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RESEARCH ARTICLE

Feeding Management and Farmer Concerns about Constraints to Production on Malaysian Dairy Farms

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ABSTRACT

Farm production and business performance data were collected from 30 dairy farms in Peninsula Malaysia. The farms were split into three groups to assess the impacts of farm management on cow milk yields. The first paper reported on key aspects of the herd management, the unit cost of milk production, net farm profits and returns on farm assets. This second paper focuses on the costs of feed nutrients and the balance of these nutrients in the rations fed to cows, yearling heifers and calves. It also provided an insight into the key farm constraints as perceived by the farmers themselves and an opportunity to assess some of the factors contributing to Malaysia's current low self-sufficiency in dairy products.

The high unit energy and protein costs of the more commonly used feeds are a concern considering the availability of other more cost-effective supplements. The better farmers who produced more milk per cow also fed their dry cows and yearlings better. Suboptimal stock performance, expressed as reduced growth rates in calves and yearlings, poor reproductive performance and low milk yields in adult cows, arose due to shortages in feed supplies, hence their feed nutrients, as provided by farmers. Protein deficiencies were likely to limit performance of all the classes of livestock on these farms. Furthermore, appetites would have been restricted through low rates of feed digestion and poor cow comfort. Upgrading farmers' skills in formulating more cost-effective and better nutrient balanced rations and in addressing the many constraints to cow comfort should be high priorities with Malaysian government dairy advisers.

The farmer's list of constraints was as expected. They included shortages of land for growing forages, high feed costs, shortages of "quality cows", poor farm infrastructure and support from service providers and inferior reproductive performance. The economic data generated in the study was used to calculate the potential savings from improved herd management practices. For example, reducing the age of heifers at first calving by 6 months can reap a profit of RM1400 per heifer while reducing calving interval by 3 months can return an extra RM 1150 per milking cow. Increasing the lactation length by 2 months can reap RM 760 per milking cow while milk rearing calves on calf milk replacer rather than fresh milk can generate an extra RM 275 profit per calf.

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INTRODUCTION

In a previous paper, Moran and Brouwer (2013) provided many valuable insights into why some farms in the humid tropics are productive and profitable why others are not. In essence, higher per cow milk yields and lower costs of milk production can be found on farms that were better equipped and better managed. Investments in improved feeding and herd management can yield good returns provided the farmers have the skills to improve their day-to-day decision making and farm practices to better utilise these additional financial inputs (Chantalakhana and Skunmum 2002). Moran and Brouwer (2013) noted that such financial benefits can be achieved in improved efficiencies of annual returns on farm assets (both its total value and the farmers' equity or

that part they actually own) and as well as in reduced daily unit milk production costs.

This survey of 30 farms in Peninsular Malaysia monitored cow and herd production and farm costs and returns. This second paper reports on additional measures of nutrient costs, feeding management of the other stock in the dairy herd and the key reasons why farmers themselves often find it difficult to achieve improved production and profit targets. The study also provided an opportunity to assess some of the factors contributing to Malaysia's current low self-sufficiency in dairy products.

In 2011, Malaysia produced only 35 million liters of milk from its 21,000 milking cows, which supplied just 6% of its national demand for milk and dairy products. Over the last 10 years, Malaysia's dairy self-sufficiency has only increased from 3 to 6%, in marked contrast to other SE Asian countries such as Indonesia, Vietnam and Thailand, which now supply 30, 31 and 50% respectively of their national demands for raw milk (FAOSTATS 2013). Malaysia, like most Asian dairy industries over the last ten years (Dudgill and Morgan 2008) has had pro-active national programs to increase domestic milk production which as yet, have been unable to achieve much impact. As these 30 farms formed part of this national investment, the findings from this survey will provide valuable insights into how Malaysia can hope to achieve the dramatic increases in domestic milk production it is seeking.

