REVIEW ARTICLE

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ISSUES OF RUMINANT INTEGRATION WITH OIL PALM PLANTATION

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ABSTRACT

The National Agricultural Policy identified integration of ruminant with plantation as an important strategy to increase beef production. Thus, the nationaI beef production was forecasted to increase from 9500 t in 2005 to 20 200 t in 2010 while the numbers of cattle should reach 1 million by 2015. This follows integration of 739 600 ha of plantation with ruminant. A further increase to 2.2 million hectares for livestock integration should spearhead beef production towards self-sufficiency. Integration with ruminant provides additional income and biological control of weeds thus, reduces chemical contamination. Despite the efforts to promote livestock integration, the idea did not really take off. The managements of established plantations remain focused on palm oil production claiming that livestock integration distracted them from that primary function. Therefore, livestock integration system should be reviewed to encourage small planters' participation via modifications of the current 'on-farm' or 'farm within plantation' integration where all activities are carried out in the same farm to 'between-farm' integration where each farm concentrates on a specific output with exchanges of resources between farms or farmers. However, 'between-farm' integration requires modification of the current policy on livestock-crop integration. Furthermore, it requires close coordination for successful and sustainable venture.

Keywords: ruminant integration, oil palm plantation, issues.

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INTRODUCTION

Ruminant industry in Malaysia consists of approximately 482 000 head of goats, 130 000 sheep, 118 000 buffaloes and 752 000 head of cattle (Department of Veterinary Services, 2014). It supplies 13.5% of local demand for mutton and 29.8% of beef. To fulfil the demand, Malaysia is spending approximately RM 5.8 million annually to import livestock products (Aziz, 2007). Analysis revealed that importation of breeding females could improve self-sufficiency (Yasmin *et al*., 2000). Therefore, the Malaysian government had decided in 2005 to increase the cattle and goat populations to approximately 1 million head each by 2010 through breeding programme (Ibrahim *et al*., 2006). Thus, importation of breeder cattle and goats from various ruminant-producing countries began in 2006 and the ruminant-crop integration has been identified as one of the major rearing systems for these animals.

Putting animals into plantations has been practiced in Malaysia for as long as there were plantations (Hadi, 1998). Traditionally, estate workers and villagers led their cattle, goat or sheep out to graze in oil palm plantations without proper rearing system. Only in mid 1980's that

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some plantation management realised the benefits of these grazing animals in the plantation system. The integrated animals provide biological control of weeds, thus generate savings from the cost of weedicide and labour for weeding other than the additional income from the livestock. Thus, livestock integration is a healthy practice that contributes in reducing the load of chemicals being applied in oil palm plantation.

The National Agricultural Policy (1992 – 2010) supported beef and sheep production through integration with oil palm and rubber plantations while the National Beef Production Plan of the Department of Veterinary Services, Malaysia provided the guidelines for integration (Department of Veterinary Services, 2003). Researchers started formulating rearing system while the Federal Land Development Authority (Felda), Federal Land Consolidation and Rehabilitation Authority (Felcra) and Rubber Industry Smallholders Development Authority (RISDA) and the state agriculture and land development institutions started implementing cattle and sheep integration. It was aimed that by 2013, an additional of 17 300 head of beef cattle should be integrated under oil palm plantation (Ismail and Wahab, 2014) since cattle under this system were productive with high calving rate and low mortality (Devendra, 2007), especially when integration is designed sustainably (Rofiq *et al.*, 2014).

OIL PALM PLANTATION ENHANCES CATTLE OUTPUT

The nationaI beef production was forecasted to increase by more than 100% from 9500 t in 2005 to 20 200 t by 2010 through livestock integration (Ibrahim *et al.*, 2006). Based on the projection of accommodating 100 breeder females and five bulls in 400 ha oil palm (Rosli, 2000), a total of 317 000 ha of oil palm are required to fulfil the forecast and by 2010, a total of 739 600 (17.7%) ha of oil palm plantation out of 4.17 million hectares of oil palm plantation (Basiron, 2007) should actively involve in livestock integration.

Oil palm plantation should be an important source of feeder and breeder cattle (Ariff, 1998). Beginning with 100 breeder females per herd, a potential of 35 feeder cattle (aged 6 – 30 months) can be made available yearly beginning from the third year of integration (Department of Veterinary Services, 2003). Mathematically, an active stocking of breeder cattle under oil palm using this recommended herd size should be able to boost the supply of feeder cattle for feedlots to drive the beef production towards self-sufficiency. Therefore, the future of beef production is laid on the integration of livestock with tree crops that supply animals to feedlot (Rosli, 1995).

