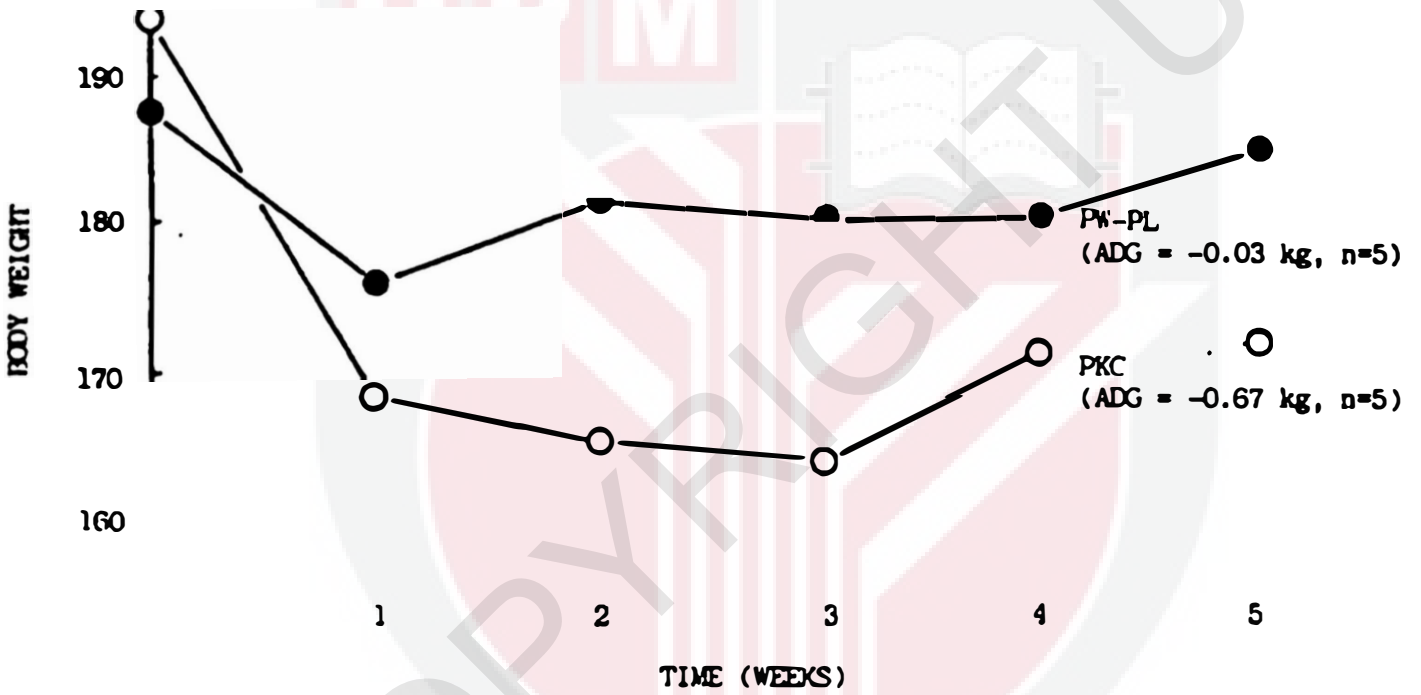
FIG. 2. PERFORMANCE OF ANIMALS FED PINEAPPLE WASTE-POULTRY LITTER (PW-PL) RATION



All animals on PKC ration lost weight, except for animal #10 which showed an ADG of 0.97 kg/day (Fig.1). On PW-PL based ration (Fig.2), two animals lost weight, while the rest showed overall increases with ADG between 0.06-0.28 kg/day.

The mean liveweight change of both groups of animals is shown below in Fig.3.