MATERIALS AND METHODS

Full details of the methodology have previously been provided by Moran and Brouwer (2013). Briefly, visits were made to 31 dairy farms in Peninsular Malaysia over a 4 week period during October 2012 to collect data on cow production, herd performance and farm profitability. During each 2 to 3 hour visit, observations were made of the general state of the stock and supporting farm infrastructure and each farmer was interviewed about key aspects of their farm management, the costs of farm inputs and their herd performance (using a detailed questionnaire). Questions were both technical and attitudinal in nature with the final question being an open one "Please list the three major constraints to your overall dairy farm performance and profitability".

Farmers were asked to list the quantities of feeds they offered their different classes of dairy stock each day on average, namely:

- Lactating (or milking) cows
- Dry cows (pregnant and non-pregnant)
- Yearlings or weaned heifers
- Milk-fed calves (heifers and bulls)

These quantities were provided on an "as fed" basis (kg/animal/d) and were then converted to dry matter (DM) offered then allocated values for contents of metabolisable energy (ME) and protein (CP) using data readily available in reference texts such as Malaysia's Department of Veterinary Services booklet (2009) and Moran (2005, 2012a, 2012b). When stock were provided with opportunities to graze, their pasture intakes were estimated as 20 kg fresh forage/day for milking cows, 15 kg/d for dry cows and 7.5 kg/d for yearlings. If total DM intakes (grazed pasture and concentrates) exceeded 3% of live weight (400 to 450 kg for milking cows), the assumed grazed pasture intakes were adjusted back to that total DM intake. Daily total intakes per animal (milking cow, dry cow, yearling or milk fed calf) of DM and ME, the contents of ME and CP in the total ration and the daily feed costs (in Malaysian Ringgits or RM) were calculated for each farm. For calculating the feed costs, the home grown forages were given a token cost of RM 0.10 per kg for fresh grass.

The data from one farm was considered too unreliable because the calculation of some of the KPI provided nonsensical values, so data from this farmer were excluded from any analyses. This left 30 farms for the data analyses.

The farms were categorized into three groups (designated A, B and C) based on increasing herd milk yields (MY in kg/cow/d). The 10 farms with the lowest yielding cows were designated as Group A, the second 10 farms as Group B and the 10 farms with the higher yielding farms as Group C. As the data presented in the tables were all the mean values of three lots of ten farms stratified in a continuous array, any statistical analyses could not consider these three groups as discrete entities. Accordingly, statistical assessments of the feed intake and ration quality data were undertaken using the correlation coefficient for data from all 30 farms. The level of significance of the correlation coefficients was presented in Table 2. A significant correlation coefficient could then be interpreted as a meaningful association between that measure of feeding management and the resultant MY.

The full statistical analyses and discussion of herd and farm production and the business performance have been presented by Moran and Brouwer (2013). This paper presents data on the nutrient costs, the feeding management on each farm, the diversity of concerns expressed by these farmers about the constraints to farm production and the potential cost savings from some improved herd practices.

RESULTS AND DISCUSSION

Cost of feed nutrients

Data on the cost and nutritive value of the diversity of feeds are presented in Table 1. The number of farms using each feed is detailed in the table while the feed costs are the average values calculated from the range of costs provided for each feed type by the farmers. The DM, ME and CP contents are the preferred values derived from the literature sourced while the nutrient costs are those calculated using data from the previous columns. The feeds are categorized into forages, energy feeds, protein feeds and inorganic additives and have been listed in increasing costs of energy in RM/MJ (for forages and energy feeds) and of protein in RM/kg (for protein feeds).

On an energy basis, the cost of forages varied from 0.02 (corn factory waste) to 0.07 RM/MJ (maize silage, maize stover and rice straw) whereas the farmer who purchased the fresh whole crop maize paid an expensive 0.20 RM/MJ.

