Oil Palm Frond, a Feed for Herbivores

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ABSTRACT: Oil palm (Elaeis guineensis jacq.) is a multipurpose tree, cultivated extensively in South East Asian countries and Africa. The primary oil palm product is palm oil, but processing by-products include palm press fiber, palm kernel cake and palm oil sludge which are used by the animal feed industry. Recently, oil palm frond (OPF) has been identified as a potential feed for herbivore livestock. The average weight of OPF pruned from a mature plant is 13.3 kg and total OPF production is about 5500 kg/ha/year. The dry matter (DM), crude protein (CP), ash, ether extract (EE), crude fibre (CF), acid detergent fibre (ADF), lignin, calcium (Ca) and phosphorus (P) content of OPF has been shown to be 349, 70, 50, 24, 323, 536, 276, 4 and 9 g/kg respectively. The gross energy and metabolizable energy (MJ/kg DM) of OPF is 17.2 and 6.5 respectively. These data indicate that OPF, a low cost by-product available throughout the year, could be more widely used as a roughage source for ruminants and other herbivorous livestock.

Key words: Oil Palm Frond, Ruminant Feed, Herbivore Feed

INTRODUCTION

Oil palm is a plant that produces many by-products used by the animal feed industry, in addition to palm oil. The area under cultivation for palm oil is rapidly increasing in South East Asian countries. Malaysia, with 4.6 million ha under palm oil cultivation now produces more palm oil than Nigeria, Congo and Indonesia, the traditional sources of palm oil. Recently, OPF has been identified as a potential feed for ruminants and other herbivores (Dahlan, 1989, Dahlan., 1992a, 1992b; Dahlan et al., 1993a, 1993b, Dahlan, 1996 and Ishida et al. 1994, Oshio et al., 1990, Islam, 1999) as discussed in this review.

CHEMICAL COMPOSITION OF OPF

The nutrient content of OPF has been reported by many researchers. The average CP value of OPF is about 7% (Asada, et. al.,1991; Wong and Zahari, 1992; and Dahlan, 1992 a) but a higher value was reported by Alimon (1993). OPF contains a considerable amount of lignin and silica (Akmar et al. 1996) that reduce its nutritive value when fed to ruminants. The average crude protein (CP) composition (11.0%) in the leaflets suggests its potential value for livestock feeding as it’s CP contents is far above the critical 6.25% CP level required to maintain normal intake by ruminants (Playne, 1972). Oshio et al. (1990) reported that OPF leaflets had a higher (p<0.05) CP value and crude fat content than petiols. Cellulose levels are usually lower than hemicellulose in both petiols and leaflets.

INTAKE AND DIGESTIBILITY OF OPF

Ishida and Abu Hassan (1992) studied Kedah-Kelantan bull fed urea treated OPF silage. They observed the dry matter intake of 0%, 3% and 6% urea treated OPF was 39.9, 32.1 and 24.0 (100 kg body weight) and dry matter digestibility was 45.0%, 44.2% and 35.8% respectively. The lower digestibility of 6% urea treated OPF was due to prolonged bacterial activity. Oshio et al. (1990) investigated the in vitro digestibility of different tissues of OPF. Dried organic cell wall digestibility of leaflets and petioles were 21.15 and 14.4% respectively and the estimated TDN for leaflets (27.5) was higher than petiole (16.3). Dahlan (1992a) reported that the IVDMD of leaflets and petiols were 43.52% and 39.10 where TDN were 45.66 and 39.62 respectively. It has also been reported the gross energy (MJ/kg DM), and metabolizable energy (MJ/Kg DM) of leaflets and petiols were 17.18 vs. 17.38 and 6.5 vs. 5.8 respectively (Dahlan, 1996). Dahlan (1992 a b) showed that OPF is highly acceptable by goat and sheep where the dry matter intake (DMI) was 30-45 g/kg live weight. Dahlan and Norwaty (1999) recently studied the utilization of OPF by deer fed in captivity.