FIG. 3 MEAN LIVEWEIGHT CHANGE OF ANIMALS FED TWO TYPES OF RATION



It must be noted that prior to this feeding trial, all the animals were housed in group pens and fed PW-PL based ration. The adaptation period in this trial was the result of two factors. Confinement in individual pens was a factor that involved both groups of animals. Furthermore, one group underwent a sudden change of diet from PW-PL to PKC. The period when adaptation was over was taken as the point at which the animals started to gain weight. Hence the adaptation period for the group whose diet had been changed from PW-PL to PKC was longer (3 weeks) while that of those animals continued on PW-PL ration was 1 week.

The DMI levels are shown in Figs.4 and 5. Four animals on PKC ration showed overall increased DMI, except for animal #8 which showed no change in DMI throughout the trial. There was overall increase in DMI for all animals fed PW-PL ration.

FIG. 4 DRY MATTER INTAKE (DMI) OF ANIMALS FED PALM KERNEL CAKE (PKC) RATION

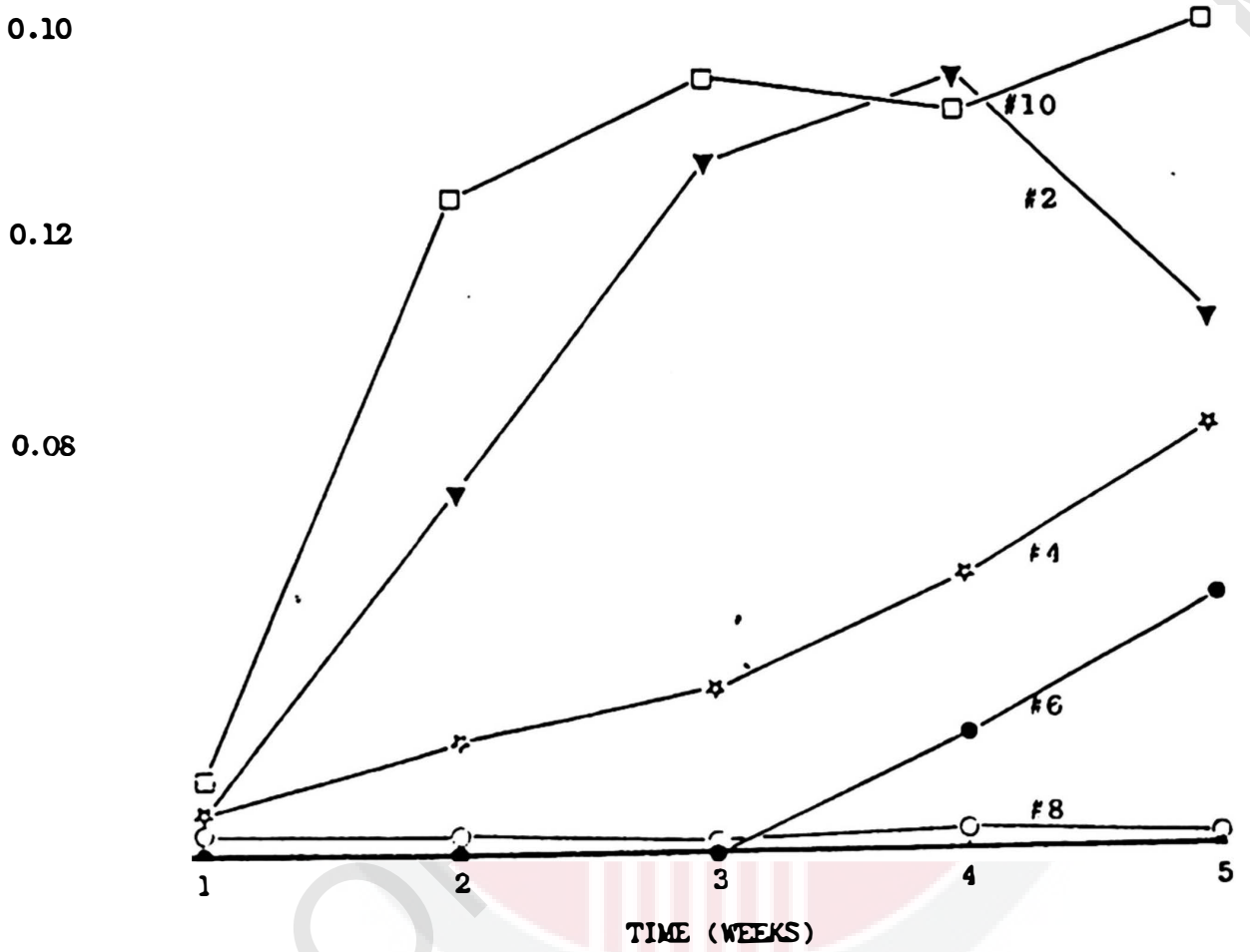


FIG. 5 DRY MATTER INTAKE (DMI) OF ANIMALS FED PINEAPPLE WASTE-POULTRY LITTER (PW-PL) RATION

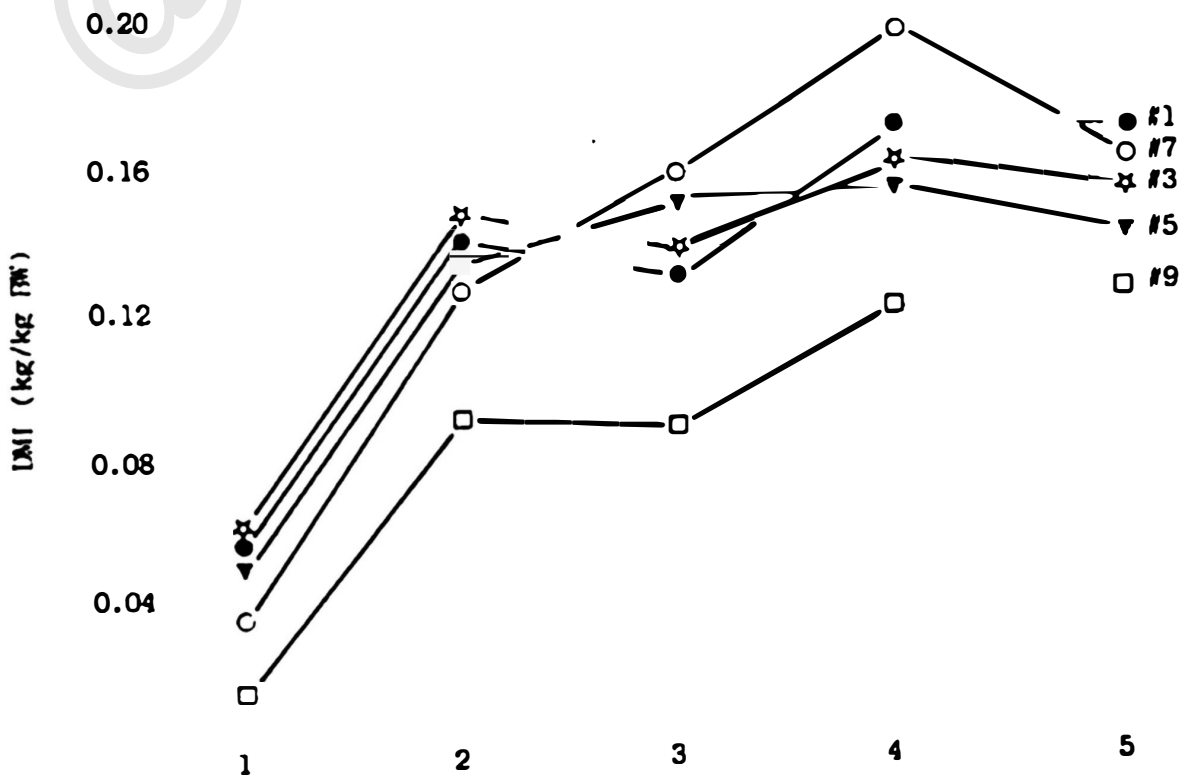