Table 1: Typical cost in Malaysian Ringgits fresh (MR/t) and the contents and cost of dry matter (DM) in RM/kg, metabolisable energy (ME) in RM/MJ and crude protein (CP) in RM per kg of feeds fed on dairy farms in Peninsula Malaysia

	N	Cost	DM	ME	CP	Cost (RM/unit) of		
		RM/t	%	MJ/kg	%	DM	ME	CP
Forages								
Corn factory waste	1	42	25	9	8	0.17	0.02	2.1
Oil palm frons	1	100	40	5	10	0.25	0.05	2.5
Napier grass	26	100	25	8	11	0.40	0.05	3.6
Maize silage	2	100	20	8	8	0.53	0.07	6.6
Maize stover	2	100	20	7	7	0.50	0.07	7.1
Rice straw	3	363	85	6	6	0.43	0.07	7.1
Fresh whole crop maize	1	350	25	7	8	1.40	0.20	17.5
Bean sprouts	1	-	20	6	20	-	-	-
Energy feeds								
Waste rice noodles	2	475	85	14	5	0.56	0.04	11.2
Sago pith	1	200	35	14	1	0.57	0.04	57.1
Sago waste	1	100	25	11	1	0.40	0.04	40.0
Waste bread	2	550	90	13	13	0.61	0.05	4.7
Dried distillers grain	1	700	90	14	30	0.78	0.06	2.6
Biscuit pieces	1	550	90	11	12	0.61	0.06	5.1
Pineapple waste	1	130	20	9	7	0.65	0.07	9.3
Ground maize grain	6	853	90	13	11	0.95	0.07	8.6
Broken rice	1	980	89	13	7	1.10	0.08	15.7
Enerlac*	1	1200	75	17	3	1.60	0.09	53.3
Molasses	26	905	75	11	3	1.21	0.11	40.2
Dairy cattle pellets	23	1063	90	11	17	1.18	0.11	6.9
Calf muesli	1	3000	90	12	22	3.33	0.28	15.2
Calf milk replacer	1	6720	96	19	20	7.00	0.37	35.0
Cassava roots	1	-	30	10	2	-	-	-
Cassava (Tapioca) mill waste	1	-	30	10	5	-	-	-
Protein feeds								
Urea	3	1900	90	0	280	2.11	-	0.8
Brewers grain	13	135	25	10	25	0.54	0.05	2.2
Sesame cake	1	900	90	9	40	1.00	0.11	2.5
Soybean waste	12	126	20	10	20	0.63	0.06	3.2
Copra cake	3	850	90	11	21	0.94	0.09	4.5
Soybean meal	3	1967	90	14	45	2.19	0.16	4.9
Palm kernel extract	19	747	90	10	16	0.83	0.08	5.2
Soy bean hull pellets	7	911	90	11	18	1.01	0.09	5.6
Fish meal	1	2750	90	8	50	3.06	0.38	6.1
Rice bran	1	700	90	8	12	0.78	0.10	6.5
Leucaena leaves	1	-	30	8	22	-	-	-
Inorganic additives								
Mineral premix	23	3900	95	-	-	-	-	-
Salt	22	400	95	--	-	-	-	-
Mineral blocks (10 kg)	13	3300	95	-	-	-	-	-
Di calcium phosphate	9	2570	95	-	-	-	-	-
Limestone	3	450	95	-	-	-	-	-
Sodium bicarbonate	1	1800	95	-	-	-	-	-
Star Bio*	1	13000	95	-	-	-	-	-

*Enerlac is a commercial energy supplement and Star Bio is a commercial probiotic

The most popular energy feeds were molasses and dairy cattle pellets (used by 26 and 23 farmers respectively) but these were also the most expensive (at 0.11 RM/MJ) compared to the other energy feeds fed to milking cows. Ground maize grain was a commonly used feed (on 6 farms) and was considerably cheaper (0.07 RM/MJ).

The most popular protein feeds were palm kernel extract and brewer's grain (used by 19 and 13 farmers respectively). The usage of brewer's grain was restricted to those farmers who could readily source this cheapest form of protein supplement, restricted by their location and local availability. Only three farmers used urea, the cheapest source of feed nitrogen, this probably being due to the lack of farmers who were confident in its incorporation into the ration supplement.

