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Cassava leaves as a source of protein

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Abstract

Analysis of cassava cultivars and interspecific hybrids leaves revealed a protein percentage ranges from 21 to 32%. Polyploid types did not show significant increase. Varieties with low HCN content can be selected to enrich flour of cassava and other grain crops. Interspecific hybrids with very vigorous vegetative growth are good sources of protein. They can be used for raising animals in Brazilian semi-arid region.

***Key words**:* Semi-arids, polyploidy, leave protein, interspecific hybrids.

Introduction

Cassava is a major staple food in Brazil and tropical countries. Its leaves are all year product. They are, however, so far under researched and under utilized. Accordingly large tonnages of these leaves are currently discarded as wastes after harvesting the roots. Since green vegetables have been recognized as the cheapest source of protein we thought to evaluate its content in cassava leaves.

Cassava interspecific hybrids are systematically produced, grown and studied for potential use at the Universidade de Brasilia. Some of them, such as the hybrid of *M. anomala* x cassava and *M. neusana* x cassava, produce an enormous vegetative growth candidates for use as forage crops. For these reason they were, beside other cassava cultivars, a subject of our analysis for protein content in their leaves.

Material and Methods

Leaf samples were harvested from local or genetically improved cassava varieties; interspecific hybrids too. All samples were taken from cultivated plants in the Federal district; a typical savanna (cerrado) conditions. The rainfall ranges from 1200 to 1500 mm during October to April. Samples analyzed were of fully expanded leaves; the fifth and sixth leaves in descendrical order in both sides of plant. About 100 g each of cassava leaves were sundried for 2-3 days with constant turning over to avert fungal growth. It was analyzed for protein content by Kjeldahl according to AOAC[3]. Twenty cultivars and interspecific hybrids have had their leaves been analyzed. Among this material two polyploid types were studied too.

Results and Discussion

Table 1 presents the mean values for the leaf protein. The crude proteincontent in different clones and interspecific hybrids ranged from 22.73 to 32.58%. This analytical data on crude protein in cassava leaves shows a variation which enables selection for high protein content in certain cultivars. There was no significant difference in polyploid and diploid types in relation to protein content in leaves.

This data clearly suggests their high potentials as cheap source of alternative protein for human and/or animals. It may be used to enhance the protein content of low-nitrogen traditional staples such as flours from cereals and tubers including cassava flour itself. Because of the simplicity of this technology involved in leaf protein, its incorporation for local food production will be most practical for a highly sustainable strategy.

The high protein content and nutritive value of cassava leaves are well documented by our analysis. It is in accord with analysis made by other researchers [2, 4]. The major draw to the widespread

Table 1. Protein content in cassava leaves of cultivars and interspecific hybrids.

M. pseudoglaziovii	28.67 ± 0.11
UnB 20	25.19 ± 0.12
UnB 60	32.58 ± 0.10
ICB 300 diploid	30.28 ± 0.08
ICB 300 tetraploid	30.28 ± 0.07
UnB 21	23.02 ± 0.16
UnB 248 diploid	32.30 ± 0.10
UnB 248 tetraploid	32.14 ± 0.12
UnB 11	29.54 ± 0.08
UnB 90	24.33 ± 0.16
UnB 12	28.54 ± 0.15
UnB 400	32.14 ± 0.09
UnB 031	26.07 ± 0.08
M. neusana	29.35 ± 0.12
M. anomala	30.22 ± 0.09
UnB 302	21.62 ± 0.16
UnB 308	24.06 ± 0.11
UnB 310	28.12 ± 0.14
UnB 312	22.72 ± 0.16
UnB 316	22.66 ± 0.10
UnB 307	23.41 ± 0.12

use of cassava leaves as food is cyanide scare as its content of cyanogenic glucosides which may reach 6 times higher than the root [13]. This may limit the nutritional value of cassava leaves. If cassava cultivars with low HCN content and high protein of leaves were selected it could offer an valuable source in poor regions of Brazil and other countries. The clones Unb 400 (Fig. 1) and UnB 500 are known by their very low HCN content. They are the best table clones for cooked root. Both showed in our analysis to have high carotenoid content [1, 8]. In the meantime their leaves have a high protein content, as much as 32%. So they are excellent candidates to use in enriching both root flour or consumed directly.

Cassava leaf yields to as much as 4,60 tonnes dry matter per hectare. Thus they may be produced as a by-product at root harvest [10]. From our analysis, the genetic variability that exists between cassava cultivars in relation to leaf protein content is suggestive of the potential response to selection and appears to be fruitful area for further research. Some interspecific hybrids of cassava with relative wild species such as *Manihot neusana* and *M. anomala* produced enormous vegetative growth that may reach to 10 times of common clones.

To increase potentiality of cassava leaves as a protein source, a strategy to the cultivation of cassava aims towards leaf production can be followed. The plant density could be increased and harvested more frequent. Foliage can be harvested for 4 months of age in a cycle of 60-70 days. With adequate irrigation and fertilization, cassava plants can withstand this defoliation for several years [7]. Under such conditions, annual leaf yield over 21 tonnes per hectare can be obtained. By establishing a density of 4200 plants/ha, 24 tonnes of fresh leaf can be collected. This equals about 613 kg of dry leaf. Considering that the minimum of protein content in cassava is 21%, therefore from one hectare of cassava, it is possible to obtain 140 kg of protein. If this strategy been applied on interspecific hybrids such as *Manihot neusana* x cassava and *Manihot anomala* x cassava, obtained yield may reach 1400 kg of protein.

In view of the predicted world shortage of cereal grains, cassava leaves are a potential source of protein for livestock raising in the tropics. Because of competing needs for the expanding human population and the diminishing food producing capacity of the earth's surface [4], it is argued that major priority is to develop livestock feeding systems which do not depend on cereal grains[9].

Cassava leaves are considered as a good source of supplementary protein too. They can be used for preparing dishes of cassava leaves adding variety to the diet as well as nutrients.

Figure 1. Cassava hybrid with *M. Neusana.*

The digestibility of cassava leaves has been investigated by Eggum [6] and Ravidran *et al.* [10, 12] who found it to be 80% for the protein in young leaves and 67% for the protein of older ones. This adds more support to the idea of using it for enriching food of poor people.

Conclusions

Leaves of cassava are a considerable source of protein. They may alleviate nutrition deficiency in poor countries of tropics and subtropics. Interspecific hybrids of cassava with certain wild species such as *M. neusana* and *M. anomala* can play an important role in providing a greater amount of protein due to their immense vegetative growth. Cassava cultivars which are used for cooking purposes are good candidates to have their leaves enriching grain crops flour. For these reasons, using cassava leaves as a source of protein serves well for a highly sustainable strategy.

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