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NUTRITIONAL ASPECTS OF CASSAVA STORAGE AND PROCESSING

Aspects Nutritionnels du Stockage et du Traitement du Manioc

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SUMMARY

Recent cassava work at TDRI has focussed on the cyanide and phenolic components. Cassava contains cyanogenic glucosides which on tissue damage are hydrolysed via cyanohydrins to HCN. Medical studies have stressed the importance of the long term effects of dietary cyanide. An enzymatic assay developed at TDRI can permit measurement of total cyanide, non-glucosidic (free) cyanide and HCN. Cyanide losses during simple processing of cassava pieces (drying, boiling, soaking) are limited by the hydrolysis of the cyanogenic glucosides. A key factor in cyanide removal from desintegrated tissues is the conversion of non-volatile cyanohydrins to HCN. The interaction of these factors is discussed with respect to traditional processing. The rapid post harvest physiological deterioration of roots appears to be essentially due to wound responses. These include increased activity of phenylalanine ammonia lyase, peroxidase and polyphenol oxidase; formation of phenols such as leucoanthocyanidins, catechins, scopoletin and condensed tannins; and the formation of wound periderm. The influence of storage humidity on these responses is described. The possible anti-nutritional effects of condensed tannins is discussed.

RESUME

Les travaux récents du TRDI (Institut Tropical de Recherche et de Développement) ont porté sur les composés cyannurés et phénoliques. Le manioc contient des glucosides cyanogéniques qui, quand les tissus sont endommagés, sont hydrolysés en cyanhydrines puis en HCN. Des études médicales ont souligné l'importance des effets à long terme des régimes contenant des composés cyanurés.

Une étude enzymatique entreprise au TRDI peut permettre

de mesurer le cyanure total, le cyanure non glucosidique (libre) et le HCN. Les pertes en cyanure pendant le traitement de morceaux de manioc (séchage, ébullition, trempage) sont limitées par l'hydrolyse des glucosides cyanogéniques. Un facteur-clé pour extraire le cyanure de tissus désintégrés est la conversion des cyanhydrines non volatiles en HCN. L'intéraction de ces facteurs est discutée par rapport au traitement traditionnel. La rapide détérioration physiologique après récolte des racines semble être essentiellement la réponse à des blessures. Celles-ci comprennent une activité accrue de phénylalanine ammonia lyase, peroxidase et de polyphenol oxidase; la formation de phénols tels que les leucoanthocyanidines, les catechines, la scopoletine et des tannins condensés; et la formation de périderme de blessure. L'influence de l'humidité de stockage sur ces réponses est discutée. Les effets anti-nutritionnels possibles des tannins condensés sont discutés.

2. INTRODUCTION - Cyanide Aspects

World production of cassava is about 120 million tonnes per year, and this has been estimated to provide a major source of calories for about 500 million people (Cock, 1985). Cassava contains the cyanogenic glucosides linamarin and lotaustralin which on tissue damage are hydrolysed to the corresponding cyanohydrins and hence to hydrogen cyanide, by the endogenous enzyme linamarase (Conn. 1969). Cassava is one of the few human food crops in which the content of cyanide can cause nutritional problems (Coursey, 1973; Cooke and Coursey, 1981). Traditonal cassava processing is unlikely to remove all the cyanide (Cooke and Maduagwu, 1978; Oke, 1983), the presence of which is responsible for the chronic toxicity associated with the continued ingestion of cassava products (Ermans et al, 1980). Recent medical studies (Delange and Ahluwalia, 1983) have stressed the need for screening of cassava to locate lower cyanide lines, and for extended studies of the effects of cassava processing on residual cyanide contents.

A major reason for slow progress in these two areas was the tediousness, lack of accuracy and reproducibility of standard assay methods for total cyanide in cassava. This situation was improved by the development of an enzyme assay (Cooke, 1978) which achieves a rapid and quantitative hydrolysis of the cyanogenic glucosides, and obviates the need for steam distillation or aspiration. Minor variations in the assay procedure permit measurement of total cyanide, non-glucosidic (free) cyanide and HCN (Cooke and De La Cruz, 1982(b). This is an important factor because these different forms of cyanide respond differently to cassava processing and have different toxicities. Application of this assay method has been the subject of collaborative research between TDRI and CIAT (Cooke, 1979; Gomez et al, 1980; Gomez and Valdivieso, 1984), and between TRDI and IITA (Cooke et al, Cooke and Maduagwu, 1978; IITA, 1982). Results of these studies, and applications of this assay at other research centres are discussed in the next section.