Trace mineral mix and salt were the most popular inorganic additives (on 23 and 22 farms respectively) with di calcium phosphate and limestone used as calcium additives only 12 of the farms. Very few farms specifically fed rumen buffers, although they may have been incorporated into the formulated dairy cattle pellets. A couple of farmers fed proprietary supplements supplying either energy or probiotics.

Intakes of feeds and feed nutrients

The intake, composition and quality of feed and the daily feed costs for the various stock categories are presented in Table 2, categorised into the three farm groups differing in herd average daily milk yields.

Table 2: The intake, composition and quality of feed and daily feed costs on farms with differing average milk yields, grouped into either A, B or C (10 farms per group) based on increasing average milk yields (kg/cow/d). Cor is correlation coefficient relating farm average milk yield to each variable.

Farm and feed data	Mean	A	B	C	Cor	Sig
Herd average daily milk yield (kg/cow/d)	9.8	7.5	9.7	12.4	-	
Milking cows						
Dry matter intake (kg/cow/d)	12.6	10.8	12.4	14.6	0.62	***
Metabolisable energy intake (MJ/cow/d)	107	87	106	130	0.71	***
% forage in ration DM	47.5	56.9	42.8	42.7	-0.35	
% concentrate in ration DM	50.8	41.2	55.1	56.0	0.36	*
% additive in ration DM	1.7	1.9	2.0	1.3	-0.07	
Farms with cows grazing pasture	-	5	4	2	-	
Ration dry matter content (%)	36.1	33.6	35.7	38.9	0.40	*
Ration metabolisable energy content (MJ//kg DM)	8.5	8.1	8.5	9.0	0.41	*
Ration crude protein content (%)	12.0	11.6	12.1	12.3	0.25	
Daily feed costs (RM/cow/d)	9.20	7.44	8.75	11.41	0.63	***
Dry cows						
Dry matter intake (kg/cow/d)	8.7	7.9	8.4	9.9	0.32	
Metabolisable energy intake (MJ/cow/d)	68	58	64	82	0.37	*
Ration dry matter content (%)	30.3	27.6	31.4	31.8	0.15	
Ration metabolisable energy content (MJ//kg DM)	7.8	7.4	7.6	8.3	0.24	
Ration crude protein content (%)	9.9	8.6	11.1	10.0	0.28	
Daily feed costs (RM/cow/d)	4.54	3.90	4.39	5.34	0.31	
Yearlings						
Dry matter intake (kg/animal/d)	4.4	4.1	4.4	4.7	0.18	
Metabolisable energy intake (MJ/animal/d)	35	32	33	40	0.25	
Ration dry matter content (%)	33.4	34.2	34.6	31.5	-0.12	
Ration metabolisable energy content (MJ//kg DM)	8.0	7.7	7.8	8.4	0.17	
Ration crude protein content (%)	10.2	9.7	11.8	9.2	0.07	
Daily feed costs (RM/animal/d)	2.46	2.32	2.26	2.81	0.20	
Calves						
Dry matter intake (kg/animal/d)	3.2	3.5	2.7	3.2	-0.06	
Metabolisable energy intake (MJ/cow/d)	17	17	14	18	0.10	
Ration metabolisable energy content (MJ//kg DM)	5.9	5.0	5.9	6.7	0.25	
Ration crude protein content (%)	8.2	7.0	8.0	9.6	0.27	
Daily feed costs (RM/animal/d)	6.38	7.14	5.33	6.68	0.03	

Sig; significance of correlation coefficient; * P<0.05, *** P<0.001

Significant associations were observed with the milking cows between milk yield and DM intake, % concentrate in the ration, hence ration quality and daily feed costs. Similar trends were noted with much of the data collected from the dry cows and yearlings but only in one case, namely ME intake of dry cows, was it statistically significant. The daily DM and ME intakes and the ration ME contents tended to increase on the farms with the higher milk yields. In other words, the better farmers who produced more milk per cow also fed their dry cows and yearlings better. As expected, increased concentrate feeding increased total ration ME and CP and decreased DM contents in the milking cow rations. When farmers grazed their milking cows (11 out of 30 farmers), milk yields was lower (9.0 v 10.3 kg/cow/d) due primarily to depressed feed intakes (10.8 v 13.6 kg DM/cow/d).

