THE COMING FAMINE

THE GLOBAL FOOD CRISIS AND WHAT WE CAN DO TO AVOID IT
Prospects of Palm Kernel Cake use in Cattle Feed

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Presentation Plan

- Part 1: Introduction to animal feed
- Part 2: Introduction to PKC
- Part 3: Opportunities and Potentials
- Part 4: Quality evaluation of PKC
Animal Production Process

Inputs
Feed 70%

Measurement Analysis

Resources

Output
Why animals need Feed?

- To Grow
- To Live
- To Produce
Feed Provides Nutrients

- Protein
- Carbohydrates
- Fat
- Minerals
- Vitamins
- Water
# Nutrient Drain through Milk

## Milk Yield 1

<table>
<thead>
<tr>
<th>Nutrients in Milk</th>
<th>Gms</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>886</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>840</td>
<td></td>
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</table>

## Milk Yield 10

<table>
<thead>
<tr>
<th>Nutrients in Milk</th>
<th>Gms</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>8860</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>8400</td>
<td></td>
</tr>
</tbody>
</table>
Feeding of Dairy Animals

Feed of the Animal

Roughages
50% (DM Basis)

- Green Fodder
- Dry Roughage

Concentrate
50% (DM Basis)

- Vanda Feed
Concentrate Feeds
Concentrated source of Nutrients

- Dairy animals with high genetic potential for milk production also have high requirements for energy and protein.

- Given that animals can eat only a certain amount per day, roughage alone cannot supply the required amount of energy and protein.

- Generally, the purpose of adding concentrates to the ration of dairy cattle is to provide a concentrated source of energy and protein to supplement the roughage to meet the animal requirements.
Energy Sources

- **Fat Sources**
  - Vegetable Oil Seed
  - Animal Fat/ Lard

- **Carbohydrate Sources**
  - Grains
    - Corn
    - Rice
    - Wheat
    - Sorghum
    - Barley
  - Grain Milling Byproducts
    - Wheat Bran
    - Wheat Middling
    - Rice Polishing
Protein Sources

- **Vegetable Sources**
  - Vegetable Oil Meals
  - Vegetable Oil Cakes
    - Cotton Seed
    - Rapeseed
    - Canola
    - Soybean
    - Sunflower
  - *Palm Kernel cake*
    - Linseed
    - Safflower
    - Popyseed
Basics of Ration Formulation

- Step 1: Product Specification
  (Nutrient Requirement of the Feed)

- Step 2: Raw Material Selection
  (Availability, price, nutrient content, anti-nutrient content and other preferences)

- Step 3: Designing a Product
  (Feed Formulation, Numerical Calculations, and non-numerical expressions of the Feed stuffs)
Introduction to Palm Kernel Cake (PKC)
Palm Products

- Crude Palm Oil
- **Palm Kernel Cake/Meal**
- Palm Fatty Acid Distillate (PFAD)
- Biomass

**Other By-Products**
- Oil Palm Fronds (OPF)
- Palm Press Fiber (PPF)
- Palm oil mill effluent (POME)
Palm Kernel Cake/ Expeller (PKC/E)
Palm Kernel Cake/ Expeller (PKC/E)

- Palm Kernel is the endosperm of white cellular mass coated with tough black membrane or testa, which is encasted in a thick shell or endocarp of an oil palm seed.
- PKC/E obtained from the palm kernel after palm kernel oil has been extracted.
## Composition of Palm Kernel

<table>
<thead>
<tr>
<th>Constituents</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fats</td>
<td>50 %</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>9 %</td>
</tr>
<tr>
<td>Carbohydrates (Starches, Sugars, Cellulose)</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Source: Malaysian Palm Oil Council
## Composition of PKC

<table>
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<tr>
<th>Constituents</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter (DM)</td>
<td>93 %</td>
</tr>
<tr>
<td>Crude Protein (CP)</td>
<td>16 %</td>
</tr>
<tr>
<td>Crude Fiber (CF)</td>
<td>17 %</td>
</tr>
<tr>
<td>Ether Extract (EE)</td>
<td>08 %</td>
</tr>
<tr>
<td>Ash</td>
<td>4-5 %</td>
</tr>
<tr>
<td>Calcium (Ca)</td>
<td>0.3 %</td>
</tr>
<tr>
<td>Phosphorus (P)</td>
<td>0.7 %</td>
</tr>
<tr>
<td>Magnesium (Mg)</td>
<td>0.27 %</td>
</tr>
<tr>
<td>Metabolisable Energy (ME)</td>
<td></td>
</tr>
<tr>
<td>Cattle</td>
<td>2510 K Cal</td>
</tr>
<tr>
<td>Chicken</td>
<td>1673 K Cal</td>
</tr>
</tbody>
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Source: Malaysian Palm Oil Council
## Fiber Composition

