Cattle Integration in Oil Palm Plantation through Systematic Management

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ABSTRACT

The oil palm industry in Malaysia has expanded rapidly from 60,000 ha in 1964 to 4.49 million ha in 2008. More than 80% of the matured areas may provide vast opportunity for integration with livestock. This is to maximize the utilization of such production resources as feeds, land and workforce. Cattle integration in oil palm plantation offers one of the best options to increase local beef and dairy supply. Studies and observations on cattle-oil palm integration have shown promising benefits in terms of savings in weeding and labor costs, as well as improved biological and agro-ecosystem impact. A case study on systematic management for the integration of cattle into oil palm was conducted at Sawit Kinabalu Sdn Bhd plantations. The objective of the study is to evaluate the effect of systematic management of cattle integration in oil palm plantation on labor requirement and weeding cost. The study comprised of data collection from participating plantations with regards to maintenance, labor cost, chemical/herbicides usage and yield. The results showed that the integration of cattle into oil palm through systematic management is sustainable. The results also indicated that cost savings in maintenance, labor requirement and labor cost can be achieved.

Key words: cattle integration, oil palm industry, weeds, systematic management

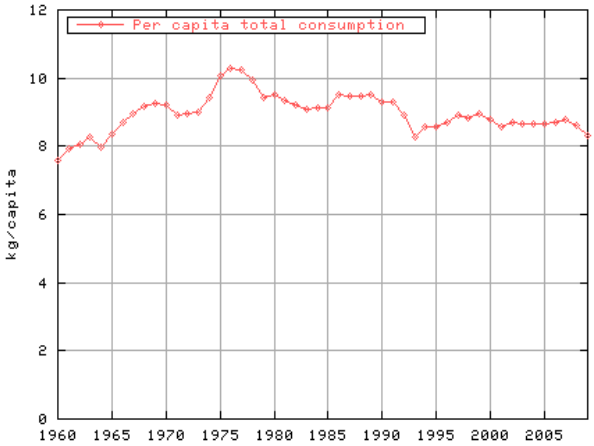
INTRODUCTION

Sustainability of Palm Oil Industry

The world's palm oil production was 36.85 million metric tons (USDA Report, 2007) and palm oil is the main commodity for Malaysia. It has been the most significant agriculture sector that generates around 30% of the Malaysian economy. Both Malaysia and Indonesia are the two leading palm oil producers in the world with an estimated planted area of 4.48 million hectares in Malaysia (MPOB, 2008) and 6.07 million hectares in Indonesia (USDA Report, 2007).

The year 2000 has witnessed the most difficult and challenging year for the industry when surplus stock had caused the commodity price spiraling down below production cost. Further speculation and the environmental issues of global warming have serious negative impact to the industry sustainability. Several measures and initiatives have been taken by Malaysian government to stabilize the situation through Malaysian Palm Oil Board, Malaysian Palm Oil Council and the plantation sector. Among others is the replanting directive to lower down the stock and to diversify its utilization such as bio-fuel.

The raid expansion of oil palm plantation has leads to single or mono cropping land utilization. This will predispose the commodity to biological and economic risk. Alternative approaches must be offered to minimize the risk and simultaneously utilize the plantation area towards resource maximization. One of which is through systematic integration of livestock into the oil palm plantation area.



Source: USDA (2007).

Figure 1. Per capita total consumption of beef

Beef Supply

The increasing world population has affected food self sufficiency level including red meat. Figure 1 below shows the world's per capita consumption from 1960 to 2005 at the range level 7.8kg to 8.5kg (USDA, 2007).

In Malaysia the per capita consumption of beef has increased from 4.3 kg in 1995 to 6.7 kg in 2005, and projected to further increase to 8.4 kg by 2010 (Table 1). Even though the self sufficiency level in steadily improved from 19.2% (1995) to 22.5% (2005), the imported beef into Malaysia from Brazil, Australia, India, New Zealand, Thailand and China has continually increased from 85,277mt to 102,304mt in 2007 (Malaysia Veterinary Department, 2008).