With regards to the milk-fed calves, the farms varied considerably in their daily allocation of fresh milk per calf. One farmer fed 5 L/calf/d, two farms fed 4 L, whereas the majority fed only 2 L/calf/day. Seven farms fed either 100% calf milk replacer or a combination of these two feeds. Daily feed costs for the milk-fed calves ranged nearly fivefold, from RM 2.71 to 12.80 /calf/day. However the level of milk feeding or total feed costs for calves was not related to the milk yield of their dams.

Constraints to herd performance and farm profitability

Each farmer was asked to highlight the three biggest problems on their farms that were constraining herd performance and farm profitability and these are summarised on Table 3. There was no pattern of these constraints across the three farms groups differing in cow milk yield. This table provides a valuable list of farmer perceived problems with the high priority ones being:

- Limitations to feed supplies, such as land to grow forages and high concentrate costs
- Shortages of quality cows that is, improved dairy cattle rather than indigenous stock
- Sourcing farm workers
- Connection to services, such as electricity and piped water
- Problems with reproductive management, such as AI services supplied by government inseminators
- the lack of general technical support by government advisers and staff from cooperatives

DISCUSSION

Unit costs of energy and protein

The unit cost of dietary nutrients is one of the Key Performance Indicators highlighted by Moran (2009b). The high unit energy and protein costs of formulated dairy cattle pellets and molasses are a concern considering the availability of other more cost-effective supplements such as ground maize grain, dried distillers grain and broken rice. One excellent and cheap, though low protein, supplement is sago pith although it does require some

effort to split the trunks and extract the pith from the sago palms. There is a wide diversity of agro-industrial by products, many still with low extraction rates that could be better integrated into current dairy feeding systems (Wadhwa and Bakshir 2013). More usage could also be made of urea, as a very cheap source of dietary nitrogen that can be safely fed in conjunction with molasses, a readily available source of fermentable energy. The high levels of energy-rich supplements sometimes used and the very low usage of rumen buffers could contribute to sub clinical rumen acidosis and associated lameness (Moran 2005) that was observed on some of these farms. Furthermore, it cannot be assumed that all dairy cattle pellets contain adequate levels of rumen buffers, considering the fact that many farmers supplemented their milking cows with molasses, a rapidly fermentable carbohydrate. Clearly improving the farmers' skills in formulating more cost-effective rations for all classes of dairy stock, but particularly milking cows, should be a high priority with Malaysian government dairy advisers.

Table 3: Summary of farm problems highlighted by farmers and the frequency of their mention

Problem	Frequency
Need more land for forages (including better quality land)	12
High concentrate costs	10
Need more cows	11
Availability of employed labour	7
Need better genetics of dairy stock	6
Need electricity connected	5
Poor AI service provided by government inseminators	4
Poor shed design (ventilation and cow cooling)	4
Poor technical support (nutritional and veterinarian)	4
Need better water supplies (including water quality)	3
Problems dealing with government advisers and veterinarians	3
Poor skills of employed labour	2
Poor reproduction and herd fertility	2
High costs of purchased stock	2
Low milk price	1
Poor productivity of current stock	1
Tradition of older generation	1
Need to improve milk harvesting system	1
Need to purchase bucket milker (but father will not agree to the loan)	1
Poor cash flow	1
Not enough milk	1
Local cooperative untrustworthy	1
High young stock mortality	1
Easier access to farm (in oil palm plantation) on weekends	1
Need for farm machinery for cultivating land for forage	1
Subclinical mastitis	1
Forage supplies too distant from farm	1
Mud around sheds	1
Difficulty of collecting payments for private milk sales	1