BENEFITS OF LIVESTOCK INTEGRATION TO OIL PALM PLANTATION

Research on livestock integration in ESPEK plantations for a period between 1992 and 1998 revealed an average of 16.7% (range between 6.9% and 30%) increased in the oil palm yield (Chen and Harun, 1994; Harun and Chen, 1995). A study in Felda scheme at Gua Musang revealed increase in the annual oil palm yield between 0.26 and 2.06 t ha^{-1} from 1995 to 1996 (Rosli and Nasir, 1997). Another Felda scheme in Kelantan benefited from cattle integration with increase in oil palm yield from 0.98 t ha^{-1} in 1994 to 4 t ha^{-1} in 1997 (Nasir, 1998). The payback period from cattle integration is four years with profit of over RM 100.00 ha^{-1} that may exceed RM 160 ha^{-1} from year 9 onwards was forecasted (Department of Veterinary Services, 2003).

In livestock integration, weeds are rich source of green feed for cattle. The amount of grass available under palm is high for the first years after planting, amounting to 2000 – 3000 kg dry matter per hectare but declined when the palm canopy started to reduce sunlight penetration. From 6 to 20 years, the amount ranged between 400 kg and 800 kg dry matter per hectare per year (Chen *et al.*, 1991) that can effectively be removed by the integrated animals. However, 7% to 8% of the forage species under oil palm are not palatable (Ismail, 1989) and these weeds may be removed by selective weeding. Through this arrangement, the cost of weeding could be reduced between 20% and 40% (Chen and Harun, 1994), 30% and 60% (Rosli and Nasir, 1997) and by a remarkable 73% (Nasir, 1998). Labour costs for weeding could be reduced by 75% and chemical costs by 68% (Nasir, 1998). Nevertheless, reduction of weeding cost is not immediate and requires two years for great changes on species colonisation to occur (Harun and Chen, 1995).

ENVIRONMENT-FRIENDLY

Animals grazing under oil palm significantly reduce the usage of chemical fertilisers, herbicides and pesticides making naturally available water safe for the cattle and wildlife. Herbicides are among the most commonly used chemicals in oil palm (Mohamad *et al.*, 2010) while high usage of fertiliser in oil palm plantation may endanger neighbouring aquatic ecosystem when the excess chemicals are transported to waterways (Comte *et al.*, 2015). Thus, palm oil buyers often carry out chemical residue analysis making rational fertiliser programme and pesticide management important issues (Page and Lord, 2006). A recent study, however, has shown that livestock integration significantly reduces the use of chemicals in oil palm plantation, particularly the smallholders (Dabbo and Abdlatif, 2013).

Trees benefited the nutrients returned to the soil through faeces and urine of cattle. Studies have shown that dung and urine contain beneficial nutrients such as nitrogen, phosphorus and potassium while the solid fraction contains organic matter that is important to maintain soil structure and fertility. Furthermore, cattle grazing in oil palm plantation help to increase biodiversity and maintain soil ecosystem. Availability of cattle dung in oil palm plantation increases the number and biodiversity of dung beetles that helps restore soil properties such as soil hydrological properties and fertility (Slade *et al.*, 2014). In addition, there was no difference in soil compaction between integrated and non-integrated areas (Harun and Chen, 1995; Chen *et al*., 1996). Studies revealed that soil in areas with grazing cattle were characterised by 57% - 83% lower soil macroporosity, 8% - 17% higher bulk density and 27% - 50% higher resistance to penetration (Kurz *et al.*, 2007).

Plants like *Euphorbia heterophyla* and *Ageratum conyzoides* (Ho and Teh, 1999), *Cassia cobanensis*, *Asystasia gangetica* and *Cleome rutidosperma* (Basri *et al.*, 1999), which are associated with the life cycle of bagworm are also consumed by cattle, naturally reduces the incidence of bagworm.

ISSUES CONCERNING LIVESTOCK INTEGRATION

It is clear that the oil palm industry is the only basis for animal production in the tropics, including Malaysia since conventional grazing alone is uneconomic (Jalaludin and Halim, 1998). Furthermore, the current high price of imported cattle form Australia, the restriction of export of livestock by Australia to many Asian countries and the reduced supply of cattle to Malaysia from Thailand due to high demand from China provide opportunities for livestock integration. Despite the benefits and efforts to promote livestock integration in oil palm plantation, the response by major plantations was lukewarm. Thus far, only Felda, Felcra and RISDA are involved in livestock integration with different outcomes (Ismail and Wahab, 2014). The main reasons for the major oil palm plantations not considering livestock integration include:

