

# Economic Analysis of Beef Cattle Integration in Mature Oil Palm

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## ABSTRAK

*Lembu yang sering dianggap sebagai perosak kepada tanaman sawit boleh digunakan sebagai agen kawalan rumpai yang berkesan untuk tanaman matang. Kaedah integrasi lembu yang sistematik dengan menggunakan pagar elektrik mudah alih sebagai kawalan ternakan telah terbukti boleh menyesuaikan kepada ladang sawit. Sistem ragutan bergilir yang diamalkan untuk kawalan rumpai boleh menyumbang kepada pencapaian matlamat program pengurusan perosak bersepadu. Pendekatan yang menyeluruh kepada integrasi yang sistematik boleh mengharmonikan kewujudan lembu di dalam sawit dan dalam masa yang sama ia adalah berdaya maju secara ekonomi. Sehingga tahun 1998, telah terdapat sebanyak 120 ladang dan 300 blok felda peneroka yang memelihara sebanyak 71 838 ekor lembu dengan menggunakan kaedah yang sistematik. Dari pemerhatian yang dijalankan ke atas perladangan yang telah menjalankan integrasi, dua model ekonomi yang mengambil kira jangka masa sepuluh tahun telah dibina. Model tersebut ialah penternakan secara ibu-anak dan penternakan lembu penjantan sahaja. Dari model yang dibina, kadar pulangan dalaman yang diperolehi untuk penternakan ibu-anak ialah 13% dan untuk penjantan sahaja ialah 77%. Manakala kadar keberuntungan kosnya pula ialah 1.17 untuk ibu-anak dan 1.19 untuk penjantan sahaja pada kadar diskaun sebanyak 12%. Nilai semasa bersih yang diperolehi pada kadar diskaun yang sama untuk model ibu-anak ialah RM13 720 dan RM703 061 untuk model penjantan sahaja. Sistem integrasi yang sistematik ini patut dijalankan oleh pihak perladangan, selain dari menjadi matlamat dasar Kerajaan, ia juga berdaya maju dan boleh mapan.*

## INTRODUCTION

The presence of stray cattle in oil palm estates has always been considered a serious problem because they eat up fronds and chew on fruit bunches (Chung *et al.*, 1995). They also cause soil compaction and damage to drainage. The negative impact of cattle on oil palm plantations occurs only in situations where there is no proper control of the animals (Chen *et al.*, 1996). High stocking density and grazing for long periods on the same area uncontrolled will result in reduced crop yield.

Cattle has always showed an affinity for oil palm plantations because of the presence of numerous types of weeds, which are tempting to their palates. There are 60 to 70 species of weeds consisting of planted legume cover crops, naturally growing grasses, broad leaves and ferns, which can be considered as feed to cattle. Under normal agronomic practices of the plantations,

this list of weed species will be reduced to about 20 as the palms grow older (Chen *et al.*, 1993). The yield, palatability and feeding value of the undergrowth in the plantations were reported to be adequate for cattle (Chin, 1995).

Shortage of labour and rising labour costs are serious concerns of the plantation sector. Under appropriate conditions, cattle can be effectively used for weed control. The proper management of cattle in oil palm plantations with minimal use of selective herbicides can result in the plantations being more environmentally friendly besides ensuring sustainable development of resources.

Work on the biological control of weed in the integrated pest management system of oil palm has been concentrated on the use of insects and specific plant pathogens (Chung *et al.*, 1995). The ecological approach to weed control is to ensure that the host plants work with nature and not against it. The use of cattle as a biological agent for weed control in oil palm plantations allows the establishment of a harmonious relationship be

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tween cattle, the undergrowth and oil palms. This technique has been in existence since 1987 and is continuously being adopted and perfected. A holistic approach is the key to the success of the system. Strategic monitoring of the biota and corrective measures for deviation from expected results on a continuous basis will ensure compatibility. This is the principle underlying the systematic integration of cattle under mature oil palm.

### SYSTEMATIC INTEGRATION OF BEEF CATTLE IN OIL PALM PLANTATIONS

The objectives of systematic integration of beef cattle under oil palm are:

- Outputs from land, *i.e.* FFB and cattle are maximized through optimal use of resources.
- Weeds are biologically controlled and the cost of herbicide usage reduced.