Nutrient requirements and that supplied by the farmers

Despite interviewing farmers who had little documentation of their feeding programs, the use of generic nutritive values of the diversity of feeds and the assumptions made of forage intakes of grazing stock, the derived feeding management data provided a relatively accurate estimate of nutrient supplies to the various classes of dairy stock. Nutrient requirements, derived from feeding tables sourced by Moran (2005, 2012c), and the data calculated in the current survey were as follows:

- Milking cows: Housed and non-pregnant 400 kg cows, each producing 10 kg/d of milk (with 4.4% fat and 3.1% protein) require a ration supplying 101 MJ of ME/d and 14 to 16% protein, depending on their stage of lactation. The mean values were 107 MJ/d of ME and 12.0% protein (which ranged across herd groups from 87 to 130 MJ/d and 11.6 to 12.3% protein). This indicates protein deficiencies in many of these herds.
- Dry cows: Housed and 8 months pregnant 400 kg dry cows each require a ration supplying 60 MJ of ME/d and 10 to 12% protein. The mean values were 68 MJ/d of ME and 9.9% protein. This indicates a marginal protein deficiency in many of these herds.
- Yearlings: Housed 9 to 12 month old heifers weighing 200 kg and growing at 0.4 kg/d each require a ration supplying 38 MJ of ME/d and 12% protein. The mean values were 35 MJ/d of ME and 10.2% protein. This indicates a more severe protein deficiency in many of these herds.
- Milk-fed calves: Milk-fed calves weighing 100 kg and growing at 0.5 kg/d each require 21 MJ of ME/d and 14 to 16% protein. The mean values were 17 MJ/d of ME and only 8.2% protein. Clearly many of these calves were growing considerably below target rates for milk-fed calves due to shortages of both dietary energy and protein.

Suboptimal stock performance, expressed as reduced growth rates in calves and yearlings, poor reproductive performance and low milk yields in adult cows (Moran and Brouwer 2013), arose due to shortages in the supplies of forages and supplements, hence their feed nutrients, as provided by farmers. Protein deficiencies were likely to limit performance of all the classes of livestock on these farms. Furthermore, appetites would have been restricted through low rates of feed digestion, due to imbalances of essential nutrients (such as drinking water), and also by reduced cow comfort in poorly designed and managed housing facilities. High levels of heat stress, the use of tie stalls and shortages of thick rubber mats were all factors leading to reduced cow comfort (FAO 2011).

Clearly upgrading farmers' skills in formulating better nutrient balanced rations and addressing the many constraints to cow comfort should also be high priorities with Malaysian government dairy advisers.

Addressing the constraints to current levels of herd performance and farm profitability

The list of constraints arising from the farmer questionnaires are as expected (Moran 2013), namely:

- Shortages of land for growing forages means that farmers must greatly depend on purchased supplies of forage over which they have less control of feed quality.
- High feed costs. Dairy cattle pellets and molasses, the most commonly used energy feeds, have the highest cost per unit energy of other alternatives (Table 1).
- Shortages of "quality cows". All too often, farmers blame the cows, rather than their lack of management skills, for poor stock and herd performance.

- Poor infrastructure, which includes power, water and local labour supplies.
- Poor support from service providers. This becomes increasingly apparent since many of the government services are free and this provides little incentive for the private sector to develop and compete for such services.
- Poor reproductive performance. Reduced milk yields through under nutrition may be accepted as "normal" by many farmers but in many SE Asian countries, farmers routinely complain about high ages at first calving, lengthy calving intervals and poor conception rates to AI.

In addition to those highlighted by the farmers above, the authors developed the following list:

- Climate control, through fans in every shed, sprinkler system in most of them and higher roofs with open air spaces at the apex.
- Cow comfort, through thick rubber mats, free stalls, better shed hygiene and closer attention to treat and prevent lameness.
- Sufficient clean drinking water.
- Better agronomic management of existing forages, such as routine use of inorganic fertilisers and shorter harvest intervals, to reduce forage fibre levels, stimulate more rapid feed digestion rates hence promote better appetites and cow performance.
- Improved milking hygiene practices such as more frequent replacement of rubber liners and greater attention to mastitis management.
- Financial assistance to source more feed to better feed existing animals prior to sourcing credit to buy more stock.
- Capacity building (both advisers and famers) with the two priorities being firstly, nutrition and feeding management and secondly, farm business management.