They found that Cervus timorensis deer performed well on three diets consist of 50% OPF chopped fresh plus 50% Asystasia intrusa (OPFF), 50% OPF silage plus 50% Asystasia intrusa (OPFS) and 50% OPF pellet plus 50% Asystasia intrusa (OPFP). The dry matter intake were 39.5, 37.3 and 38.5 g/kgW0.75 for diet OPFF, OPFS and OPFP respectively. Shin, et. al. (1999) reported on the use of foreign non-conventional roughage sources (rice straw (RS), Chinese wildrye hay (CWH), sugarcane leaf hay (SLH) and oil palm frond pellet) on lactating dairy cows in Korea. They found that the dry matter intake for RS, OPF, SLH and CWH were 13.63, 14.57, 12.54 and 14.02 kg/head/day respectively. The crude fiber content of OPF was significantly higher than RS, SLH and CWH (p<0.05). The daily forage intake (kg) of SLH was significantly lower compared with RS, OPF and CWH (p<0.05) and, OPF showed a higher value for dry matter intake than SLH (p<0.05).
In an evaluation of OPF pellets by Shin et al. (1999) on Korean Native goats, OPF and CWH had a higher nutrient digestibility than SLH. They concluded that foreign non-conventional roughages, particularly OPF and CWH were as good quality roughage for replacing the rice straw in Korea. Although degradability is considering in first attempts as evaluating fibrous feed, very little research has been conducted to determine the DM and OM degradation. Wong and Zahari (1992) found that the dry matter disappearance of OPF was 37% at 48 hours, 40% at 72 hours and 52% at 96 hours. More than 80% of the dry matter was degraded within 48 hours suggesting that OPF could be a suitable source for ruminants.

**EFFECT OF OPF ON RUMEN METABOLISM**

Shin et al. (1999) used four cannulated Korean Native goats to investigate the effects of Chinese wildrye hay (CWH), sugarcane leaf hay (SLH) and OPF on ruminal fermentation characteristics. They found that 3 hours after feeding, OPF and SLH produced more ammonia than did RS. The pH values were lower with OPF and CWH than SLH. OPF (pelletized) showed a higher activity of CMCase and xylanase (cellulolytic enzymes) than RS. Acetate, total VFA concentration and the ratio of acetate and propionate were the highest with OPF pellets. These data suggest that OPF is more digestible than SLH and RS.

**USE OF OPF AS A HERBIVORE LIVESTOCK FEED**

**Cattle**

Abu Hassan et al (1993) conducted two experiments with dairy and beef cattle with OPF and observed that OPF performed well as a fibrous feed. They reported that there were no significant difference between 50% OPF and 50% grass based diet. However, 30% OPF silage with 70% concentrate based diet produced more milk than a 50% OPF and 50% grass based diet. Moreover, they observed no toxic effects when used for a long time. Asada et al. (1991) reported that OPF leaves and petioles have a good palatability for ruminants, that may be an effective sources’ roughage for replacing rice straw and thus ensiling might be a way of conservation of OPF.

**Goats**

Dahlan (1992a, b) reported that oil palm leaves (OPL) are readily accepted by goats and sheep. Dahlan, et al. (1993a) reported that metabolizible energy intake (MEI) of OPF fed goats was 311.3 kg ME/W kg 0.75. Kearl (1982) reported that the maintenance requirement for goat ranged from 238.7 to 585.13 kg ME/kg W 0.75. Thus it can be concluded that OPL is suitable to be used as a maintenance feed and to produce quality meat from goats.

**Sheep**

A 120 day feeding trial was conducted by Schrader (1994) with 30 male Siamese long tail (SLT) lambs of 3-6 month’s ages. The lambs gained 81.82 g/day when fed OPF silage (30%) with concentrate mixture (70%) and grew faster than the control group on pasture (82 g/day).

**Buffalos**

Mardi (1991) evaluated the growth performance and carcass characteristics of Swamp buffalo fed OPF and sago meal based diets. OPF based diet had a higher average daily gain (470 vs 440 g) and dry matter intake (2.37% vs 2.30). They stated that OPF could be used as a roughage source in buffalo feeding and resulted in good quality meat.