The main success factor in the systematic integration is the control of cattle. The technique of controlling cattle in oil palm plantations was first developed by ESPEK, RISDA in 1987 (Gopinathan, 1998). Since then, the system has been adopted and improved upon by different estates as shown in *Table 1*. In 1997, there were 70 estates using the system and the number increased to 120 in 1998. The number of beef cattle in the

**TABLE 1. OIL PALM PLANTATIONS WITH SYSTEMATIC BEEF CATTLE INTEGRATION (1997 - 1998)**

Plantations	States	Number of estates	Number of cattle (heads)	Number of estates	Number of cattle (heads)
		1997	1997	1998	1998
FELDA settlers	Peninsular	300 blocks	30 238	300 blocks	33 000
FELDA Farm Products Sdn. Bhd.	Peninsular and Sabah	38	8 761	47	12 098
ESPEK (RISDA) Livestock Sdn.Bhd.	Peninsular	19	8 655	19	9 260
Mengkebang Estate	Kelantan	1	619	1	200
Syarikat PROLIP Sdn. Bhd.	Terengganu			1	170
Terengganu Devp. Mgnt. Sdn. Bhd.	Terengganu			3	850
Ladang Rakyat	Terengganu			2	807
LPP Jerangau	Terengganu			1	160
Ladang Jabor Velly	Terengganu			1	310
FELCRA Bhd.	Terengganu			5	476
Ldg. Perkaya	Terengganu			1	110
Ldg. Ketengah Jaya	Terengganu			1	154
Ldg. Ketengah Perwira	Terengganu			1	60
PASFA Bukit Kerisik	Pahang	1	1 161	1	826
LPP Gambang	Pahang	1	1 200	1	1 300
Ladang Sawit Kurnia Setia	Pahang	1	138	1	200
Chin Teck Plantation Sdn. Bhd.	Pahang			1	1 071
Ladang Sawira DARA	Pahang			1	130
Ladang Juasa Sdn. Bhd.	Pahang			1	200
Ladang Tabung Haji	Pahang			4	475
FELCRA Bhd.	Pahang			2	285
Ladang Planting Jernih Sdn. Bhd.	Negeri Sembilan			1	49
FELCRA Bhd.	Negeri Sembilan			3	500
Ladang Yayasan Pertanian Melaka	Melaka			1	200
Johor Tenggara Oil Palm	Johor	1	2 866	2	3 500
Pertubuhan Peladang Negeri Johor	Johor	1	1 100	1	1 045
Ladang Tabung Haji	Johor	1	200	6	1 100
Ladang Yayasan Pelajaran	Johor	1	602	1	1 000
Estate Plantation Agency	Johor	4	600	4	800
KUB Agrotech Sdn. Bhd.	Johor	1	38	1	175
FELCRA Bhd.	Johor			5	1 327
	Total	300 blocks 70 estates	56 178	300 blocks 120 estates	71 838

system by the end of 1997 was 56 178 heads and had increased to 71 838 by the end of 1998. The block farming system practised by Felda settlers applies the same technique of controlling cattle (Nasir, 1998). In this system, every block of the scheme is considered as an estate and weeding is carried out in each block by one herd of cattle. In 1998, there were 300 blocks of Felda settler's scheme practising the system, which had 33 000 heads of cattle.

The systematic integration of cattle which ensures the maximum return from investments was termed as the defined farming system (Rosli and Mohd. Nasir, 1997) and described as mixed farming (Rosli, 1998). In this system which is only suitable for palms above six years old, there should not be any stray cattle grazing in the estate. The cattle is either managed by the estate management or the contractors doing upkeep work. There has also been a situation where some planters allowed the owners of the cattle to practise the system in their estate to take advantage of the savings obtained from the reduction in weeding cost. This type of deal could only lead to difficulty of integrating upkeep work (as carried out by another party) with the grazing by cattle.

There are certain preconditions necessary for effective biological control of weed by systematic integration of cattle in oil palm plantations. The preconditions are:

- the management of oil palm should be at its optimum;
- the personnel managing the cattle, especially the stock man should have sufficient knowledge of cattle;
- every head of cattle purchased and brought into the estate should be certified free of disease and breeder cows should also be fertile;
- every head of cattle should have a permanent identification;
- every event that occurs (to each head of cattle) should be recorded, and
- facilities such as control yard and head crutch for the purpose of restraining and examining cattle should be made available.