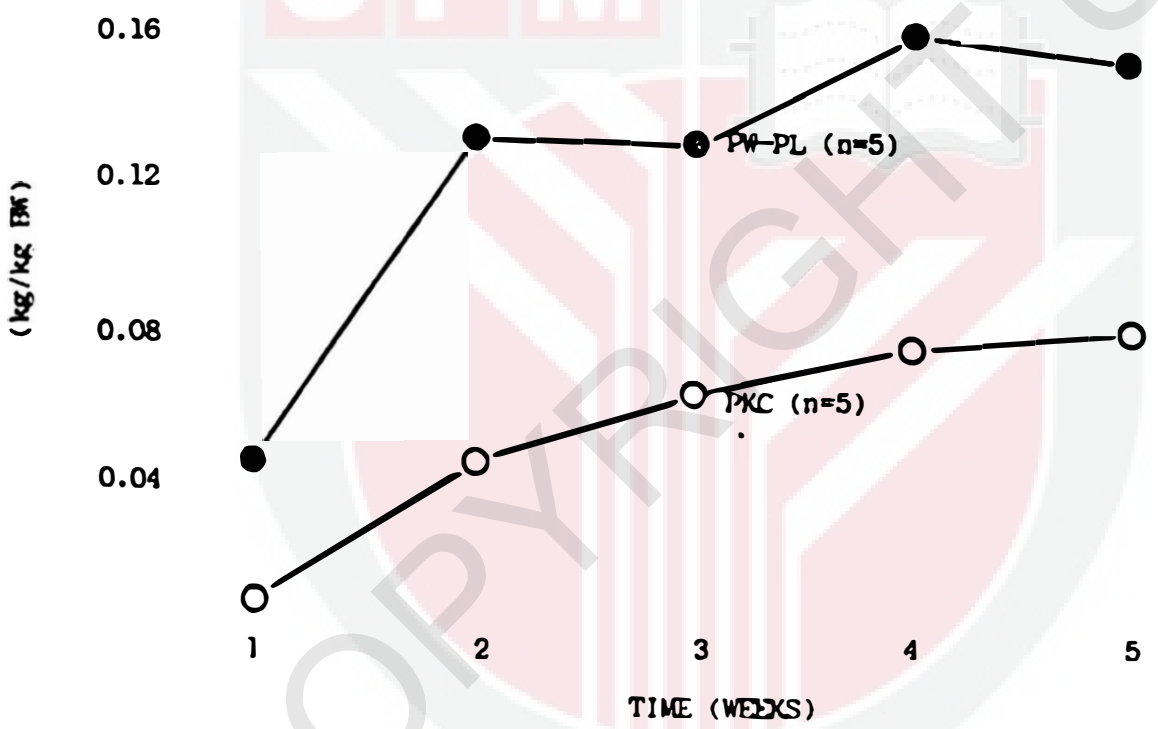


Fig.6 presents the average DMI for both groups. For the group on PW-PL, the average DMI increased markedly until the second week, after which it was maintained or increased only gradually. In contrast, the average DMI for the group fed PKC increased gradually throughout the feeding trial. The average DMI of animals on PW-PL was 0.61 kg/kg BW, while that of animals fed PKC was 0.27 kg/kg BW.

FIG. 6 AVERAGE DRY MATTER INTAKE (DMI) OF ANIMALS FED TWO TYPES OF RATION



The performance of experimental animals is shown in Table 2.