Potential savings from improved herd management practices

One of the best ways to encourage farmers to consider ways to improve their current management is to demonstrate the economic benefits from such practice changes. For example, every additional kg of milk produced generates an extra RM 1.45 above the cow feeding costs. Below are five examples of such savings, calculated from economic data derived from this survey:

Reducing age at first calving by 6 months (from 33 to 27 months)

Additional income: For a milking cow, milk income less feed costs is RM 1.45/kg milk or RM 14.50/d for a milking heifer producing say 10 kg/d or RM 2610 over 180 days.

Additional costs: Daily feed costs for a milker is RM 9.20/d while for yearling, it is RM 2.46/d, or RM 6.74/d difference. Over 180 days, this amounts to RM 1213.

Net profit: RM 2610 additional income less RM 1213 additional costs amounts to RM 1397/heifer profit when calving 6 months earlier.

Reducing calving interval by 3 months (from 17 to 14 months)

Additional income: For a milking cow, milk income less feed costs is RM 1.45/kg milk or RM 17.40/d for a milking cow producing 12 kg/d or RM 1566 over 90 days.

Additional costs: Daily feed costs for a milker is RM 9.20/d while for a dry cow, it is RM 4.54/d, or RM 4.66/d difference. Over 90 days, this amounts to RM 419.

Net profit: RM 1566 additional income less RM 419 additional costs amounts to RM 1147/cow profit when calving 3 months earlier.

Increasing the lactation length by 2 months (from 8 to 10 months)

Additional income: For a milking cow, milk income less feed costs is RM 1.45/kg milk or RM 17.40/d for a milking cow producing 12 kg/d or RM 1044 over 60 days.

Additional costs: Daily feed costs for a milker is RM 9.20/d while for a dry cow, it is RM 4.54/d, or RM 4.66/d difference. Over 60 days, this amounts to RM 280.

Net profit: RM 1044 additional income less RM 280 additional costs amounts to RM 764/cow profit when milking for an additional 2 months.

Reducing the costs of calf rearing by replacing raw milk with calf milk replacer (CMR)

CMR powder costs RM 6720/t and makes 7690 L CMR solution (at 130 g/L solution), therefore costs RM 0.87/L solution. Raw milk sells for RM 2.40/kg or RM 1.63/kg more. For a milk-fed calf fed 2kg/d of milk for 12 weeks (or 84 days), using CMR provides RM 274/calf savings.

Reducing the costs of calf rearing by replacing calves suckling cows for 9 months cost with 4 months of feeding CMR

From 4 above, CMR costs RM 0.87/L solution compared to RM 2.40/kg for raw milk. Assuming a suckling calf will drink 3 kg raw milk/d for 9 months, or 810 kg over 9 months, this costs RM 1944/suckling calf. By rearing the same calf on 2 L/calf/d of CMR solution and weaning it at 4 months, total CMR costs are RM 146/calf. The daily feed costs of yearlings are RM 2.46/d or RM 369/weaned heifer over 5 months (although this would be for yearling heifers). Total feed costs are then RM 515/CMR reared calf versus RM 1944 for the suckling calf, or RM 1429/calf savings. There may be a difference in live weight at 9 months of age between these two calves because of their vastly different rearing programs.

The economic data generated in this survey will provide the opportunity to more objectively assess many different variations in current and improved management practices.