- the concern on important issues regarding palm oil, particularly the yield, diseases of oil palm and the palm oil smearing campaign (Wahid and Chan, 2008). Furthermore, in high value plantation crops such as rubber and oil palm, livestock will always be secondary importance (Sophanodora and Tudsri, 1991);
- livestock integration was seen as an added responsibility for the plantation management that tends to shift the attention from the palm oil. Although previous studies concluded that livestock integration is sustainable, it requires input of systemic management (Ayob and Kabul, 2009);
- many large plantations in South-east Asia prohibit animal integration, not so much because of the impact of the animals, but more to prevent the presence of people who pilfer plantation products and cause damage to trees (Sanchez, 2014);
- the current security issue, particularly the theft of the livestock kept under plantation increased the risk and costs of livestock integration; and
- extra costs incurred by the management in livestock integration, which include capital to acquire the livestock and the extra workers for livestock killed the interest. It was reported that integration involving 4-6 ha of plantation requires electric fencing and extra two workers (Latif and Mamat, 2002).

Since livestock integration in major plantations is uncertain, efforts should be focussed to promote livestock integration among smallholders. Devendra (2011) had concluded that integration might benefit resource-poor smallholder farmers for additional income. Similarly, Moog and Faylon (1991) had suggested for the government policies on livestock integration be focused on smallholder farms where prospects for integrating forage in plantation crops are good. Nevertheless, for the efforts to be successful, modification of the current integration system and development of multicropping systems to maximise returns should be implemented (Reynold, 1996).

MODIFICATION OF CURRENT INTEGRATION SYSTEM

A high integration of crops and livestock is often prefered, but small farmers need to have sufficient knowledge, assets and inputs to manage this system (FAO, 2001). Optimal pathways for crop-livestock integration should achieve the best utilisation of locally available resources without much reliance on external input through recycling of crop/animal residuals. However, the crop-pasture rotation system is complex (Rota and Sperandini, 2010) and the realities of the system are often more complicated (Iiyama *et al.,* 2007). Furthermore, the forage species under the plantation vary with age of the crop. Therefore, the nutritive quality is also varies leading to fluctuation in livestock productivity (Reynold, 1996). When livestock under high value crops are considered secondary in importance, implementation of proper livestock integrated management system as suggested by Ayob and Kabul (2009) is not possible over the long-term (FAO, 2001). Thus, majority of the integrated farms were between 40% and 80% of technical efficiency (Serin, 2004). Therefore, varying performance by the integrated animals is expected (Sophanodora and Tudsri, 1991), which usually non-sustainable and lead to failure. The current concept of livestock integration that establishes a livestock farm within crop plantation (Thomson and Bahhady, 1995) or 'on-farm' integration (FAO, 2001) although will enhance supply of beef cattle (Rofiq *et al.*, 2014), is deemed non-sustainable.

Under the current on-farm integration system, livestock integration is packed with activities, which include planting pasture, rearing, breeding and marketing of livestock. Farmers will not be able to complete all tasks successfully, especially when livestock is meant for additional income. Thus, adoption of best practice technology and optimal resource allocation could improve the skills of farmers/managers (Serin, 2004). Efforts must be made to reduce the involvement of smallholders in livestock rearing activities via the 'between-farm' integration system (FAO, 2001) where there are exchanging of resources between different farms, blocks or groups. Therefore, 'farmers' specialisation' in a livestock integration activity should be encouraged. Under this 'between-farm' integration, a minimum of three groups of farmers should be created:

- farmers that are solely planting established pasture, such as Napier or Guinea grass within the plantation. Their objective is to supply high quality grass;
- farmers that integrate breeder livestock within the plantation. Their main objective is to keep and breed the animals within the plantation to supply offspring or calves; and
- farmers that integrate growing animals within the plantation, either in the form of rotational grazing or feedlot. They supply livestock for consumption.

The small planter that plant established pasture should supply high quality grass to planters that concentrate only on rearing of breeder or feedlot livestock under plantation. New species of forage could be introduced and integrated into the plantation. Tohiran *et al.* (2014) suggested the possible use of Napier and sorghum as quality grass to be integrated. The planter breeders, in turn, breed and supply the feedlots or growers planters with suitable calves (Ariff, 1998). Needless to say, the activities of these different groups of small farmers need to be properly coordinated and monitored (*Figure 1*). While the idea of 'between farm' integration might not fully meet the criteria of integrated system where crop and livestock interact to create a synergy that allow maximum use of available resources (Rota and