Ruminant Industry in Southeast Asia

Large ruminant particularly cattle and buffalo is an essential historical component of the agricultural sector in South East Asia. They have been providing draught power for agriculture activities, mean of transport and source of meat. Increasing meat consumption requires bigger ruminant population, hence higher forages requirement to feed them. Remenyi and Mc William (1986) suggested the need for doubling of forage supply for the livestock, and one obvious source of naturally occurring forage and of land for improvement of forage supply is the area under plantation crops. The presence of a range of perennial tree crops in many of the countries of South East Asia provides a common platform for development of integrated system involving ruminants. Production system integrated with perennial tree crops like coconut, rubber, oil palm and fruits as well as the use of available agro-industry by-product.

Cattle Integration in the Oil Palm Plantation

The integration of cattle in oil palm is a form of mixed farming where the combinations of the two commodities can be synergized in order to optimally utilize the same piece of land. The two commodities, when properly integrated can contribute towards sustainable food production system. They are 60 to 70 species of undergrowth under oil palm plantation consisting of planted leguminous cover crop, naturally growing grasses, broad leaves and ferns. These are considered as weeds that need to be controlled periodically with either chemical spray or manual slashing. These are potential feeds source as the yields, palatability and nutritive values are adequate for cattle. Under appropriate conditions and systematic management, cattle can be effectively used for weed control. The use of cattle as a biological weed control mechanism in oil palm plantation allows the establishments of a harmonious relationship between cattle, the undergrowth and oil palm. Reduced herbicides usages are environmentally healthy, and simultaneously help to reduce total weeding cost through lower volume of chemical use and reduced and extra labor. Reduced herbicides usage means reduced maintenance cost and less environmental contamination and pollution (Azid, 2004).

In Malaysia, 39.2 million hectares of the oil palm plantation areas are suitable for integration (MPOB, 2009). Samsudin (2002) and Harun (2003) as sighted by Azid (2004) reported that by implementing the integrated system, the estates manage to save between 30 to 60% of the maintenance cost especially on herbicides. Rosli (2000) concluded that the systems will also improved productivity per unit area of land and it may also contribute positively to local beef production.

Table 1. Projected and self-sufficient level of beef in Malaysia (1995 – 2010)

	1995	2000	2005	2010	Average annual growth rates (%)			
					1995-2000	2000-2005	2005-2010	1995-2010
Projected total demand	88	122.5	172.3	240	6.8	7.1	6.9	6.9
Per capita consumption (kg)	4.3	5.3	6.7	8.4	4.3	4.8	4.6	4.6
Self-sufficiency level (%)	19.2	20.8	22.5	24.4	1.6	1.6	1.6	1.6
Forecast production ('000 tones)	16.9	20.3	23.9	28	3.7	3.3	3.2	3.4

Source: Ministry of Agriculture (2006)

Table 2. Comparison between non-systematic and systematic management of cattle integration in oil palm plantation

No.	Non-systematic management	Systematic management
1.	The cow owner and estate worker left the cow graze in the oil palm grazing area without realized the cattle received insufficient ruminants (Hadi, 1998)	The estate management will ensure the cattle will get sufficient ruminants supply by using the portable electric fence (Rosli, 2000)
2.	The cow owner has sent the cattle to the same place of grazing which could cause the soil compaction.	Through the "cattle smart system", cattle only graze at one piece of land four times in a year and minimal compaction (Zainuddin, 2008)
3.	The cattle were exposed with the disease such as mainly brucellosis in the oil palm plantation.	The systematic management will carry out the health management system to ensure free from disease such as brucellosis, tuberculosis and leptospirosis (Rosli, 2000).
4.	The cattle was no permanent identification	The cattle have the permanent identification
5.	The inbreeding was always occurred in non-systematic cattle rearing.	The management will always do the selection after grazing rotation completed. The green looting will be carried out to avoid inbreeding.
6.	Normally the owners or the farmers reared the local breed	The estate management will rear the imported breed.

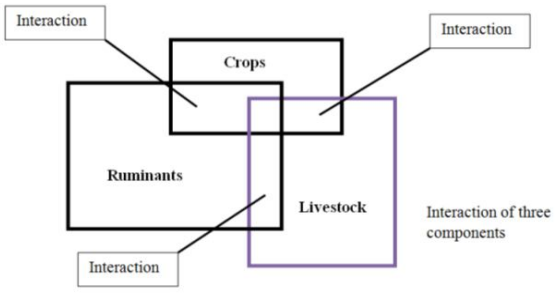
Systematic management of cattle integration in oil palm plantation defined as a management of cattle that integrated with oil palm where the objectives are to maximize the land used through the optimal use of resource and also to control the weeds through biological control with the cattle integration system. This involved the strategic insertion in the activities of cattle integration without disturbing the estate operation such as harvesting, manuring maintenance work and other related estate operations.