An overview of Malaysia's dairy industry

Despite the fact that Malaysia's farm gate milk prices are among the highest in SE Asia as is their milk to feed price ratio (Ahuja and Staal, 2013), domestic milk production in Malaysia has stagnated over the last decade. There are many contributory factors for Malaysia to have "flat lined" in domestic milk production. Among the possible reasons are:

- Dairy farming is expensive in the tropics because of lack of suitable stock, forages and quality ingredients for concentrate formulations. Farmers react by demanding higher milk prices but processors respond by purchasing more of their dairy ingredients from cheaper overseas sources.
- The poor understanding of most dairy farmers of how dairy cows need to "function" to become profitable units of investment. They are just not simply "cash cows". They are living animals that require a degree of nurturing to remain healthy and productive. Basically dairy cows are temperate animals, so to fully utilise their propensity to produce milk, they need to be provided with as comfortable an environment (in a very torrid hot and humid climate) as possible.
- Many farmers enter the industry with little, if any, practical experience in managing a dairy enterprise. Ideally novice dairy farmers should have spent time either growing up on a farm or at least working on one, before they decide to invest their assets and livelihood in a dairy farm.
- Unfortunately the banks and other credit agencies often lack the technical skills to assess the suitability of an applicant for a loan to invest (and further invest) in dairy farming. Consequently unwise dairy loans can be made.
- On the whole, few farmers are business minded as they only consider profits through increasing unit milk returns rather than taking a more logical approach, namely reducing unit costs of milk production. This can be done either through reducing unit prices of farm inputs or diluting many of them through increased levels of milk production.
- Over the last decade, there have been several attempts to establish large scale intensive dairy enterprises in Malaysia. Unfortunately most of these have failed to produce a long term, sustainable and profitable dairy feedlot in the country. In other SE Asian countries, successful models are apparent so one should expect at least one to have evolved within Malaysia.
- There seems to be a lack of structured and ongoing encouragement within government advisers for farmers to share their problems and discuss possible solutions in dairy production technology. Other countries have dairy cooperatives in which communication lines are better developed between farmers. Farmers can learn a lot from each other rather than rely on government advisers, many of whom lack the practical experience in the day to day activities of a tropical dairy enterprise.
- There are many free services provided by government. There has always been the approach the government should look after infant industries such as dairy farming, but a common result occurs if farmers do not have to pay for such services themselves, so they value them less.
- Many of the farmers do not use government veterinary services (and only some use private veterinarians) or artificial insemination (they use their own bulls), because they find the services unreliable.
- There appears to be a gross shortage of experienced and competent private dairy farm consultants in Malaysia. The government is becoming a training ground for those who eventually freelance their skills. Universities should also provide such advisers both from within their teaching ranks and from well trained graduates in all aspects of dairy production technology. However in dairy farming, this has hardly occurred in Malaysia.
- As in most developing dairy industries, much of the technical support originates from trained veterinarians. However, veterinarians are trained to attend to sick animals and not healthy and potentially highly productive stock such as milking cows. Formal university training in dairy science requires a greater emphasis on the practical applications of the physiology and the economics of increasing per cow, per herd and per farm production.
- Many of the nutrition advisers in the dairy industry were originally trained in monogastric nutrition (poultry and pigs) whereas specialist dairy nutritionists require a theoretical and practical background in ruminant nutrition and physiology.
- In addition to providing advice on nutrition and feeding management, dairy farmers, both large operators and smallholders, require consultants with practical knowledge in many aspects of dairy production technology. These include forage production, rearing young stock, optimising cow comfort (through appropriate housing and climate control), milk harvesting and of even greater importance, farm business and entrepreneurial skills in managing a large investment such as a profitable and successful dairy enterprise.
- Government agencies could be more proactive in fostering relationships with the private sector through the formation of both formal and informal Public Private Partnerships. These should be seen as collaborative rather than competitive.

National policy makers in Malaysia's dairy support services, both government and agribusiness, would benefit from addressing much of the above in conjunction with greater collaboration with some of their SE Asian neighbours. The FAO in SE Asia is represented by APHCA (Animal Production and Health Commission for Asia and the Pacific) of which Malaysia is a member. It has recently established the Asia Dairy Network (APHCA 2013) to improve communication and knowledge sharing among stakeholders in Asia and the Pacific region along the entire dairy value chain. Recent initiatives in this Network include an e-conference on agro-industrial by-products for small holder farmers, a "Question and Answers" open forum and regular sessions at future international animal science congresses.

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