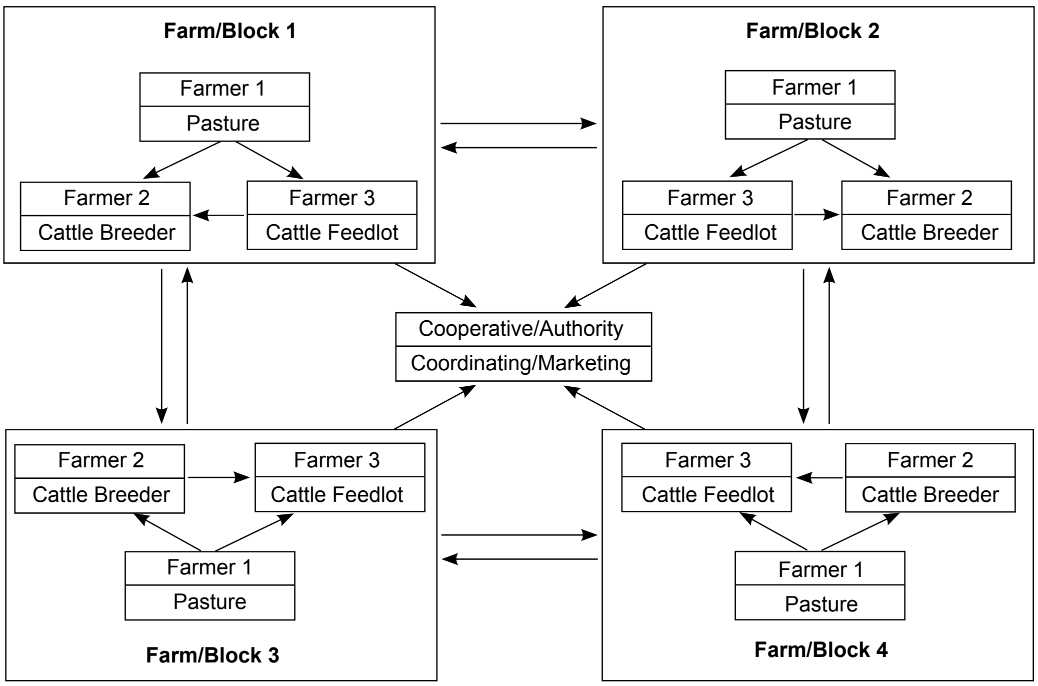

Figure 1. Schematic representation of small farmer specialisation and their relationships. The arrows represent interactions between the farmers, farms and the authority.

Sperandini, 2010), it promises better involvement of the smallholders for sustainability.

The success of 'between-farm' integration requires proper and close monitoring and supervision from the 'authority'. Target Area Concentration (TAC) is a programme developed by the Department of Veterinary Services, Malaysia that aimed at increasing the ruminant industry in Malaysia. It involves a total of 487 367 ha of land; mostly oil palm plantation carrying 1330 beef cattle integration projects, 939 goat projects, 11 buffalo projects and 72 sheep projects. As of December 2011, there was a total of 19 698 head of beef cattle, integrated within 16 TAC areas. Although each state is provided with a TAC officer for monitoring and coordinating, the animal performances vary between TAC areas. Calving percentage ranged between 1% and 70.1% with an average of 21.3% while the rate of animal mortality ranged between 0% and 9.2% with an average of 1.8%. These variations in the performance of integrate animals were due to many factors, including the many livestock integration tasks that farmers need to perform. Therefore, modification of the current integration system toward specialisation by the small planters as suggested above and being monitored by the TAC officer of each state might help solve the poor performances and enhance the ruminant industry in Malaysia.

Similarly, the Malaysian Palm Oil Board (MPOB) has the Integration Research and Extension Division (IRED), which consists of 19 research officers and supported by approximately 152 extension officers, located all over Malaysia. The Division is responsible to 167 356 oil palm smallholders with a total area of 652 378 ha. As such, the ratio of extension officer to smallholder is 1:1 101, which is high for effective extension activities. Furthermore, they are encouraging formation of cooperative among the smallholders for easy management and monitoring. The cooperatives should get involve with the 'between-farm' livestock integration with monitoring from the extension officers in collaboration with the local TAC officer from the Department of Veterinary Services.

While the groups of smallholder are responsible for production of specific output, which is pasture, calves or slaughter cattle, the 'authority' such as the TAC officers and the cooperatives is not only required to coordinate and monitor the performance of each group to ensure supply but should also active in marketing. In fact, marketing of the integration outputs should be made through the 'authority'.

In conclusion, the idea of 'between-farm' integration requires slight modification of the current policy on integration. Furthermore, it requires proper and close coordination for successful and sustainable venture.

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