

# IDENTIFICACION AND EVALUATION OF AGROINDUSTRIAL BY-PRODUCTS FOR SUPPLEMENTARY FEEDING OF BUFFALOES IN THE AMAZON

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## INTRODUCTION

An increasing search for economically viable alternatives to give more sustainability for the regional buffalo milk and beef production systems has lead to the use of agroindustrial by-products and post-harvesting crop residues, found plentifully all over Brazil. Some of those by-products were very well studied and play an important role in animal feeding. Due to the high costs of concentrate supplements imported from other regions of the country, the Amazon animal production systems are based exclusively on forage grasses, which do not meet animal nutritional needs, resulting in low productivity rates. Considering the great economic potential of regional by-products and crop residues, a study was carried out aiming to identify and evaluate, through chemical composition and nutritive value the material that can be used for supplementary feeding of buffaloes.

## MATERIAL AND METHODS

A survey was carried out to characterize the regional agroindustrial by-products and crop residues and to obtain information about method of obtaining, availability, economic value and place of occurrence of the materials. A qualitative evaluation was done through analysis of dry and organic matter, crude protein, fat content, neutral detergent fiber, acid detergent fiber, cellulose, lignin, silica and "in vitro" digestibility of the organic matter (IVDOM) (1,2,3,4).

## RESULTS AND DISCUSSION

The results of the analysis of the material studied are presented in Table 1. The main materials are:

**Açaí (*Euterpe oleraceae*)** - The residues are obtained from the leaves treated after the sheath removal. They are available in high quantities, being burned or left in the production site. Crude protein levels vary from 1.2 a 10.8%, being higher the value for the waste matter, which presents high humidity (92.4%). The values for IVDOM are low, 36.8% for the waste matter, 21.2% for the internal fiber, 22.7% for the external fiber and 3.1% for the kernel+lees, due to high lignin contents (22.0 to 28.98%).

**Oil palm (*Elaeis guineensis*)** - Oil palm agroindustry generates several by-products, being the most available the pulp fiber and the kernel cake, with 14% of crude protein and 60.5% of IVDOM, a good alternative for animal feeding. Pulp fiber, of low digestibility and protein content and high fat content, has less possibility of being used as a feed source.

**Passion fruit (*Passiflora edulis*)** - Its industrialization leaves 60% of peel, 30% of juice and 10% of seed. IVDOM, crude protein and lignin are 69.5 and 63.2%, 6.6 and 5.4%, and 8.6 and 8.8% respectively for bagasse treated and non treated with lime. Bagasse can supply part of the demand for energy. Although with high crude protein content (14.7%) seed cake has low digestibility (15.0%) and small availability in the region.

**Index terms:** Agroindustrial by-products, crop residues, nutritive value, chemical composition.

Table 1. Chemical composition and "in vitro" digestibility of organic matter of Amazon region by-products.

| Discriminação                                   | DM    | CP    | OM    | FAT   | NDF   | ADF   | HEM   | CEL   | LIG   | IVDOM |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| % in Dry Matter                                 |       |       |       |       |       |       |       |       |       |       |
| <b>Açaí (<i>Euterpe oleracea</i>)</b>           |       |       |       |       |       |       |       |       |       |       |
| Palm heart waste                                | 7,58  | 10,85 | 80,45 | 1,25  | 68,43 | 47,86 | 20,57 | 17,24 | 28,98 | 36,77 |
| Internal fiber                                  | 19,93 | 2,45  | 92,75 | 0,98  | 78,15 | 59,87 | 18,28 | 37,19 | 22,29 | 21,24 |
| External fiber                                  | 23,56 | 1,20  | 92,68 | 1,23  | 77,80 | 64,60 | 13,20 | 41,57 | 22,05 | 22,73 |
| Kernel+less                                     | 56,90 | 6,63  | 90,01 | 1,53  | 79,86 | 73,73 | 6,13  | 42,24 | 24,72 | 3,08  |
| <b>Oil palm (<i>Elaeis guineensis</i>)</b>      |       |       |       |       |       |       |       |       |       |       |
| Kernel cake                                     | 92,83 | 14,00 | 95,51 | 11,95 | 75,41 | 43,41 | 32,00 | 30,09 | 11,12 | 60,50 |
| Pup fiber                                       | 78,26 | 5,08  | 95,13 | 14,39 | 71,82 | 49,79 | 22,04 | 35,52 | 12,52 | 33,64 |
| <b>Passion fruit (<i>Passiflora edulis</i>)</b> |       |       |       |       |       |       |       |       |       |       |
| Bagasse   | 12,74 | 6,65  | 90,43 | 0,71  | 53,61 | 45,97 | 7,64  | 36,42 | 8,57  | 69,49 |
| Bagasse + lime                                  | 17,70 | 5,45  | 76,03 | 1,62  | 39,77 | 35,68 | 4,09  | 26,40 | 8,84  | 63,23 |
| Seed cake                                       | 92,25 | 14,68 | 97,97 | -     | 85,36 | 67,82 | 17,54 | 58,28 | 08,46 | 15,01 |
| <b>Cowpea (<i>Vigna unguiculata</i>)</b>        |       |       |       |       |       |       |       |       |       |       |
| Pod straw                                       | 82,44 | 5,46  | 92,25 | 0,27  | 65,28 | 51,96 | 13,32 | 32,14 | 19,21 | 48,66 |
| Residual leaves                                 | 88,17 | 16,40 | 82,61 | 1,22  | -     | -     | -     | -     | -     | 48,00 |
| <b>Cocoa (<i>Theobroma cacao</i>)</b>           |       |       |       |       |       |       |       |       |       |       |
| Fruit shell                                     | 15,00 | 7,47  | 83,71 | 2,17  | 57,98 | 50,70 | 7,28  | 29,30 | 20,60 | 34,05 |
| Seed coat                                       | 91,14 | 15,31 | 89,92 | 3,42  | 48,26 | 44,28 | 3,98  | 23,11 | 19,58 | 42,31 |
| <b>Cotton (<i>Gossypium hirsutum</i>)</b>       |       |       |       |       |       |       |       |       |       |       |
| Cake  | 85,59 | 32,25 | 94,34 | 14,13 | 41,32 | 29,16 | 12,16 | 22,59 | 6,95  | 53,65 |
| Seed coat + linter                              | 85,62 | 22,44 | 94,72 | 19,50 | 42,69 | 30,50 | 12,19 | 25,95 | 3,59  | 48,82 |
| <b>Rice (<i>Oryza sativa</i>)</b>               |       |       |       |       |       |       |       |       |       |       |
| Lowland - Bran                                  | 78,58 | 13,63 | 88,07 | 17,78 | 39,04 | 12,53 | 26,51 | 6,54  | 4,41  | 75,81 |
| Seed coat                                       | 85,99 | 2,59  | 79,27 | 0,99  | 90,89 | 69,73 | 21,16 | 43,38 | 10,47 | 7,14  |
| Upland - Bran                                   | 83,39 | 16,36 | 90,68 | 14,32 | 43,66 | 21,27 | 22,39 | 11,70 | 6,61  | 64,98 |
| Seed coat                                       | 87,39 | 5,00  | 86,09 | 1,82  | 88,21 | 66,78 | 21,43 | 40,48 | 13,92 | 3,85  |
| <b>Anattotree (<i>Bixa orellana</i>)</b>        |       |       |       |       |       |       |       |       |       |       |
| Seed hulls                                      | 87,51 | 10,36 | 84,15 | 1,55  | 86,62 | 76,36 | 10,26 | 43,29 | 30,66 | 7,25  |
| Crop residue                                    | 82,26 | 14,10 | 93,26 | 2,97  | 76,82 | 69,08 | 7,74  | 30,85 | 31,76 | 42,74 |
| <b>Coconut (<i>Cocos nucifera</i>)</b>          |       |       |       |       |       |       |       |       |       |       |
| Cake  | 97,18 | 20,66 | 92,97 | -     | -     | -     | -     | -     | -     | 55,10 |