## Biological Control of Weeds

The biological control of weeds is the main activity of systematic integration of cattle. The practice of rotational grazing using portable electric fences as tools to control the cattle is important for biological weed control. The areas to be used for grazing and the site for building the control yard should be carefully planned. The practice of blanket or carpet spraying should be stopped at least two months before the introduction of cattle into the estate. Before cattle is introduced for weed control, the undergrowths or weeds that are suitable for grazing should be allowed to grow by the practice of selective weeding using metsulfuryl-methyl herbicide. Almost all species of grasses and some species of broad leaves with the exception of *Eupatorium odoratum*, *Melastoma malabathricum* and *Clidemia hirta* are palatable to cattle. The weeds that can be considered palatable and with good nutritional value to cattle are *Asystasia gangetica* and *Paspalum conjugatum*.

Upon arrival in the estate, the cattle should be conditioned to the electric fence. This is usually done by confining the cattle in the control yard and a single line gauge 14 poly wire is encircled inside the yard. The cattle are then released into the yard to experience and remember the shock from touching the live wire. All cattle should experience the shock before the wire can be effectively used for control grazing. The process of conditioning may take between four to twelve days depending on how wild the cattle is on its previous grazing ground.

The components of the portable electric fence are a 13 plate 60 N 12 volt rechargeable lead battery, an energizer, 1.1 metre long insulated rod post, two sets of 500 metre roll poly wire, a wire spool, a tester and a battery charger. The set is sufficient to encircle four hectares of grazing area which is also known as the paddock and can confine 100 heads of cattle to graze in one day. The size of the paddock is dependent on the quantity and quality of forage (not called weed any more because it is now utilized for feeding cattle), the number of cattle in the herd and the practical grazing time. Drinking water and mineral salts should be made available in the paddocks at all times.

Once the forage is optimally grazed, normally leaving about 15cm of forage above the ground, the herd is moved to an adjacent paddock. It is a common practice among planters to make ready an adjacent paddock a day before the cattle is moved in, which means four sets of poly wire are required at all times. Normally, the cattle will come back to a grazed paddock after 60 to 80 days, allowing enough time for the forage to recover to be a good source of feed for the cattle. The decision to introduce the herd into a paddock and to move it out should be done by the planter after discussing with the planting advisors or visiting agents. This is to ensure that the amount of forage allowed to grow and be grazed on does not affect the production of FFB.

Rotational grazing allows the planter to decide what species of forage should be allowed to grow in the estate. This is to avoid the loss of balance in the integrated pest management programme where disturbances of certain natural habitat in the biome can result in the flare up of certain kinds of insect pests such as the bagworms. Fortunately, plants like *Euphorbia heterophylla* and *Ageratum conyzoides* which attract the parasitoids of bagworm (Ho and Teh, 1999) are palatable to cattle. Similar findings were noted for *Cassia cohanensis*, *Asystasia gangetica* and *Cleome rutidosperma* (Mohd Basri *et al.*, 1999) which are also palatable to cattle. The planters practising systematic cattle integration should encourage the growth of palatable species of forage for the benefit of the palms as well as the cattle. A paddock with 60% *Asystasia gangetica* and 30% *Paspalum conjugatum* is considered to be good pasture for grazing cattle under oil palm.

Once the cattle is moved out to an adjacent paddock, all weeds that are not palatable and remain in the grazed paddock should be sprayed or preferably manually removed. The stockman who is normally employed full time to look after the cattle herd can do weeding in the grazed paddocks. Weeding in the grazed paddock should be done as soon as possible since the unpalatable weeds are easily identified. Spraying using only metsulfuryl-methyl was observed to be adequate to remove the unwanted weeds. In many plantations belonging to the Felda Plantations Sdn. Bhd., such a practice has resulted in the increase of forage that is palatable. It takes about five to six rotations, which is

equivalent to about one year to establish the growth of desired species of forage. The grazing of cattle, which is similar to service cutting of the forage, could result in the good rejuvenation of preferred shoots.

The success of biological control of weed in oil palm plantations using systematic cattle rearing is largely dependent on the grazing management. A systematic and dynamic practice of rotational grazing that ensures harmonious balance of biota in the plantation is the key factor in determining the viability and sustainability of the system. There are other factors that determine the profitability which can be derived from cattle. These are the management of reproduction and health (Rosli, 1998). The cost-benefit of integration of beef cattle in oil palm plantations is described below.

## ECONOMIC MODELS OF BEEF CATTLE INTEGRATION IN OIL PALM

There are two types of economic models as discussed in this paper, *viz.* the cow-calf model and the males only model. The models are constructed based on observations made at estates practising the systematic integration of cattle in oil palm.

