Integrated Animal Production in the Oil Palm Plantation

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Abstract
The oil palm industry offers a number of opportunities in terms of feed resources which can be utilised for animal production. These feed resources range from forages in the inter-rows to the by-products from the oil palm. Many of these by-products, e.g. palm kernel cake and oil palm fronds, are rich in nutrients and have been proven to be feeds of high quality. Integrating animals with oil palm plantations will ensure long-term profitability as well as sustainability of the agriculture industry in a very competitive environment.

KEY WORDS: African oil palm, by-products, forages

Introduction
Oil palm cultivation is rapidly expanding within the tropical zone and South-East Asia is the leading producer of palm oil, accounting for more than 80% of the world's output. Palm oil, with a 20% market share, has emerged as one of the dominant vegetable oils, second only to soya bean oil. During the past three decades, the production of palm oil grew at the fastest rate (8% per year) compared to rape seed oil (7.2%), soya bean oil (4.5%), and sunflower oil (3.7%). Palm oil production is expected to increase further with the expansion of oil palm cultivation and improved cultivation techniques. The oil palm industry, with diverse products and by-products, offers two opportunities for the promotion of animal production. Firstly, the products and by-products from the industry are valuable feed resources with the potential to be utilised for expanding

animal production. Secondly, the forages in the inter-rows can be consumed by ruminants. Integrating animal production with oil palm plantations should take into account all the available resources, i.e. the products and by-products of the industry as well as the forages grown in the inter-rows.

Palm Oil By-products

Palm oil is available in about 15 different grades, ranging from crude to semi-refined, refined, crude fractionated, refined fractionated oil and refinery by-products. Palm oil is currently the main fat source in feeds for monogastric animals, but it is not commonly fed to ruminants because it can result in rumen disorders, metabolic problems and reduced milk fat content (Palmquist, 1995). However, calcium soaps of palm oil origin, given to dairy cattle to increase energy intake, produced many positive effects of an energy supplement (Palmquist, 1995). This is attributed to the high level of unsaturated fatty acids (primarily oleic acid) which escape rumen degradation, leading to enhance digestibility. This makes calcium soaps of palm oil origin a good source of by-pass energy.

Oil Palm By-products

Palm press fibre

Palm press fibre (PPF) is a fibrous residue of oil palm fruits after oil extraction. The potential of using PPF for ruminant production is enormous but, due to its bulkiness and low feeding value, the amount consumed and digested is inadequate to support production at an economic level. Therefore, the use of PPF could be enhanced by improving its nutritive value by chemical treatment and by manipulating the ration to optimise rumen fermentation.

Treating PPF with chemicals such as sodium hydroxide, urea and ammonium hydroxide has shown varying degrees of improvement in feed intake and biodegradability. For example, DMD increased from 43.3% to 58.0% when PPF was treated with 8% sodium hydroxide (Jelan *et al.*, 1986). Buffalo could be induced to increase voluntary intake of PPF (360 g/head/day) which was sprayed with molasses and supplemented with fish meal. Animals fed urea-treated PPF had significantly higher voluntary feed intake when energy and protein were supplemented compared to those receiving only protein or energy. This is a clear indication that PPF is limiting in both energy and protein. A feeding system based on PPF needs to be carefully balanced with supplements in order to ensure optimum production.

Palm Kernel Cake

In Malaysia, more than 60,000 tonnes of palm kernel cake (PKC) are produced annually. The world production of PKC far exceeds the stated amount. PKC has a fairly high nutritive value and is being used extensively for fattening steers in feedlots. Crude protein content of PKC ranges from 7.7 to 18.7% depending on processing methods and the degree of impurities such as shell content. At 70% DMD, PKC is readily consumed. Hutagalung (1985) reported that cattle fed 6-8 kg PKC combined with small quantities of feed additive (e.g., minerals and vitamins) produced daily growth rates of 0.7-1.0 kg/animal. Similar results were obtained under farming conditions by Jelan *et al.* (1986).

There are two intrinsic problems in the utilisation of PKC, namely, the high oil residue and the copper content. The oil content in certain cases can be as high as 20%, which can cause rancidity and rejection by the animals. Palm oil is extracted by expeller or solvent. The former process is rather inefficient resulting in large quantities of oil residue in the PKC. The high copper content can cause toxicity in small ruminants, particularly sheep. To a certain extent, copper toxicity can be alleviated by the addition of zinc molybdate. The extent of copper toxicity in larger ruminants is somewhat unclear because feeding PKC over a long period to either cattle or buffalo has not resulted in retarded growth or mortality. Furthermore, steers fed high level of PKC were found to have normal concentrations of rumen metabolites, glucose, urea, alkaline phosphate and glutamate oxaloacetate transaminase. A more recent study by Hair-Bejo *et al.* (1995) showed that buffalo fed 100% PKC had twice as much copper and zinc in the liver and adrenal cortex compared to buffalo fed a normal diet. However, high mineral contents in these two organs did not cause any mortality.

Oil Palm Fronds

Oil palm trees require regular pruning to facilitate harvesting of mature fruit, thus yielding large quantities of fronds (leaves and petioles), which at present are not utilised for feeding animals. Oil palm fronds (OPF) with nearly 15% crude protein is a potential ruminant feed (Abu Hassan, 1995). However, it cannot be economically utilised unless processed into pellet form. Cattle fed OPF pellets measuring 9 mm in diameter and 3-5 cm in length with 33.3% total digestible nutrients gained 0.93 kg/day (Asada *et al.*, 1991).

Empty Fruit Bunch

Empty fruit bunch (EFB) can also be processed into ruminant feed as pellets. Very little work has been done to utilise EFB as ruminant feed but there should not be serious problems in developing appropriate technology to improve the feeding qualities of EFB.