TABLE 2. PERFORMANCE OF EXPERIMENTAL ANIMALS

Item	Diet	
		PW - PL
No. of animals	5	5
Average initial body weight, kg/head	193.6	187.2
Average final body weight, kg/head	172.4	186.2
Feeding period, days	32	32
Average daily gain, kg/day	-0.67	-0.03
Average daily feed intake, kg/kg BW	0.01^{a}	0.16^{b}
Average daily DMI kg/kg BW	0.009^{a}	0.018^{b}

^{a,b} Means on the same row with differing superscript letters 5% level

It is interesting to note that animals in both groups showed overall weight loss for the duration of the trial, but the lossesare not significantly different (P<0.05). The meanweight loss for the group fed PW-PL was only 1.0 kg, while that for the other group was 21.4 kg. The ADG of both groups is not significantly different (P<0.05) because of the large standard error and the small sample size. The average daily feed intake and average daily DMI were significantly higher (P<0.05) for the PW-PL based group; this indicates that the ration is more palatable than PKC.

4.2 Analyses of Records

4.2.1 Performance

4.2.1.1 Mini-feedlot

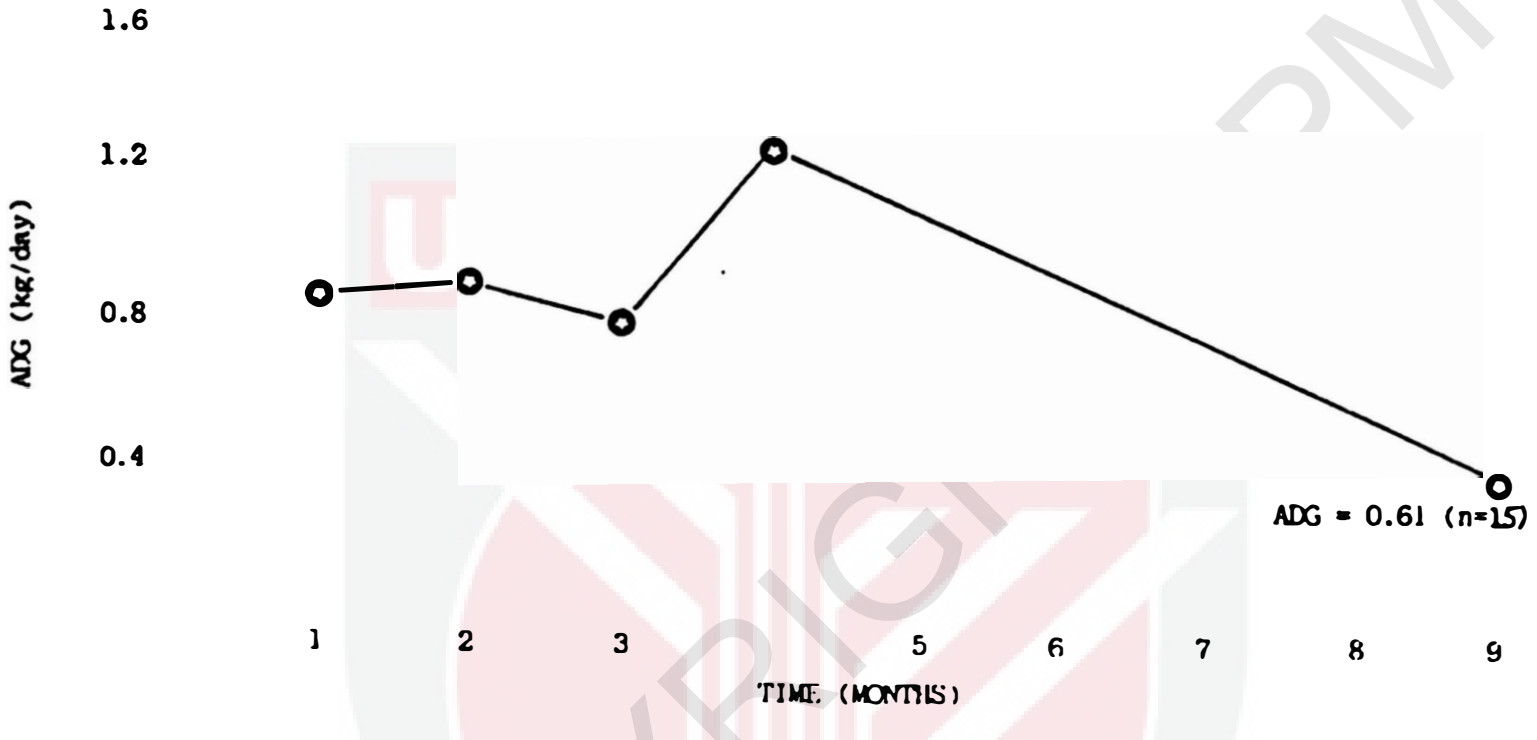
The performance of crossbred cattle under mini-feedlot is shown in Table 3. The average growth rate ranged between 0.54-0.66 kg/day, with a mean of 0.61 kg/day.