### The Cow-calf Model

In the cow-calf model, the initial stock of cattle introduced in the plantations for the biological control of weed is the breeder cows (fertile female cow at the age of two years and weighing above 250kg each) and the breeder bulls (fertile males at the age of three years and weighing above 300kg each). The ratio of bull to cows in the model is 1:20, although a ratio of 1:15 might be necessary for the exotic imported breeds of cattle. The ratio of bulls to cows is one of the important determinants for the prolificacy of breeding cows.

The breeds of cattle suitable for integration in oil palm plantations are the Kedah-Kelantan (KK), Brahman, Draughmaster, Freisian-Sahiwal, Australian Commercial Crosses, Nalore and their crosses. Planters favour the KK because they are more resistant to diseases, more fertile and relatively hardy compared to the other breeds. The only constraint with the KK is that they are not available for purchase in large numbers within short time periods. Cattle for the project can be

purchased locally or imported from Australia. The KK crosses are used as an example in the model.

The technical parameters and assumptions made for the model are as follows:

- One hundred breeder cows and five bulls integrated systematically in 400 hectares of six-year old oil palms;
- Calving percentage of 80% per year;
- Calf mortality of 10% for those less than six months old;
- Calf mortality of 5% for those between the age of six to twelve months;
- Total herd mortality of 2%;
- Culling of 10% of breeder cows per year starting from year three of project;
- Replacement of breeder cows comes from own herd.

With these assumptions and technical parameters, the herd and cash flow of the model for a ten-year period are constructed as shown in *Table 2*. The livestock flow shows that the herd is stabilized at year 5 with the total number of cattle in the herd at 263 heads. The herd is maintained as a close herd where there is no more introduction of breeder cows from elsewhere. The bulls however, have to be changed every three years for the purpose of improving the herd performance.

The output obtained from the herd is from the sale of culled breeders, sale of used bulls, sale of excess heifers and sale of males born in the farm, which only starts at year three of integration. The sales made for each year for the ten-year period varies from RM77 546 to RM103 678. The sales are based on following prices and weight of cattle:

- Ten heads of breeder cows starting from year three at RM3.80/kg for 350kg/head;
- Five heads of used bulls at year three, six and nine at RM4.70/kg for 450kg/head;
- Twelve heads of heifers in year three and 21

heads the following years at RM5.00/kg for 300kg/head;

- Twenty five heads of males in year three, 33 heads in year four and 34 heads in the following years at RM4.70/head for 300kg/head.

The cost for the model is classified into fixed and operational costs. The fixed cost accounts for the purchase of breeder cows, bulls, mobile home, portable electric fence, weighing balance, water pump, water tank, miscellaneous tools and the construction of a control yard. The mobile home is a 1.5-tonne trailer, which is modified to have a roof and walls for the stockman to live in and moved along following the movement of the herd. The total fixed cost for the model is RM 172 950. The details of the fixed cost is shown in *Table 3*.

The operational cost includes repair and maintenance, the purchase of drugs and treatments cost, cost for water and petroleum, purchase of minerals salts and vitamins, workers remuneration, administrative cost, professional advice cost and live-stock tithe for Muslims only. The operational cost for the model varies from RM22 026 to RM30 508 per year for the ten-year period.

The yearly cash balance as shown in *Table 2* is negative for the first two years. This is because the sale of cattle only starts at year three. Although the cumulative profit and loss is only positive at year seven, the value of stock at hand is already in excess of the cumulative profit by year two. The profit and loss will show a better picture if the savings from weeding cost are taken as unrealized income.

The internal rate of return (IRR) computed in the model is 13% and the net present value (NPV) at 12% discount rate is RM13 720. The benefit cost ratio (BCR) for a discount rate of 12% is 1.17. When the saving from weeding cost is taken into account as unrealized income, the IRR, NPV and BCR computed at 12% discount rate are 20%, RM89 962 and 1.44 respectively. The average cost for the ten-year period for breeder cows per year is RM497 and the average cost per hectare land per year for the same period is RM124. The average profit made for the ten years period per head of breeder cow and per hectare land per year are RM424 and RM106 respectively.