The integration system with the major crops was not a new concept and has been practiced when the coconut was introduced in Malaysia (Sani et al., 1993). Cattle in the oil palm have existed since the establishment of plantation crop in the country. Traditionally cattle production was managed through open grazing system. The cut and carry system using coconut by product, tapioca waste, banana waste and *Imperata cylindrica* and weeds has been practiced earlier.

Types of Ruminants-Oil Palm Interaction

There are many benefit of crop-animal-soil interaction (Devandra and Thomas, 2002). The following interactions are common, almost all of which result in tangible benefit:

i. Benefit effect of shade and available feeds on livestock.
ii. Draught animal power on land preparations and effect on crops growth.
iii. Beneficial effect of dung and urine on soil fertility and crops growth
iv. Used of crop residue and agro-industrial by product (AIBP) from tree in situ.
v. Use of native vegetation and effects on cost of weed control, crops management and growth.
vi. Type of animal production system



Source: Rosli (1998)

Figure 2. Illustration concept of crop-livestock integration

The interactions can be positive or negative depending on types of livestock and trees, age of trees and management system. Cattle are well suit to integration with tree crops such as coconut and oil palm. However sheep, cattle and buffaloes are not suitable with rubbers as they caused damage to tree bark and disturb the latex collection cups.

Forage Supply in Oil Palm Plantation

Under oil palm plantation, light penetration allows forages or 'weeds' to grow and there are more than 50 species identified (Wong and Chin, 1998). The common weeds as *Ottochlora*

nodosa, *Axonopus compresses*, *Mikania micranta* and *Asystapia intrusa*. The Table 3. below shows their nutrient values.

Table 3. Nutrient value contain from the natural forage in Malaysia

Location	Species	Nutrient Contain	
		Raw protein	Raw Fiber
Rubber plantation	Weed	11.4	33.1
	Fern	13.4	27.2
Oil palm	*P. conjugatum*	15.8	-
	A. compressus	13.0	-
	O. nodosa	16.8	-
	I. cylindrical	8.7	-
	N. biserrata	18.2	-
Open shade	*A. compressus*	7.5	30.0
	P. conjugatum (4 weeks)	13.6	26.3
	Guinea (4 weeks)	12.4	33.8
	I. cylindrica	11.7	32.0
	Asystasia intrusa	15.8	35.8
	P. phaseoloides	22.8	33.5
	C. pubescens	25.4	35.7

Source: Mustapa (1983) dan Chin (1991).

Table 4. Difference of labor cost with cattle integration (1912 hectares) and without grazing area

No.		Manual	Grazing	±Difference
1.	Total mandays	14	2	-12
2.	Cost/manday (RM)	15.00	30.00	- 15
3.	No. of spraying rounds (*Imperata*, circle spraying and woodies)	1 ½	1 ½	
4.	Labor force/ha/year	1:137	1:956	819 ha

Source: Samsuddin (2002).

The objective is to evaluate the effect of systematic management of cattle integration in oil palm plantation on labor requirement and weeding cost.

MATERIALS AND METHODS

This study is based on analysis of secondary data. Discussion with Sawit Kinabalu Farm Products Sdn Bhd was held to get clearer picture of the model and the operation of integrating cattle under oil palm. The any adverse effect to existing palm oil production (Azid, 2008). The integration model comprises of pilot project and feasibility study which incorporate two important strategic mechanisms: ***strategic insertion*** and ***strategic rotational grazing management***.

RESULTS AND DISCUSSION

Cost Saving in Weeding and Labour

The cattle integration in the oil palm plantation can reduce the cost of weeding and labor. Weeding is still carried out as not all the weeds grazed by the cattle such as *Clidemia hirta Melastoma malabatricum*, *Pennisetum spp*. and other brushes. Chong (2001) observed significant 60% reduction in workers requirement to perform weeding with the introduction of cattle. He reported that with 144 head of grazing cattle, only two (2) workers are required to perform weeding in 400ha mature oil palm instead of six (6) under normal circumstances.

