Tropical and Subtropical Agroecosystems, 1 (2003): 193 - 196

Tropical and Subtropical Agroecosystems

PROCESSING OF *MUCUNA* FOR HUMAN FOOD IN THE REPUBLIC OF GUINEA

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SUMMARY

Since 1996, Sasakawa Global 2000/Guinea has been collaborating with the National Departments of Extension and Research on promoting *Mucuna pruriens* as a cover crop for improving and maintaining good soil fertility. Efforts have also continued to promote *Mucuna* as human food and animal feed so farmers will be encouraged to continue growing it. These studies on *Mucuna* for human food have been carried out by the Department of Extension and Rural Development, Ministry of Agriculture and Livestock.

We have previously reported that by the year 2000, 300 women were trained in the preparation of *Mucuna* recipes (ragout, *tau*, porridge and coffee) and that over 1,500 participants had consumed full meals of the *Mucuna* food preparations without showing any negative effects (Diallo *et al*., 2002). Since then, the number of women and girls trained in the preparation of *Mucuna* by the Agricultural Technical Schools and the number of people who have tasted the *Mucuna* foods have more than tripled (1,957 and 8,500 respectively). To date, no negative effects have been reported.

In the recipes tested thus far, the only method used for reducing L-Dopa to safe levels has been soaking the seeds for a minimum of 48 hours with a change of fresh water every 12 hours (in our efforts, the targeted L-Dopa concentration has been below 1%; it should be noted that the L-Dopa concentration of the food preparations is lower since *Mucuna* is only one ingredient of many). Recent experiments reported here have focused on developing techniques that are more labor- and cost-effective in aiding in the consumption of *Mucuna*. We have demonstrated two ways for reducing the level of L-Dopa in *Mucuna* beans: 1) cracking the seeds and soaking them in running water (from a faucet) for 36 hours and 2) putting *Mucuna* beans in a cloth bag and leaving them immersed in a flowing river for three days.

Key words: L- Dopa, protein, amino acids, minerals.

INTRODUCTION

Sasakwa Global 2000/Guinea (SG2000/Guinea) is one of Sasakawa Africa Association's (SAA) Agricultural Projects in Sub-Saharan Africa working in the Republic of Guinea (Guinea Conakry), West Africa. SAA's seat is in Tokyo and it is financed by the Nippon Foundation. SAA works very closely with its sister NGO, Global 2000 of The Carter Center in Atlanta, Georgia, USA because Former President Carter is one of the co-founders of Sasakawa Global 2000. The main objective of the Agricultural Projects of Sasakawa Global 2000 is to assist Sub-Saharan African countries to achieve food self-sufficiency and food security through the transfer and use of improved crop production technologies by small scale farmers. One major strategy in this effort is the improvement and maintenance of soil fertility by the use of organic (i.e., leguminous cover crops) and inorganic fertilizers.

In Guinea, chemical fertilizers are either unavailable or they are too expensive (US$25.00 per a 50-kg sack; i.e., US$500.00 t^{-1}) to the farmers. Sometimes, they are available but do not arrive in time for the crop season in a particular region. Therefore, leguminous cover crops may provide a partial solution, as they can directly reduce the dependence on inorganic fertilizers and enhance the efficiency of chemical fertilizers. With cover crops, similar yields can often be achieved with half the fertilizer inputs.

Studies in Guinea and in the region have shown that *Mucuna pruriens* is one of the best cover crops. Trials with *Mucuna* for soil fertility improvement and for the control of noxious weeds such as *Imperata* and *Striga* have been ongoing since 1996. At Kilisi Research Center, Kindia, Guinea, in three years (1996-1998) *Mucuna* doubled the organic matter content of the soil from 26 to 50 t ha^{-1} and the N content from 4.04 to 9.4 mg 100 g^{-1} soil while available P and K increased from 0.53 and 4.62 to 6.25 and 4.80 mg 100 g^{-1}, respectively. Cereal yields went up by 0.5-1.5 t ha^{-1} (Centre de Recherche Aqronomique, 1998). In SG2000/Guinea field trials during 2000-2002, *Mucuna*, in combination with rock phosphates from Senegal and Mali, has been used successfully to

recover the acid soils of the Fouta Djallon by raising pH and improving organic matter (SG2000/Guinea Annual Report, 2001/02). However, despite its several positive characteristics as a cover crop, the experience is that small-scale farmers are reluctant to adopt and cultivate a crop such as *Mucuna* which cannot be eaten, fed to animals, or sold. To alleviate this problem, SG2000/Guinea started supporting studies on the use of *Mucuna* as human food and animal feed.