TABLE 2. LIVESTOCK AND CASH FLOW OF SYSTEMATIC BEEF CATTLE (cow-calf model)/OIL PALM INTEGRATION

Particulars	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>1. Livestock flow*</b>											
Number of breeder cows	100	98	100	100	100	100	100	100	100	100	100
Number of breeder bulls	5	5	5	5	5	5	5	5	5	5	5
Number of female calves (<6 months old)	18	18	18	18	18	18	18	18	18	18	18
Number of male calves (<6 months old)	18	18	18	18	18	18	18	18	18	18	18
Number of female calves (6 - 12 months old)	17	26	26	27	27	27	27	27	27	27	27
Number of male calves (6- 12 months old)	17	26	26	27	27	27	27	27	27	27	27
Number of female yearlings (12 - 18 months old)	0	19	25	25	25	25	25	25	25	25	25
Number of heifers (18 - 30 months old)	0	6	9	9	9	9	9	9	9	9	9
Number of males (12 - 30 months old)	0	25	34	34	35	35	35	35	35	35	35
Number of cull breeder cows sold	0	0	0	10	10	10	10	10	10	10	10
Number of used bulls sold	0	0	0	5	0	0	5	0	0	5	0
Number of heifers sold	0	0	0	12	21	21	21	21	21	21	21
Number of males sold - excluding used bulls	0	0	0	25	33	34	34	34	34	34	34
Total number of stock in farm at the end of year	175	241	261	262	262	263	263	263	263	263	263
Total number of stock including sold cattle	175	241	314	327	328	328	333	328	328	333	328
Total number of animal unit including sold cattle	141	168	229	233	234	234	245	234	234	245	234
<b>2. Output in RM</b>											
Sale of cullled breeder cows @RM3.80/kg (350kg/head)	0	0	13 300	13 300	13 300	13 300	13 300	13 300	13 300	13 300	13 300
Sale of used bulls @RM4.70/kg (450kg/head)	0	0	10 575	0	0	10 575	0	0	0	10 575	0
Sale of heifers @RM5.00/kg (300kg/head)	0	0	18 700	31 276	31 795	32 036	32 036	32 036	32 036	32 036	32 036
Sale of males@RM4.70/kg (300kg/head)	0	0	34 971	47 044	47 536	47 767	47 767	47 767	47 767	47 767	47 767
<b>Total sale</b>	<b>0</b>	<b>0</b>	<b>77 546</b>	<b>91 620</b>	<b>92 630</b>	<b>103 678</b>	<b>93 103</b>	<b>93 103</b>	<b>93 103</b>	<b>103 678</b>	<b>93 103</b>

\* To the nearest round number.

Continue next page.