The savings from weeding varies according to the stages of integration. In the first two years the saving can be as much as 30%, and increased further to more than 70% when the number of cattle is at optimum with palatable undergrowth (Harun, 2003). Samsudin (2002) reported significant saving on labor requirement and weeding cost.

Table 5. Comparison cost summary cattle integration project

No.	Types	Before cattle project			After cattle project			± Difference	Saving percentage
		Total expenditure for 5 years (RM) (1991–1995)	Area completed (Hectare)	Cost per hectare	Total expenditure for 7 years (RM) (1996-2002)	Hectare completed	Cost per hectare		
1	Weeding	771,398.26	9, 536. 85	80.89	512,419.91	13,380.99	38.29	-42.60	52.66%
2	Lallang	168501.23	9536.85	17.67	109386.14	13380.99	8.17	-9.50	53.76%
Total		939899.49	9536.85	98.55	621806.05	13380.99	46.47	-52.08	52.85%

Source: Samsuddin (2002)

Table 6. Cattle population growth in Mensuli and Sandau Estates

Estates	July 2002	July 2003	December 2003	December 2004
Mensuli	197	-	348	407
Sendau		224	268	287
Total		421	616	694
%Increase			146	65

Source: Azid (2008).

The weeding area was coverage per labor tremendously increased by almost 600% from 137 ha to 956 ha, which leads to total weeding cost saving of 52.85% (Table 4). The fact that grazing cattle is contributing positively towards weed control is undeniable. As circle and spot spray of herbicides normally cover about 25 per cent of planted area, the weeds are 'cleared' naturally by rearing of sheep, cattle, goats, or deer under the palm (Anon, 2006). Combined together with biological pest control, both will help to reduce the use of herbicides and pesticides in oil palm estate.

Cattle Integration Projects in Sawit Kinabalu Sdn Bhd

Two pilot projects were conducted successfully in two 'experimental' estates which indicate that cattle had survived and multiplied. The cattle population had increased by 65 per cent within two years with no significant negative impact on overall estate management (Table 6).

The common agronomic practices such as harvesting, manuring, maintenance were carried out as planned. It was also observed that the cost of weeding in Mensuli estate was reduced by 21 per cent after cattle was introduced (Table 7).

Feasibility Study

In his feasibility study, Azid (2004) reported that 36,028 ha was suitable for integration, and should be able to accommodate up to 20 000 heads of cattle. The integration model was then adopted to handle three thousand heads of cattle "breeders" and 97 head of stud bulls that were brought in from Australia in three consignments over two years in 2005 and 2006 (Table 8).

The introduced cattle had settled down and multiplied as they adapted to the new environment as illustrated in Figure 3. As of September 2009 there are 8,288 heads of cattle integrated under oil palm and distributed in 14 estates across the region of Lahad Datu (59%), Tawau (30%) and Sandakan (11%); details of which are shown in Table 9.

The total grazing area has reached 22,224 ha and stocking rate varies between 1.9 and 3.7 ha per head depending on forage availability under the palm and on-going replanting program at the respective estate.

Strategic Insertion

In the strategic insertion approach, the introduction of the cattle into an estate operation is carefully planned by studying its existing operation, mainly harvesting, manuring, and up keep or maintenance. This is basically the 'fact-finding mission' to determine the suitability of the estate in terms of individual estate manager's understanding and commitment, availability and types of weeds of vegetation, herd size and timing of introduction (Azid, 2007). "Dry-weight-rank' (DWR) method described by Aminah and Chee (1999) as cited by Azid (2004) can be a very useful estimation tool to determine the population size. Sufficient fund has to be allocated for stock purchase as well as basic infrastructure as described by Rosli (2000). Cattle shall be introduced during the time when operational activity is minimal. Rosli (2000) and Azid (2004) had concluded that commitment of estate management is the perquisite for successful cattle-oil palm integration. The strong commitment and understanding will be translated into supportive approach toward it implementation, and potential operational matters shall be constructively handled and adjusted to accommodate the 'additional' activity within the same premise. The SKSB top management team has been the driving force toward the successful adoption of the model as its provides confidence to them that the core business of producing palm oil will never be compromised along the way (Azid, 2007).