TABLE 3. PERFORMANCE OF CATTLE UNDER MINI-FEEDLOT PROJECT IN GELANG PATAH, JOHOR BAHRU

Item	Farmer 1	Farmer 2	Farmer 3	Mean
No. of animals	5	5	5	5
Average initial body weight, kg	118.4±26.1	116.0±14.7	110.0±9.4	114.8±17.2
Average final body weight, kg	292.4±26.7	293.3±40.3	255.6±32.3	280.4±36.0
Fattening period, days	270	270	270	270
Average total gain, kg	174.0±25.6	177.3±33.1	145.6±28.3	165.6±30.7
Average daily gain, kg/day	0.64±0.09	0.66±0.12	0.54±0.10	0.61±0.11

Fig.7 shows the growth rate of mini-feedlot animals. The fattening period was unusually extended (270 days) due to marketing problems at that time.

FIG. 7 GROWTH RATE (ADG) OF ALL ANIMALS IN MINI-FEEDLOTS



The maximum ADG of 1.22 kg/day was attained between the third and fourth month, after which the growth rate declined. It is suggested that these animals should have been kept for about 120 days for maximum profit.

4.2.1.2 Commercial Feedlot

The imported A.C.C. cattle in this feedlot had an average starting weight of 250 kg, and an average finishing weight of 340 kg. The fattening period of 180 days gave an ADG of 0.5 kg/day. On the contrary,Chandapillai et al.(1977) reported that crossbred cattle showed an ADG of 1 kg/day in similar feedlot.

4.2.2 Economic Evaluation of the Feedlots

Table 4 compares growth performance and some economic evaluation of mini-feedlot and commercial feedlot operations. This was based on various assumptions (Appendix 1).

TABLE 4. GROWTH PERFORMANCE AND SOME ECONOMIC EVALUATION ON CATTLE FED PKC (MINI-FEEDLOT PROJECT) AND PINEAPPLE WASTE-POULTRY LITTER (COMMERCIAL FEEDLOT OPERATION)

Ration	ADG (kg/day)	Average DMI (kg/head/day)	Feed/Gain Ratio (kg feed/kg gain)	($/kg feed)	Cost of Feed ($/head/day)	($/kg LWG)
PKC	0.6	6.4	11.45	$0.26	$1.82	$2.98
PW-PL	0.5	7.2	100.00	$0.017	$0.85	$1.70

Ration	Returns ($/head/day)	Gross Returns ($/head/day)	($/head/fattening period)	Annual Turnover (Animals/yr)	Annual Gross Returns ($/yr)
PKC	$1.95	$0.13	$35.10	1.4	$49.14
PW-PL	$1.60	$0.75	$135.00	2.0	$270.00

The feed/gain ratio of PKC fed cattle was about nine times less than that for the PW-PL fed animal. This means the former ration was about nine times more efficient in producing 1 kg of liveweight gain.

The cost of PW-PL based ration is very much lower compared to PKC. Consequently, the feed costs ($/head/day and $/kg LWG) were lower for PW-PL based ration.