<b>3. Fixed cost in RM</b>										
Purchase of breeder cows @RM4.20/kg (300kg/head)	126 000								8 750	8 750
Purchase of breeder bulls @RM5.00/kg (350kg/head)	8 750									
Purchased of mobile home @RM6000/set (1 set)	6 000									
Purchased of portable electric fence @ RM3700/set (1 set)	3 700									
Purchased of weighing machine @RM7500/set (1 set)	7 500									
Purchased of water pump @RM3000/set (1 set)	3 000									
Purchased of water tank @RM3000/set (1 set)	3 000									
Construction of control yard, head crutch and loading ramp	10 000									
Purchased of miscellaneous tools	5 000									
<b>Total fixed cost</b>	<b>172 950</b>								<b>8 750</b>	<b>8 750</b>
<b>4. Operational cost in RM</b>										
Repair and maintenance RM12/breeder cow/year.		1 200	1 176	1 200	1 200	1 200	1 200	1 200	1 200	1 200
Drugs and treatments RM24/breeder cows/year.		2 400	2 352	2 400	2 400	2 400	2 400	2 400	2 400	2 400
Utility (water and petroleum) RM15/breeder cow/year.		1 000	980	1 000	1 000	1 000	1 000	1 000	1 000	1 000
Minerals and vitamins @RM12/breeder cow/year		1 200	1 176	1 200	1 200	1 200	1 200	1 200	1 200	1 200
Workers remuneration 1 person @RM750.00/person/month.		9 000	9 000	9 000	9 000	9 000	9 000	9 000	9 000	9 000
Administrative cost @RM75/head/month.		1 577	2 168	2 822	2 939	2 949	2 996	2 951	2 951	2 951
Professional and technical advise		847	1 009	1 375	1 398	1 402	1 470	1 404	1 404	1 404
Livestock tith (for Muslim only)		3 701	5 399	7 749	8 372	8 408	8 419	8 419	8 419	8 419
Contingency expenses (5% of total cost)		1 101	1 224	1 868	1 448	1 450	2 823	1 451	1 451	1 451
<b>Total operational cost</b>		<b>22 026</b>	<b>24 485</b>	<b>28 614</b>	<b>28 956</b>	<b>29 009</b>	<b>30 508</b>	<b>29 026</b>	<b>29 026</b>	<b>29 026</b>
<b>Total cost</b>		<b>172 950</b>	<b>22 026</b>	<b>37 364</b>	<b>28 956</b>	<b>29 009</b>	<b>56 458</b>	<b>29 026</b>	<b>29 026</b>	<b>38 353</b>
<b>5. Cash flow savings and stock value in RM</b>										
Yearly cash balance - profit and loss		(-172 950)	(-22 026)	(-24 485)	40 181	62 664	63 622	47 220	64 078	65 325
Cumulative profit and loss			(-194 976)	(-219 461)	(-179 279)	(-116 616)	(-52 994)	(-5 774)	58 303	122 381
Profit and loss per breeder cow per year			(-220)	(-250)	402	627	636	472	641	653
Profit and loss per hectare per year			(-55)	(-61)	100	157	159	118	160	163
Saving from weeding RM30.00 - RM50.00/ha/yr.			12 000	12 000	14 000	14 000	16 000	16 000	18 000	20 000
Value of stock at year end			177 786	211 984	288 683	293 540	294 456	308 664	294 804	308 664
<b>Total cost</b>		<b>172 950</b>	<b>22 026</b>	<b>24 485</b>	<b>37 364</b>	<b>28 956</b>	<b>29 009</b>	<b>56 458</b>	<b>29 026</b>	<b>38 353</b>
<b>Total operational cost</b>			<b>22 026</b>	<b>24 485</b>	<b>28 614</b>	<b>28 956</b>	<b>29 009</b>	<b>30 508</b>	<b>29 026</b>	<b>29 026</b>
<b>Total cost</b>		<b>172 950</b>	<b>22 026</b>	<b>37 364</b>	<b>28 956</b>	<b>29 009</b>	<b>56 458</b>	<b>29 026</b>	<b>29 026</b>	<b>38 353</b>
<b>Yearly cash balance - profit and loss</b>		<b>(-172 950)</b>	<b>(-22 026)</b>	<b>(-24 485)</b>	<b>40 181</b>	<b>62 664</b>	<b>63 622</b>	<b>47 220</b>	<b>64 078</b>	<b>65 325</b>
<b>Cumulative profit and loss</b>			<b>(-194 976)</b>	<b>(-219 461)</b>	<b>(-179 279)</b>	<b>(-116 616)</b>	<b>(-52 994)</b>	<b>(-5 774)</b>	<b>58 303</b>	<b>122 381</b>
<b>Profit and loss per breeder cow per year</b>			<b>(-220)</b>	<b>(-250)</b>	<b>402</b>	<b>627</b>	<b>636</b>	<b>472</b>	<b>641</b>	<b>653</b>
<b>Profit and loss per hectare per year</b>			<b>(-55)</b>	<b>(-61)</b>	<b>100</b>	<b>157</b>	<b>159</b>	<b>118</b>	<b>160</b>	<b>163</b>
<b>Saving from weeding RM30.00 - RM50.00/ha/yr.</b>			<b>12 000</b>	<b>12 000</b>	<b>14 000</b>	<b>14 000</b>	<b>16 000</b>	<b>16 000</b>	<b>18 000</b>	<b>20 000</b>
<b>Value of stock at year end</b>			<b>177 786</b>	<b>211 984</b>	<b>288 683</b>	<b>293 540</b>	<b>294 456</b>	<b>308 664</b>	<b>294 804</b>	<b>308 664</b>

### The Males Only Model

The males only model is similar to the feed lot system with the exception that males are raised in the systematic integration by grazing in oil palm estates. In this model, 100 heads KK crosses male yearlings at the age of 18 months are brought into the estate in batches at every two months. The males are raised for six months and sold off after that. After six months, the total number of yearling males in the herd at any time will be 300 heads. The initial weight of the yearlings is about 200kg and the final weight for sale is about 300kg. The male yearlings are managed full time by a stockman or handler who stays in a mobile home close to the herd. The technical parameters and assumptions made for the models are as follows:

- Three hundred yearling males present at any time are integrated in 450 hectares of 6-year old oil palms (ratio of one head to 1.5 hectare).
- Average daily weight gain of 500 grammes.
- Mortality of 2% per batch.
- The period of rearing per batch is six months.

With these technical parameters and assumptions, the yearly livestock and cash flow for a ten-year period model are shown in *Table 4*. The total number of yearlings bought every year is 600 heads (a batch of 100 heads bought at every two

months) and the number of yearlings at the end of each year carried forward into the next year is 294. The number of yearlings sold in the first year is 294 and the number sold in subsequent years is 588. The number sold in the first year is half of that of the following years because there is no sale made in the first six-month of the first year. The number of deaths is assured at 12 in each year.