**Deer**

Recent work on deer found that pen feeding of 5 months old fawns for 18 weeks on diets consisting of 50% OPF chopped fresh (OPFF), OPF silage (OPFS) and OPF pellet (OPFP) plus 50 % commercial pellet showed encouraging results (Dahlan and Norwaty, 1999). The dry matter intakes of the fawns were 2.42 %, 2.09 % and 1.76 % of body weight OPFF, OPFS and OPFP diets, respectively.

The optimal levels of inclusions of OPF in the mixed rations (on a DM basis) were proposed to be 55%, 55%, 50%, 50% and 50% for cattle, buffalo, sheep/goats, rabbit and deer, respectively. (Dahlan., 1996).

**LIMITATIONS OF OPF**

Although OPF is available throughout the year it must be collected and piled up and also used readily or even chopped immediately within two days after harvesting/pruning. Collection of OPF incurs high costs. Since OPF contains more than 55% water, it tends to become mouldy during storage. To prevent mould, drying is essential which can also incur high. Finally, costs of pelleting and transport may have to be accounted. High silica content and the slow rate of fermentation of fiber in OPF, which reduce VFA and the role of end products of fiber digestion in relation to the over all efficiency of energy.
utilization also has to be considered. In addition, OPF contains very low protein (5.0-7.0%) and unless processed, OPF becomes mouldy. Mouldy feedstuffs have less palatability and low nutritive value and may contain fungal toxicins. Low protein content and unbalanced mineral content can result in low digestibility and low absorption or availability of nutrients for maintenance and production. These limitations can be overcome by physical and/or mechanical processing such as immediate chopping, grinding and drying, pre-digestion of fiber through chemical and biological treatment and stimulation of rumen microbes by supplementation with energy and protein rich ingredients or with urea and molasses and supplementation with essential minerals like Ca, P and S to balance up the nutrient content of OPF.

**CONCLUSION**

Effective utilization of OPF may provide a feed stuff for the livestock industry in the tropics. With the availability of cheaper and plentiful source of livestock feed from oil palm plantations, the production costs of livestock rearing will be reduced and this will promote further development of herbivore production in the tropics.

**REFERENCES**


**Table 1. Level of inclusion of OPF in ruminants/herbivores diets**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Species</th>
<th>Feeding system</th>
<th>gain g/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schrader (1994)</td>
<td>Sheep</td>
<td>30% OPF silage + 70% Conc. + special. Min. block in stall fed</td>
<td>81.82</td>
</tr>
<tr>
<td></td>
<td>Sheep</td>
<td>30% OPF silage + 70% Conc. + Standard Min. block in stall fed</td>
<td>78.52</td>
</tr>
<tr>
<td>Dahlan (1994)</td>
<td>Rabbit</td>
<td>50% OPF pellet and 50% commercial pellet</td>
<td>28.3</td>
</tr>
<tr>
<td>A Hassan et al (1992b)</td>
<td>Dairy cattle</td>
<td>30% OPF silage + 70% concentrate</td>
<td>470.0</td>
</tr>
<tr>
<td>MARDI (1991)</td>
<td>Buffalo</td>
<td>30% OPF silage + 25% PKC + 25% copra meal + SM 105% + FM 5% + urea 35 and Mineral vitamin 2%</td>
<td>470.0</td>
</tr>
<tr>
<td>Dahlan and Norwaty (1999)</td>
<td>Deer</td>
<td>50% OPF fresh + 50% commercial pellet</td>
<td>98.0</td>
</tr>
<tr>
<td></td>
<td>Deer</td>
<td>50% OPF silage + 50% commercial pellet</td>
<td>95.0</td>
</tr>
<tr>
<td></td>
<td>Deer</td>
<td>50% OPF pellet + 50% commercial pellet</td>
<td>110.0</td>
</tr>
</tbody>
</table>

**CONCLUSION**

Effective utilization of OPF may provide a feed stuff for the livestock industry in the tropics. With the availability of cheaper and plentiful source of livestock feed from oil palm plantations, the production costs of livestock rearing will be reduced and this will promote further development of herbivore production in the tropics.

**REFERENCES**


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