Forage Cover Crops

The inter-row spaces found in all oil palm plantations promote the growth of at least 60 plant species - usually considered as weeds (Chen and Dahlan, 1995). In intensive oil palm plantations, chemicals are used regularly to control weed growth so that the competition for plant nutrients is minimal. The cost of weeding is quite substantial and can be easily eliminated if the forages in the inter-rows are utilised for animal production. In addition, soil and environmental pollution is minimised. Integrating animals in the plantation can also reduce fertilizer application since the nutrients returned to the soil from the animals are quite substantial. Reducing chemical fertilisers in the long-run will not only reduce production costs but, more importantly, will minimise further deterioration in soil fertility. It is a known fact that constant application of chemicals will alter the ecological profile of the soil. With reduced biodiversity in the soil, plant growth can be affected.

Cover crops such as *Centrosema pubescens*, *Desmodium audifolium*, *Pueraria phaseoloides*, *Calopogonium caeruleum*, etc., found in the inter-rows in most plantations, are legumes with a high nutrient content. As the palm matures, the canopy increases and limits light penetration, which in turn will reduce forage production in the inter-rows. It has been estimated that after the second year of planting, the light intensity declined by an average of 10 - 15%. Forage DM yield for the five years after planting ranges from 2000-3000 kg/ha to as high as 7000-8000 kg/ha DM depending on the extent of weeding done (Chen *et al.*, 1991). After five years, DM yields declined to between 500 and 1000 kg/ha.

The stocking density has to be adjusted to correspond with the forage yield. The carrying capacities and liveweight productions of cattle grazing under immature oil palm are comparable to those found in ranch operations in Malaysia, which is about 138-285 kg/ha/year (Chen and Dahlan, 1995). The carrying capacity under mature oil palm is only 0.3 head/ha which is low. The carrying capacity can be sustained at a higher level if all the available biomass (including the by-products) are utilised. However, a production system which fully integrates livestock utilising forage and other biomass has not been developed.

Grazing Systems

Forage production in the inter-rows can be substantially increased even under mature palms provided the planting density is reduced. Reducing planting density does not necessarily mean lower fruit bunch production. On the contrary, production of fruit bunch is maintained because the reduction in planting density is compensated by increased production from individual trees. Under reduced planting density there is greater light penetration resulting in increased forage production.

Chen and Dahlan (1995) suggested that a rotational grazing system at 6-8 weekly intervals is ideal since it allows routine work to be done. They also recommended that the interval of grazing be adjusted depending upon forage availability. The stocking rate for cattle varies from 0.3-3.0/ha and in the case of sheep, from 2.0-14.0/ha. The large variation is due to the inconsistency in forage availability. Animals should be relocated after 60% of the forage is grazed when it meets both objectives of weeding and forage regeneration.

Integrated animal farming can be further intensified if the system incorporates the utilisation of by-products. The by-products from the oil palm industry are easily available at competitive costs. There is no reason why a viable animal production system cannot be developed in conjunction with the oil palm plantation. In fact, the oil palm industry is the only basis for animal production in the tropics since conventional grazing alone is uneconomic.

Conclusion

The concept of integrating animals with oil palm plantations is a feasible and practical proposition as demonstrated by many studies conducted in Malaysia over the past two decades. The only impediment towards implementing the concept is the attitude of the plantation management which lacks the expertise in animal husbandry and is unable to see the benefits derived from such a farming system. Future plantation managers should be competent in both crop and animal production. At present, plantation management cannot ignore the need to optimise all available resources for two reasons. Firstly, with the rapid expansion of oil palm cultivation worldwide, ensuring profitability solely from extracting oil has become somewhat uncertain. Secondly, demand for animal products has exceeded supply because of improved standards of living and affluence. Finally, a paradigm shift is needed in the way the oil palm sector is managed. This is only possible through new policy directions and availability of training packages to advance the concept of animal/crop integrated farming system.

References

Abu Hassan, O. 1995. Utilisation of oil palm trunks and fronds. In Proc. 1st Int. Symp on Integration of Livestock to Oil Palm Prod. Kuala Lumpur, Malaysia. pp. 129-138.

Asada, T., Konno, T., and Saito, T. 1991. Study on the conversion of oil palm leaves and petioles into feeds for ruminants. In Proc. 3rd. Int. Symp. on the Nutrition of Herbivores. Penang, Malaysia. pp. 104.

Chen, C. P. and Dahlan, I. 1995. In Proc. 1st Int. Symp. on Integration of Livestock to Oil Palm Prod. FAO, Rome. pp. 35-49.

Chen, C. P. H. K. Wong and Dahlan, I. 1991. In Recent Advances on the Nutrition of Herbivores. Y. W. Ho et. al (Eds.) Malaysian Society and

Animal Production. pp. 233-246.
Hair-Bejo, M., Liang, J. B. and Alimon, A. R. 1995. Copper tolerance in buffalo: The potential toxic effect of copper in buffalo fed palm kernel cake. In Proc. 17th Malaysian Society of Animal Production Ann. Conf. Penang, Malaysia. pp. 246-247.
Hutagalung, R. I. 1985. Nutrient availability and utilisation of unconventional feedstuffs used in tropical regions. In Proc. Feeding Systems of Animals in Temperate Areas. Seoul, Korea. pp. 326-337.
Jelan, Z. A., Jalaludin, S., and Vijchulata, P. 1986. In Final RCM on isotope-aided studies on non-protein nitrogen and agro-industrial by-products utilisation by ruminants. International Atomic Energy Agency, Vienna, Austria. pp. 77.
Palmquist, D. L. 1995. By pass energy from palm oil for cattle. ln Proc. 1st Int. Symp. on Integration of Livestock to Oil Palm Prod. Kuala Lumpur, Malaysia. pp. 123-128.