<table>
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<th>Composition</th>
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<tr>
<td>Nitrogen Free Extract (NFE)</td>
<td>52 %</td>
</tr>
<tr>
<td>Crude Fiber (CF)</td>
<td>17 %</td>
</tr>
<tr>
<td>Acid Detergent Fiber (ADF)</td>
<td>31 %</td>
</tr>
<tr>
<td>Neutral Detergent Fiber (NDF)</td>
<td>72 %</td>
</tr>
<tr>
<td>Major Carbohydrates of Cell Wall</td>
<td></td>
</tr>
<tr>
<td>Mannose</td>
<td>56.4 %</td>
</tr>
<tr>
<td>Glucose</td>
<td>11.6 %</td>
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Source: Malaysian Palm Oil Council
# Amino Acid Profile

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<th>Protein/Amino acid</th>
<th>Composition (%)</th>
<th>Availability (%)</th>
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<tr>
<td>Total Protein (as % of PKC)</td>
<td>16.06</td>
<td></td>
</tr>
<tr>
<td>Alanine</td>
<td>0.92</td>
<td>87.0</td>
</tr>
<tr>
<td>Arginine</td>
<td>2.18</td>
<td>-</td>
</tr>
<tr>
<td>Aspartic acid</td>
<td>1.55</td>
<td>64.4</td>
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<tr>
<td>Cystine</td>
<td>0.20</td>
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<td>Glutamic acid</td>
<td>3.15</td>
<td>74.4</td>
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<td>Histidine</td>
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<tr>
<td>Isoleucine</td>
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*Source: (Yeong et al., 1983)*
Palm Kernel Cake use in Cattle Feed
Feeding Advantages with PKC

- High energy Source
- High Quality Protein
- Balanced Mineral Content
- Good Palatability
- No Toxins
- Availability
- Cost effectiveness
Ideal Concentrated Feed stuff

- PKC vs Grains Feeding
  - Grains and other starch products are highly fermentable results in
  - High energy wastage in the form of methane gas.
  - Production of increased level of acids (Propionic acid) further results in
    - Acidosis
    - Low intake and digestibility of roughages.
    - Undigested feed particles in feases.
    - Low milk fat percentage.
Amount of Grain Consumed Influences Intake and Digestibility of Forage
High Energy Source

- High contents of ME
- High contents of CF, make PKC/E, slowly fermentable, resulted in to
  - Less production of methane, and less loss of energy.
  - Production of Acetic acid, as the result of fermentation, which is precursor of the milk fat, ultimately increases the fat percentage of milk.
High Quality Protein

- Crude protein has two fragments
  - Rumen degradable Protein (RDP)
  - Rumen un-degradable Protein (RUP)
  - PKC/E is high in RUP content and its intestinal digestibility (Hindle et al., 1999; Woods et al., 2003)
    - RDP, meet the requirement of the rumen microbes, first, to convert in to microbial protein.
    - The amino acid profile of the microbial protein, becomes limiting factor for high milk production.
    - The RUP content of the ration considered when formulating diet for high milk yields.
Balanced Mineral Content

- Have high contents of Phosphorus (0.7 %), reduces the need of inclusion of expensive phosphorus sources, like DCP.
Good Palatability

- PKC/E is highly palatable in ruminants.
- No refusal due to rancid oil contents.
  - It contains Vitamin E, which acts as a natural anti-oxidant.
  - Its low content of unsaturated fatty acids also reduces rancidity problems.
Feed For Safe food

- NO Anti-Nutritional Factors
- Aflatoxin free, optimize intake and overall growth performance
  - High DM contents in PKC/E discourages growth of micro-organisms and mould.
- Free of toxic chemical and pesticides.
- Free of dioxin, like melamine
Availability

- The production of PKC/E in Malaysia is continuous throughout the year and this guarantees the uninterrupted supply and availability.
Cost Effectiveness

- **High Inclusion Levels**
  - High percentage of PKC/E, can be used as single ingredient or in combination with other ingredients.
  - Feeding of PKC up to 25% of Total mix ration, (Carvalho et al. 2006)
    - decreases the feed cost
    - without detrimental effects on productive responses
    - increased the milk protein content
    - Increased the milk lactose content.
Quality Evaluation of PKC
Quality Evaluation of PKC

- **Nutritional parameters**
  - (Minimum Factor)
    - Crude Protein
    - Crude Fat (Ether Extract)

- **Anti-nutritional parameters**
  - (Maximum Factor)
    - Moisture
    - Fiber
    - Ash
Breed insects to improve human food security