The output obtained from this model is only from the sale of finished males. The total sale made in the first year is RM414 540 and for the subsequent years, the total sale per year is RM829 080. The total sale is based on the sale price of RM4.70/kg at 300kg per head for the total bulls sold.

The model classified cost into fixed cost and operational cost. The fixed cost accounts for the purchase of mobile home, portable electric fence, weighing machine, water pump, water tank, miscellaneous tools and the construction of a control yard. The total fixed cost for the model is RM38 200. The details of the fixed cost are shown in *Table 5*.

The cost for the purchase of male yearlings is considered as operational cost in this model because the whole batch is bought and sold after every six months. The male yearlings are bought at RM4.70/kg live weight for body weight of 200kg. The total operational cost for the model is RM630 318 per year across the ten-year period.

**TABLE 3. FIXED COST ITEMS FOR THE COW-CALF MODEL**

Items	Cost(RM)
i. Purchase of 100 heads of breeder cows @RM4.20/kg (300kg/head)	126 000
ii. Purchase of five heads of breeder bulls @RM5.00/kg (350kg/head)	8 750
iii. Purchase of mobile home @RM6000/set (1 set)	6 000
iv. Purchase of portable electric fence @RM3700/set (one set)	3 700
v. Purchase of weighing balance @RM7500/set (one set)	7 500
vi. Purchase of water pump @RM3000/set (one set)	3 000
vii. Purchase of water tank @RM3000/set (one set)	3 000
viii. Purchase of miscellaneous tools	5 000
ix. Construction of control yard	10 000
<b>Total fixed cost</b>	<b>172 950</b>



TABLE 4. LIVESTOCK AND CASH FLOW OF MALES ONLY MODEL OF SYSTEMATIC BEEF CATTLE INTEGRATION IN OIL PALM PLANTATION

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>1. Livestock flow*</b>										
Number of stock purchased	600	600	600	600	600	600	600	600	600	600
Number of stock at year end	294	294	294	294	294	294	294	294	294	294
Number of death	12	12	12	12	12	12	12	12	12	12
Number sold	294	588	588	588	588	588	588	588	588	588
Total sale in kilogramme	88 200	176 400	176 400	176 400	176 400	176 400	176 400	176 400	176 400	176 400
Total weight gain (kg)	29 400	58 800	58 800	58 800	58 800	58 800	58 800	58 800	58 800	58 800
Value of gain in RM	138 180	276 360	276 360	276 360	276 360	276 360	276 360	276 360	276 360	276 360
<b>2. Output in RM</b>										
Sale @RM4.70/kg (300kg/head)	414 540	829 080	829 080	829 080	829 080	829 080	829 080	829 080	829 080	829 080
Total sale (RM)	414 540	829 080	829 080	829 080	829 080	829 080	829 080	829 080	829 080	829 080
<b>3. Fixed cost in RM</b>										
Purchase of mobile home @RM6000/set (1 set)	6 000									
Purchase of portable electric fence @RM3700/set (1 set)	3 700				3 700					
Purchase of weighing machine @RM 7500/set (1 set)	7 500				7 500					
Purchase of water pump @RM3000/set (1 set)	3 000				3 000					
Purchase of water tank @RM3000/set (1 set)	3 000				3 000					
Construction of control yard, head crutch and loading ramp	10 000									
Miscellaneous tools	5 000				5 000					
Total fixed cost	38 200				26 200					
<b>4. Operational cost in RM</b>										
Purchase of feeder cattle @RM4.70/kg(200kg/head)	564 000	564 000	564 000	564 000	564 000	564 000	564 000	564 000	564 000	564 000
Repair and maintenance @RM12/head/year	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600
Drugs and treatments @ RM24/head/year	7 200	7 200	7 200	7 200	7 200	7 200	7 200	7 200	7 200	7 200
Mineral salts and vitamins @RM12/head/year	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600
Utility (water and petroleum)RM20/head/year	6 000	6 000	6 000	6 000	6 000	6 000	6 000	6 000	6 000	6 000
Workers remuneration 1 person @RM7.50/person/month	9 000	9 000	9 000	9 000	9 000	9 000	9 000	9 000	9 000	9 000
Administrative cost @RM0.75/head/month	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600
Professional and technical advices	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800
Contingency expenses (5% of total cost)	33 526	31 516	31 516	31 516	31 516	32 895	31 516	31 516	31 516	31 516
Total operational cost	632 326	630 316	630 316	630 316	630 316	631 695	630 316	630 316	630 316	630 316
Total cost	670 526	630 316	630 316	630 316	630 316	657 895	630 316	630 316	630 316	630 316
<b>5. Cash flow, savings and stock value in RM</b>										
Yearly cash balance - profit and loss	(255 986)	198 764	198 764	198 764	198 764	171 185	198 764	198 764	198 764	198 764
Cummulative profit and loss	(255 986)	(57 222)	141 542	340 306	539 071	710 256	909 020	1 107 784	1 306 548	1 505 313
Profit and loss per hectare per year	(569)	442	442	442	442	380	442	442	442	442
Saving from weeding @RM30 - RM50/ha/year	13 500	13 500	15 750	15 750	18 000	18 000	20 250	20 250	22 500	22 500
Stock value at year end	276 360	276 360	276 360	276 360	276 360	276 360	276 360	276 360	276 360	276 360