The newly introduced cattle need to be 'conditioned' to adjust themselves with new environment as well as new feeding regime that are physiologically stressful especially for

imported cattle. The cattle should be exposed gradually to new feedstuff comprising of common 'weed' under oil palm as described by Aminah and Chee (1999), with the rotational grazing management using electrical fencing. Addressing these factors in strategic insertion had allowed successful management of the 'stressed period' to both people and the animals, hence contributed positively to cattle performance.

Table 7. Weeding cost at Mansuli estate

Year	2001	2002	2003	2004
Wedding cost (RM/ha/yr)	79.40	63.30	60.80	63.50

Source: Azid (2008).

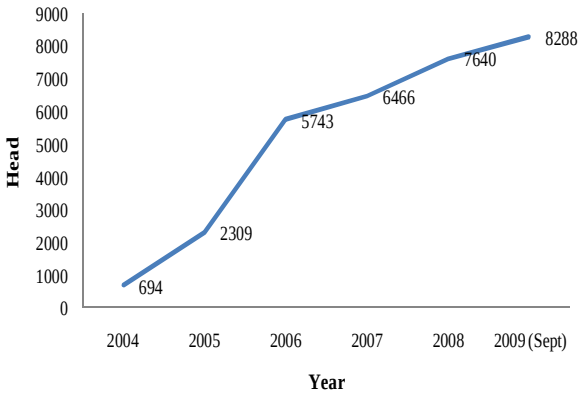
Table 8. Cattle breeder important for oil palm-cattle integration system

Year	Breeders	Stud bulls
2005	1004	50
2006	1041	47
2007	1054	0
Total	3009	97

Source: Azid (1998).

Grazing Management

The application of strategic rotational grazing management through the use of mobile electrical fencing is a dynamic process in which cattle grazing will be adjusted to suit the operational requirement of the estate. Movement of cattle within the estate will be synchronized with such estate common agronomic practices as harvesting round, fertilizer application, weeding round, and other important activities. Ideally, grazing cattle should be ahead of the other estate operational activities. 'Collision' will occasionally happen when grazing cattle and estate activity arrive at the same spot. The strategic rotational grazing management will require constant adjustment and modification according to prevailing estate operation to minimize such 'collision' and to reap the optimum benefit from grazing cattle as 'biological lawn-mower' (Azid, 2007). This explains the different level of saving in weeding cost achievement (15 to 40%) among the participating estates.



Source: Sawit Kinabalu Farm Products Sdn. Bhd Data (2009)

Figure 3. Cattle Population in Sawit Kinabalu Sdn. Bhd

Table 9. Cattle distribution and grazing area under oil palm estates

Region	Estate	Grazing area (ha)	Cattle Population (head)	Stocking rate (ha/head)
Tawau	Sg Balung	1,689	566	3.0
	Madai	2,394	716	3.3
	Sg Kawa	1,077	405	2.7
	Bongalio	2,549	766	3.3
	Matamba	0	0	0
	Sebrang	1,639	650	2.5
	Mensuli	1,370	373	3.7
Lahad Datu	Sandau	2,005	715	2.8
	Boonrich	1,590	661	2.4
	Bagahak 1	1,370	719	1.9
	Bagahak 2	1,919	1027	1.9
	Bagahak 3	2,360	761	3.1
Sandakan	Gomantong/Green	974	379	2.6
	Menanggol	1,288	550	2.3
Total		22,224	8,288	2.68

Source: Azid (2009).

The most significant highlight of the model of integration adopted by SKSB is the fact that the primary operation of its estate to produce fresh fruit bunch (FFB) was not affected by the introduction of cattle. Azid (2008) had sighted Kok (2008) observation that the presence of cattle in the participating estates had never been identified as important factor affecting yield as compared to other such more prominent factors as rainfall, nutritional status and operational efficiency. He further noted that the notion of soil compaction due to grazing cattle was unfounded as he observed that grass regeneration was rapid, luxuriant and complete after each grazing round. Similar observations had also been reported elsewhere by Rosli (2000) and Samsudin (2002). Further research is very much required to possibly quantify the relationship.

CONCLUSIONS

The cattle integration in oil palm can be successful venture through systematic approach and implementation. The holistic approach of cattle-oil palm integration encompasses Good Agriculture Practices (GAP) elements. It is environmentally friendly as it reduce herbicides use by offering biological weeds control, reduce labor requirement, palm productivity not being compromised and optimized available resources (land and feedstuff). It's synergistic, cost effective and augurs well toward sustainable agriculture.

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