DM-Dry Matter, CP-Crude Protein, OM-Organic Matter, Fat, NDF-Neutral Detergent Fiber, ADF-Acid Detergent Fiber, HEM-Hemicellulose, CEL-Cellulose, LIG-Lignin, IVDOM-"in vitro" Organic Matter Digestibility.

**Cowpea (*Vigna unguiculata*)** - After seed harvesting operations, remain available the leaves plus stems and the pod straw. Pod straw represents 30% of the material harvested in the field (1.370 kg/ha), but it is not used. Crude protein is low (5.5%), lignin, high (19.2%) and IVDOM low (48.7%). Leaves plus stems have 16.4% of crude protein and 48% of IVDOM. It is likely that the high mineral content of the material (17.4%) is due to the contamination of

sand (silica), once the leaves plus stems are in contact with the soil. Data on voluntary intake of nutrients, in g/kg<sup>0.75</sup>/day, for straw and leaves, respectively show values of 64.2 and 90.2 for dry matter, 3.4 and 14.1 for crude protein, and 74.2 and 136.1 (Kcal) to metabolizable energy. Digestibility coefficients were 28.6 and 58.3 for crude protein and 48.7 and 48.0 for organic matter, respectively. The results showed that leaves plus stems have better nutritive value than pod straw, which did not allow an adequate ingestion of nutrients, although consumed in satisfactory quantity. Both materials can be used as animal feed but associated to other feed of better nutritive value.

**Cocoa (*Theobroma cacao*)** - Fruit shell and seed coat are the main residue of cocoa manufacturing. The shell, with 7.5% of crude protein and 34.1% of organic matter digestibility, besides its low nutritive value, presents other constraint for its utility, the dispersion of the trees and plantations. Seed coat is available permanently, but although with a high protein content (15.3%), has low IVDOM, as a consequence of the high lignin content (19.6%).

**Cotton (*Gossypium hirsutum*)** - The cake resulting from mechanical extraction of seed oil, is a residue of high importance. It presents high crude protein content (32.3%) and IVDOM (53.5%). Seed coat+linter, presents 24.4% for crude protein and 48.8% for IVDOM but has low availability, which turns unviable its use.

**Rice (*Oryza sativa*)** - Rice bran is a good quality feed, with crude protein content from 13.6 to 16.4% and IVDOM from 65.0 to 75.8%. Grain husk has high fiber and low crude protein contents, low IVDOM (2.8 to 7.1%) and very high lignin and silica contents.

**Anattoe (*Bixa orellana*)** - Crop residue (hulls plus remainings of seed extraction) presents low IVDOM and high fiber and lignin contents (30.7 and 31.8 respectively).

**Coconut (*Cocos nucifera*)** - The cake obtained by mechanical extraction is a residue that has a great potential for lowering the regional dependence of animal feed from other regions. It presents a high crude protein content (20.7%) and IVDOM of about 55.1%. Actually the availability of this material is not enough to attend market demands but in a rear future can be of great importance for the production systems.

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