The studies on the use of *Mucuna* as human food have been carried out by Women in Agricultural Extension and Rural Development of the Ministry of Agriculture and Livestock. As reported by Diallo *et al*. (2002), prior to the year 2000, four recipes (i.e., ragout, *tau*, porridge and coffee) were developed. In these preparations, the method used to remove L-Dopa is to soak *Mucuna* seeds in water for more than 48 hours with a change of fresh water every 12 hours, followed by cooking in water for 60-90 min. The seed coat is manually removed after a 24-h soaking (Diallo *et al*., 2002). Nine litres of water per one kilogram of *Mucuna* seed are used in soaking the seeds. At the end of the soaking period, the *Mucuna* seeds are rinsed several times in clean water, sun dried, milled to desired size and mixed with other ingredients. More than 1,957 Guinean women have been trained and over 8,500 people from all walks of life have eaten full meals of the *Mucuna* foods without any visible negative effects. The studies of *Mucuna* as human food have been complemented by analyses of L-Dopa levels in the processed foods.

Since the year 2000, studies have focused on developing simpler and faster ways to decrease L-Dopa content of the *Mucuna* seeds and on assessing the nutritional content of the processed seeds. This paper reports the results of these studies.

MATERIALS AND METHODS

Seeds of *Mucuna pruriens*, var. utilis and var. cochinchinensis were procured from SG2000/2000 Inputs Store at Kindia, Guinea. Whole and cracked seeds were soaked in running water from a faucet in a 30-L capacity metal trough containing holes for drainage. Cracked seeds were also soaked in a flowing river for 12 to 72 hours. Samples of 1 kg were placed in cotton cloth bags measuring 20 by 30 cm for the soaking process. Cracking of the seeds was done by using a multi-crop thresher at a higher speed than what is normally used for threshing the *Mucuna*.

The seed and processed food samples were then sun dried and milled into powder using wooden mortar and pestle. From each sample, 200 g were sent to Prof. R. Myhrman (World Hunger Research Center, Judson College, Illinois, USA) for analysis of the L-Dopa content. Nutritional content was analyzed at the Poultry Science Department, University of Arkansas, USA.

RESULTS AND DISCUSSION

The results of the various treatments are shown in Table 1 and in Figures 1 and 2. It is evident that L-Dopa is removed faster from cracked seeds as compared to whole ones. A 12-h extraction of whole and cracked seeds by running water via a faucet resulted in L-Dopa content of 4.22 and 3.58%, respectively, while at 48 hours these values were 1.60 and 0.08%, respectively (Figure 1). At least 60 h of running water was needed for whole seeds but only 36 hours for cracked seeds to arrive at an L-Dopa content below 1%. As also observed by Teixeira *et al*. (this volume), L-Dopa removal is slow during the first 24 hours but its rate is greatly increased between 24 and 48 hours.

Rate of removal of L-Dopa from cracked seeds was faster when the water source was the faucet than when it was the river (Table 1; Figure 2). The cracked seeds reached an L-Dopa level below 1% within 36 h in running water from a faucet and within 48 h in a flowing river.

Analysis of *Mucuna* food samples indicated very low to relatively low contents of L-Dopa. *Mucuna* foods made from var. cochinchinensis had higher L-Dopa content than those made with var. utilis. The porridge made of maize and *Mucuna* flours contained only 0.126% L-Dopa when made with var. utilis, but when made with var. cochinchinensis, it contained 0.615%. Similarly, *tau* made with flour from cassava and var. utilis contained 0.184% L-Dopa while a similar preparation made with var. cochinchinensis contained 0.529%.

Nutritional analyses conducted on untreated *Mucuna* seed, on *Mucuna* flour produced by soaking and boiling the seed, and on flour from roasted *Mucuna* seed indicated that the protein and amino acid content are little affected by the soaking and boiling treatments in water and by soaking in calcium hydroxide solution (Table 2). The only treatment that affected the amino acid values was the process of roasting in the preparation of *Mucuna* coffee.

No surveys have been conducted yet as to how much *Mucuna* is used as food in Guinea. However, there are reports on its consumption in the villages where food preparation training courses have been carried out. The most adopted recipe seems to be the use of *Mucuna* as coffee.

The project receives many requests from villagers for training on how to process *Mucuna* for food which indicates that there is a continued interest. This is

especially true in the areas where the project has demonstrated that *Mucuna* in combination with rock Phosphate can restore the soil fertility of highly acidic soils.

Table 1. Impact of soaking time and running water from faucet or in a river on the L- Dopa content of whole and cracked *Mucuna* seeds.