\* To the nearest round number.

The slightly higher cost of operation in year one is due to the contingency estimated at five percent from the total cost including fixed cost. Other than the purchase of male yearlings, the total operational cost is for repair and maintenance, purchase of drugs and treatment cost, purchase of minerals and vitamins, cost of water and petroleum, workers remuneration, administrative cost and the cost for professional advice.

The yearly cash balance as shown in *Table 4* computed a negative balance in the first year. This is because the sale in the first year is only half of that in the following years. The cumulative profit and loss is computed to be positive in year three onwards.

The IRR computed for the model is 77% and the NPV at 12% discount rate is RM703 061. The benefit cost ratio for the same discount rate is 1.19. When the saving from weeding cost is taken into account as unrealized income the computed IRR, NPV and BCR are 87%, RM799, 127 and 1.22 respectively. The average cost for the ten-year period for yearling male per year is RM1062 and the average cost per hectare land per year for the same period is RM1397. The average profit made for the ten years period per head of yearling male and per hectare land per year are RM212 and RM330 respectively.

### DISCUSSIONS ON THE TWO MODELS

The decision rules in making an investment for integration of beef cattle in oil palm which are based on IRR, NPV and BCR are favourable at 12% discount rates for both models. At 15%

discount rate, the decision however is less favourable.

Any one of the models can be chosen for implementation although ideally the planters should practise both models in order to tap the highest margins from integration. The Fel-da Plantation Sdn. Bhd. and ESPEK RISDA as well as the Johor Tenggara Oil Palm are applying both models in their beef cattle/oil palm systematic integration project. Male calves born and raised in the cow-calf projects are harvested at weaning and transferred to another estate for finishing and sale in the male only project.

### CONCLUSION

The systematic integration of beef cattle in oil palm can be applied to the integrated pest management programme in relation to the biological control of weed. It is a viable enterprise. With some changes in the normal agronomic practices of the plantation and by using a holistic approach, the synergistic effect of cattle and oil palm can be realized to allow the maximization of land use.

The productivity of both cattle and oil palm should be monitored strategically and corrective measures taken on any deviations from the targeted outcome. A good weed management and positive attitude toward making the systematic integration to be successful is important in ensuring viability and sustainability of the undertaking.

Although the returns from cattle alone are not comparable to those of oil palm, the capital gain and the savings from weeding cost should be

**TABLE 5. FIXED COSTS OF ITEMS IN MALE ONLY MODEL**

Items	Cost (RM)
i. Purchase of mobile home @RM6000/set (one set)	6 000
iii. Purchase of portable electric fence @RM3700/set (one set)	3 700
iv. Purchase of weighing balance @RM7500/set (one set)	7 500
v. Purchase of water pump @RM3000/set (one set)	3 000
vi. Purchase of water tank @RM3000/set (one set)	3 000
vi. Purchase of miscellaneous tools	5 000
vii. Construction of control yard	10 000
Total fixed cost	38 200

attractive enough for more plantations to participate in this programme. The government is giving a lot of emphasis to this venture through its Agricultural Policy and the Industrial Master Plan. Soft loans with 4% interest at yearly rest, under the Fund for Food programme can be obtained for the purpose of investment in cattle/oil palm integration project.

Currently, there is no problem in getting and selling cattle from the projects. There are many local suppliers and traders involved in selling and buying of cattle. The plantations, which had started earlier in implementing the projects, have set up their own market channel and are ready to supply animals to interested parties.

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