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Chronic Cassava Toxicity

Proceedings of an interdisciplinary workshop
London, England, 29-30 January 1973

Editors: Barry Nestel and Reginald MacIntyre

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Cyanide Toxicity and Cassava Research at the International Institute of Tropical Agriculture, Ibadan, Nigeria

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Abstract Because of IITA's interest in cassava utilization by humans and livestock, selection for acyanogenesis will be an important objective of the cassava-breeding program. Selection for acyanogenesis will be based on finding cassava lines that lack the glucoside, glucosidase, and/or the glucoside and glucosidase. While stressing the importance of acyanogenesis, other important objectives of the program will be the retention of features such as resistance to insects and diseases in acyanogenic cassava plants.

Résumé A cause de l'intérêt que porte l'IITA à l'utilisation du manioc par l'homme et le bétail, un objectif important de son programme de recherche sur la génétique du manioc visera à la sélection de plants pour leur acyogénèse. A cette fin, on tentera de décourvrir des lignées de manioc dépourvues de glucoside, de glucosidase ou des deux à la fois. Tout en plaçant l'emphase sur l'importance de l'acyogénèse, d'autres aspects importants du programme porteront sur la rétention, par les plants de manioc acyanogènes, de caractères tels la résistance aux insectes et aux maladies.

IN Africa, about 30 million tons of cassava are produced annually on about 5 million ha (F.A.O. 1971). This comprises about 35% of the world production and approximately 50% of the area devoted to this crop throughout the world. Approximately 80% of the production and 70% of the area of cassava in Africa is grown in tropical West Africa. In this region, cassava is the chief staple food and, therefore, is regarded as the most important among root and tuber crops.

Current yield of cassava is about 6 tons/ha. Under experimental conditions, yields over 65 tons/ha have been reported by Jones (1959). With the development of improved cultivars and agronomic practices, cassava yields are expected to be as high as 80 tons/ha. This is more than a tenfold increase. Most of the cassava is now grown as a subsistence crop in a shifting cultivation type of agriculture. The suitability of cassava to this type of agriculture is due to its drought tolerance and resistance to insects, rodents, and some diseases. But above all, and in contrast to other root and tuber crops, cassava roots store well in the soil where they were grown. This storage capability will probably diminish in the future as shifting cultivation of land gives way to continuous and more permanent cultivation. This means that in the next few decades, assuming our hopes for achieving higher yields are realized, outlets for the increased supply and new usages have to be developed.

Finding new outlets and usages for cassava will be difficult indeed if the danger of cassava cyanogenesis continues to loom in the horizon.

The task of marketing cassava products in international markets will be very difficult if the toxicity question is not fully understood.

This points out the urgent need for elaborate and immediate research on cassava cyanogenesis and finding methods for its elimination from the plant or its food products. To carry out such investigations, there is urgent need for reliable qualitative and quantitative methods for determining the glucosides, glucosidases and the liberated hydrocyanic acid (HCN). The methods have to be simple and not require complicated and expensive instrumentation. Such methods have to be fast to be suitable for screening large germplasm pool and breeding materials of cassava. To illustrate the problem, it should be mentioned that, at IITA, in 1972, we had 12,000 accession numbers of cassava. We hoped to test all of these lines for cyanogenesis. Unfortunately, that was not possible in the absence of a quick and reliable method to determine cyanogenesis. In 1973, we expect about 100,000 accessions from introductions from all around the world and their recombinations, which we hope to evaluate for cyanogenesis. Again it is very unlikely that such a task can be accomplished without the availability of new screening methods. We are currently attempting to develop a qualitative analytical method which is suited for large-scale screening.

Selection for acyanogenesis can be based on finding a cassava line that lacks one of the following: a) Glucoside, b) Glucosidase, or c) Glucoside and glucosidase.

The toxicology of the glucoside is unknown and opinions are conflicting. Jones (1959) indicated that the glucoside, if ingested without the enzyme from cassava, can still be hydrolyzed by enzymes that may be present in the intestinal tract or that may be introduced to it by eating uncooked fresh vegetables. Nicholls (1951) indicated that some people who eat large quantities of cassava refuse to eat uncooked food with it, suggesting that the proper enzyme may be introduced to the body from ingested raw fruits and vegetables. Due to the stability of the glucoside (Wood 1966) and its water solubility, its hydrolysis in the digestive tract by body enzymes or by exogenous enzymes from raw fruits and vegetables is very likely. Due to such uncertainties, our goal at IITA is to find lines that are completely acyanogenic because of the glucoside and the glucosidase.

In our breeding program, selecting for acyanogenesis is only one objective. We will stress acyanogenesis without jeopardizing other important objectives of the program. One important aspect that we have to keep in mind in selecting for acyanogenesis is the possible vulnerability of acyanogenic plants to insects, diseases, and field rodents. In the cassava root, a major portion of the glycoside is concentrated in the peel. This feature may help in protecting the root from field rodents and soil insects. On the other hand, the resistance of cyanogenic cassava types to insects such as locust may be related to the cyanogenic content of leaves. These suggestions are not well documented in the literature but, if true, their significance in providing protection to the plant cannot be underestimated. One of the major diseases of cassava is the cassava mosaic virus which is transmitted by the whitefly *Bemisia* spp. It is important to know the feeding preference of *Bemisia* to low or highly cyanogenic cassava, since if cassava plants are vulnerable to *Bemisia* because of low cyanogenesis, we would be defeating a major objective of our program. More work should be done concerning insect and disease susceptibility in regard to cyanogenesis as cyanogenesis could be the natural defensive mechanism making cassava so successful in tropical areas of the world.

Although our immediate interest is related to production aspects, future attention will be given to processing aspects. This will involve evaluating the efficacy and the improvement of present traditional methods of food preparation to free cassava from cyanogenic compounds.

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