Processing method	Water source	Soaking time (h)	L-Dopa (%)
Unprocessed whole	----	0	4.93
Unprocessed cracked	----	0	4.33
Whole	Faucet	12	4.22
Cracked	Faucet	12	3.58
Cracked	River	12	3.81
Whole	Faucet	24	3.50
Cracked	Faucet	24	3.50
Cracked	River	24	3.68
Whole	Faucet	36	1.83
Cracked	Faucet	36	0.54
Cracked	River	36	1.80
Whole	Faucet	48	1.60
Cracked	Faucet	48	0.08
Cracked	River	48	0.72
Whole	Faucet	72	0.23
Cracked	Faucet	72	0.04
Cracked	River	72	0.26

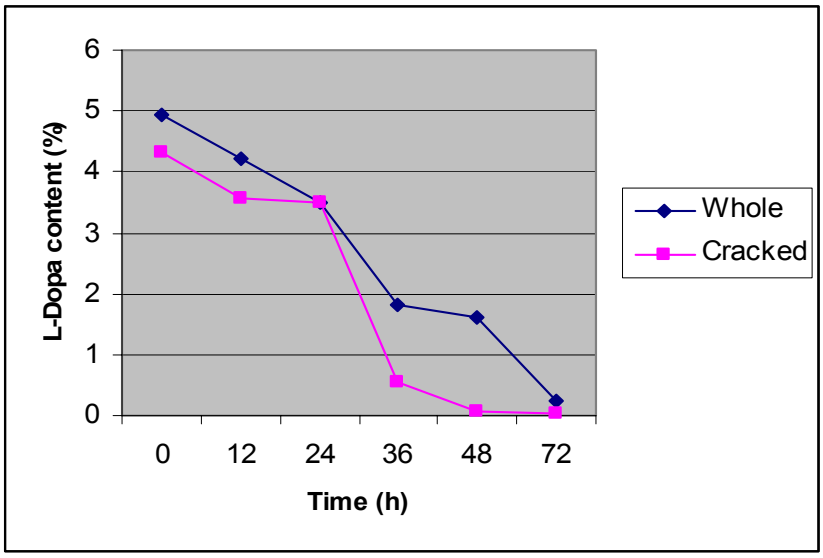

Figure 1. L-Dopa content of whole and cracked *Mucuna* seeds soaked in H_2O for different time durations in running water via a faucet.

Table 2. Content of protein and some essential amino acids in raw *Mucuna* seed, in flour produced by soaking and cooking, and in coffee produced by roasting. The values are averages from three sites.

Sample	Processing method	Protein	Lysine	Tryptophan	Methionine	Cystine
Raw seed	None	28.6	1.76	0.18	0.42	0.48
Flour	Soaking + Cooking	29.7	2.10	0.25	0.46	0.48
Coffee	Roasting	32.2	0.86	0.18	0.39	0.11

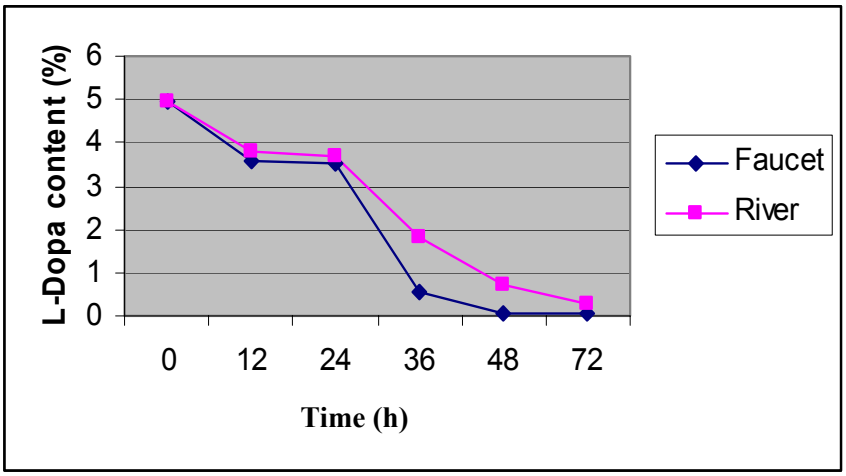

Figure 2. Comparison of L-Dopa content of cracked *Mucuna* seeds soaked in running water from a faucet and in a flowing river.

CONCLUSIONS

The results of this work are encouraging. While certain results reconfirm our earlier findings or those by other researchers, others point out ways to reduce L-Dopa content in ways that are more cost- and labour-effective. Following findings are particularly important:

- Cracking *Mucuna* seeds before soaking accelerates the removal of L-Dopa significantly. Running water removes L-Dopa faster than still water.
- The processing methods used do not greatly alter the protein and amino acid content, with the exception of roasting.
- L-Dopa can also be removed by placing the *Mucuna* seeds in bags or sacks and leaving them immersed in a river for three days.

It is clear that *Mucuna* has been rendered safe for consumption by the food preparation methods used. Future plans include the continuation of the training activities and the preparation of brochures and flyers both in French and in major local dialects (i.e., Sousou, Peul and Malinke).

However, processing *Mucuna* for human consumption still remains a time-consuming process. Research efforts will therefore continue for finding simpler methods.

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Submitted September 12, 2002 - Accepted October 1, 2002