On the other hand, the returns ($/head/day) for PKC were greater due to the higher ADG. But the gross returns ($/head/day and $/head/fattening period) for animals fed PKC were very much lower. This was due to the relatively costlier PKC. Consequently, the annual gross returns ($/year) for the PKC fed cattle were very much lower.

It must be noted that the above economic evaluation for PKC ration was based on data beseiged with marketing problems at some time. If such problems had been solved and the mini-feedlot animals marketed after 120 days, it has been estimated that the annual gross returns would have been about $381.60, which would have made it more profitable than the commercial feedlot operation using pineapple waste-based ration (Appendices 2 and 3).

Hence based on this short feeding trial and available data, PKC is believed to be more profitable as a sole ration under feedlot conditions, which agrees with the findings of Mustaffa-Babjee et al. (1984).

5. CONCLUSION

The growth performance of cattle will be greatly affected when diet composition is suddenly altered from pineapple waste-poultry litter based ration to 100% expeller palm kernel cake ration. Hence, it is recommended that the change in feeding system be gradual in order to prevent drastic retardation of the rumen microbial ecosystem. Hence, a longer feeding trial period encompassing more research needs to be conducted in this area.

In order to maximise profitability in mini-feedlots, their animals should be fattened for no more than four months. However, this fattening period may be slightly altered depending upon the initial body weights of animals being introduced into this scheme.

6. BIBLIOGRAPHY

1. Chandapillai, M.M. and Selvarajah, T. (1977): Agricultural waste utilization - feeding regimes and livestock performance. Proc. Symp. on Feedingstuffs for livestock in South East Asia, 1977, pp. 318-330.

2. Devendra, C. (1971): Recent advances in animal nutrition. MARDI Report No.2, 1973, pp. 1-21.

3. Devendra, C. (1975): Feeding beef cattle in relation to systems of production. MARDI Report No.31, 1975, pp.13-21

4. Devendra, C. (1975): Agricultural by-products for animal feeding in Malaysia. MARDI Report No.31, 1975, pp. 1-12.

5. Devendra, C. (1977): Utilization of feedingstuffs from the oil palm. Proc. Symp. on Feedingstuffs for livestock in South East Asia, 1977, pp. 116-131.

6. Hutagalung, R.I., Mahyuddin, M.D., Braithwaite, B.L., livestock. Proc. Symp. on Feedingstuffs for livestock in South East Asia, 1977, pp. 259-288.

7. Hutagalung, R.I., Mahyuddin, M.D., Braithwaite, B.L., Vijchulata, P. and Dass, S. (1984): Digestibility and performance of cattle fed palm kernel cake and ammoniated palm pressed fibre under intensive system. Proc. 8th Ann. Conf. MSAP, 1984, pp. 87-91.

8. McDonald, P., Edwards, R.A. and Greenhalgh, J.F.D. (1982): Animal Nutrition. 3rd Ed. ELBS and Longman, U.K.

9. Muller, Z.O.(1977): Economic aspects of recycling animal wastes. Proc. Symp. on Feedingstuffs for livestock in South East Asia, 1977, pp. 289-313.

10. Muller, Z.O. (1980): Feed from animal wastes: State of knowledge. FAO Animal Production and Health Paper No.18, Rome 1980.

11. Muller, Z.O. (1982): Feed from animal wastes:Feeding manual FAO Animal Production and Health Paper No.28, Rome 1982.

12. Mustaffa-Babjee, A., Hawari, H. and Rosli, M.R. (1984): Palmbeef:A value added product of palm kernel cake. Proc. 8th Ann. Conf. MSAP, 1984, pp. 92-93.

13. Palmbeef dari PKC (1985): Bingkisan Penternak Bil. 1 Jabatan Perkhidmatan Haiwan, Kementerian Pertanian Malaysia, 1985.

14. Raghavan, V. (1977): Pineapple bran as a feedingstuff. Proc. Symp. on Feedingstuffs for livestock in South East Asia, 1977, pp. 331-336.

