Introduction of inbreeding in cassava through the production of doubled haploids.

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Introductions

Inbreeding in cassava is desirable because it: a) reduces genetic load; b) allows for the identification of useful recessive alleles (particularly relevant, those for starch quality traits); c) greatly facilitates traditional genetic and molecular studies; d) allows for the exchange and storage of germplasm using botanical seed; e) facilitates mutation breeding approaches; f) allows a more efficient exploitation of heterosis; and g) ultimately could allow for a more consistent, predictable and sustainable genetic improvement of the crop. Inbreeding in cassava, however, has seldom been pursued. Several factors, particularly the time required to obtain high level of inbreeding (9-10 years), prevented this practice to be routinely used in the genetic improvement of this crop. In addition, the crop is likely to expose strong inbreeding depression.

A new initiative has been launched to introduce inbreeding in cassava genetic improvement. Below a brief description of the strategies involved in this project is provided.

Development of a protocol for the production of doubled haploid tissue

A tissue culture protocol for the production of doubled haploids (from cassava flowers) will reduce the time required for the production of homozygous lines from nine to, perhaps, 1-2 years. Plants from several elite clones have been planted in such a way to guarantee the availability of flowers through the year. Initial analysis has been conducted to determine the ideal size of flowers and microspores to initiate the tissue culture work (Figure 1, 2). This analysis involved cytogenetic evaluation of cell divisions during microspore development.

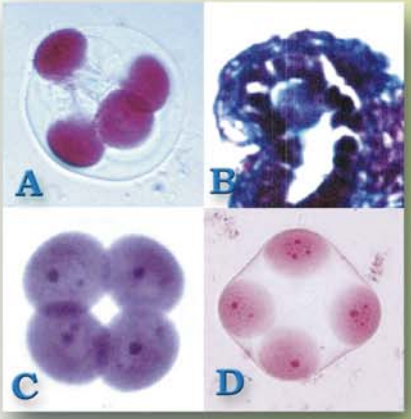

Figure 1.
Cassava tetrad developental Stages.
A) At cytokinesis;
B) Within the anther;
C) Tetrahedral arrangement; and
D) Before releasing microspores

Recurrent selection to improve tolerance to inbreeding in elite clones

While the tissue culture protocol is developed, elite cassava clones will be self-pollinated for two consecutive generations (to reach an average of 75% homozygosity). If inbreeding depression is not a limiting factor, a third self-pollination will be made, or else lines derived from the same elite clone will be recombined to reconstitute a "full vigor" composite version of these elite clones (thus completing an S_2 recurrent selection cycle for tolerance to inbreeding depression). Partially inbred germplasm has been planted in the cassava breeding nurseries at CIAT

Figure 2. Ideal flower size for pollen collection for the initial steps in the development of the protocol for the production of doubled haploid tissue.

experimental station and could be visited by participants of the meeting. A total of **3798** S_1 plants, derived from 32 elite clones, have been transplanted to the field. In addition **4065** S_1 seeds have been obtained from 22 elite clones and are ready to be planted next cycle. In addition **22** S_2 plants derived from three different clones have been transplanted and **2380** S_2 seeds (from four different clones) have been obtained and will also be planted next cycle.

Screening for the identification of useful recessive traits.

Partially inbred materials will be screened in search of previously undetected, useful recessive traits. Emphasis will concentrate on starch quality traits, but other unusual morphological / physiological characteristics will be considered. Partially inbred materials will be cloned and their stakes shipped to different agro-ecological zones (sub-humid and acid-soil savannas) for identification of genotypes showing promising reaction to abiotic or biotic stresses.

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