15. Senik, G. and Idrus, A.Z. (1977): Chemical treatment of pineapple bran for improving digestibility and utilization. Proc. Symp. on Feedingstuffs for livestock in South East Asia, 1977, pp. 200-207.

16. Sukri, M.H.I. (1980): Availability of agricultural by-products and their potential as cattle feeds in Johor Barat. MARDI Report No.70, 1980, pp. 1-7.

17. Sukri, M.H.I. (1981): The utilization of palm press fibre and palm kernel cake by beef steers in feedlot. MARDI Res Bull. (1981) 9,1:(121-125).

18. Sukri, M.H.I. (1981): The performance of Kedah-Kelantan cattle fed with pelleted pineapple bran ration. MARDI Res Bull. (1981) 9,2:(202-206).

19. Tinnimit, P. (1977): Dried poultry waste as an animal feed. Proc. Symp. on Feedingstuffs for livestock in South East Asia, 1977, pp. 314-317.

APPENDIX 1

ASSUMPTIONS FOR GROWTH PERFORMANCE AND ECONOMIC EVALUATION OF CATTLE FED PKC (MINI-FEEDLOT PROJECT) AND PINEAPPLE WASTE-POULTRY LITTER (COMMERCIAL FEEDLOT OPERATION)

(1) Average daily feed intake (as fed)

PKC 7 kg/head/day
PW-PL - 50 kg/head/day

(2) % Dry Matter of Ration

PKC - 91.6%
PW-PL - 14.4%

(3) Average retail market price of Beef was $3.20/kg LWG

(4) Other costs (Labour, Buildings, Utilities) were not considered due to unavailable data

(5) Fattening period (from data)

PKC - 270 days
PW-PL - 180 days

(6) Average liveweight gain based on (5)

PKC - 165 kg/head
PW-PL - 90 kg/head

APPENDIX 2

ASSUMPTIONS THAT WOULD PREVAIL HAD THE MINI-FEEDLOT ANIMALS BEEN MARKETED AFTER 120 DAYS

---

(1) Average daily feed intake (as fed)

PKC 7 kg/head/day
PW-PL - 50 kg/head/day

(2) % Dry Matter of Ration

PKC - 91.6%
PW-PL - 14.4%

(3) Average retail market price of Beef was $3.20/kg LWG .

(4) Fattening period

PKC - 120 days
PW-PL - 180 days

(5) Mini-feedlot fed PKC (from data)

Mean starting wt = 115 kg
Mean finishing wt = 224 kg
Hence average LWG = 109 kg
ADG = 0.9 kg/day

(6) Commercial feedlot fed PW-PL (from data)

Mean starting wt = 250 kg
Mean finishing wt = 340 kg
Hence average LWG = 90 kg
ADG = 0.5 kg/day

APPENDIX 3

GROWTH PERFORMANCE AND SOME ECONOMIC EVALUATION OF CATTLE FED PKC (MINI-FEEDLOT PROJECT) AND PINEAPPLE WASTE-POULTRY LITTER (COMMERCIAL FEEDLOT OPERATION), BASED ON ASSUMPTIONS AS PER APPENDIX 2

Ration	ADG (kg/day)	Average DMI (kg/head/day)	Feed/Gain Ratio (kg feed/kg gain)	($/kg feed)	Cost of Feed ($/head/day)	($/kg LWG)
PKC	0.9	6.4	7.71	$0.26	$1.82	$2.00
PW-PL	0.5	7.2	100.00	$0.017	$0.85	$1.70

Ration	Returns ($/head/day)	Gross Returns ($/head/day)	($/head/fattening period)	Annual Turnover (Animals/yr)	Annual Gross Returns ($/yr)
PKC	$2.88	$1.06	$127.20	3.0	$381.60
PW-PL	$1.60	$0.75	$135.00	2.0	$270.00