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#### *About the Institute*

The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

Oct. 18, 1972

Dear Jorge:

Here, finally, is some copy to use for collecting propagating material for Manihot esculenta. I am sorry that I did not comply with your request much earlier. Unfortunately, your request came just when I was winding things up for my leave of absence, and it got lost in the shuffle.

I do not remember any precise format that you had requested, so the enclosed paper may not cover all the topics you wanted for the proposed handbook. Hopefully, I haven't missed any important criterion. It is clear that people have been moving yuca around for a very long time without any formal instructions, so there really should be no problem in the actual process of propagation.

My real worry is that people will not take the proper precautions to prevent disease transfer. Some of the most sophisticated people have been guilty of evading the quarantine requirements, including those at CIAT. The problem, of course, is that yuca has no place in the world where it can be quarantined before intercontinental shipment. I have fitfully proposed that some organization be given responsibility for this activity, but so far, no one has taken up the suggestions.

I know that CIAT does put their latest introductions into a quarantine in Bogota, before transshipment down to Cali, but this is not an effective technique, because they have to raise the plants in greenhouses which are not really adequate for protection.

On another subject, the Technical Conference, I have now heard from Brian Snod and Lother Seidowitz, and they are confirmed. As I wrote earlier, H. D. House did not wish to participate, and I have been trying to get a replacement for him. I wrote to Mario Quitierrez at CIMMYT, and had a response from him several days ago. He did not accept, but wanted further information about the nature of the meetings and the objectives of the symposium on documentation. I proved him with as much information as I have, and hopefully, he will accept our invitation. I did not suggest that his travel and expenses would be paid, hoping that Rockefeller can provide him with funds. His discussion would center on experiences they have had at CIMMYT with documentation of their maize and trigo collections.

I have taken your suggestions on the pilot project to heart, and we are now (as you know from Jack Hawkes's letter) bringing in the International Potato Center people, through Sawyer. This will, hopefully, solve the problems. I have recast the proposal for the pilot project, to focus specifically on the data problems, and only suggesting an organizational structure for ongoing work. Thanks very much for your advice.

Sincerely,

David J. Rogers  
Professor of Biology

Encl.

Procedures for collection of propagating materials of Manihot esculenta Crantz.

Introductory Comments

Manihot esculenta is one of the easiest of all crops to propagate from vegetative materials. The crop is typically reproduced by mature stem cuttings, and almost never from seeds. The reasons are obvious: the seeds are produced from open- or cross-pollinated, monoecious flowers, which cannot be automatically self-pollinated because the pistillate flowers open one to several days before the staminate flowers of the same inflorescence. Thus, the seeds typically contain heterogenous genetic materials. Insect pollination is the rule. Efforts to inbreed cultivars of Manihot esculenta have been generally unsuccessful.

Several experiments to determine the most effective materials for cuttings indicate that mature stem material is most satisfactory. Any portion of the mature stem, up to the point where the stem color changes to green, may be used for propagation, but the probability of strong plants is greater from the sections of stems that have reached relatively mature diameter. This stage is easily observed.

Preservation of cuttings is accomplished by farmers by selecting the necessary number of stems to provide cuttings for a predetermined field size, keeping the full stem (except for side or secondary branches) in one piece until just before the planting begins. Most frequently, the moisture content of the cuttings is maintained by farmers by providing a light cover of foliage stripped from the plants over a pile of stems away from direct sunlight. Stems so cared for will remain viable for up to six months (extreme) but viability is low at the end of this period, and generally it is the practice not to use such materials more than two months old. ~~Again,~~ Variations occur, dependent on habitats, condition of the stems at time of cutting, including vigor and freedom from fungus infection. At

planting time, cuttings are made, generally from 12 to 15 cm long, but sufficiently long to provide 6 to 8 nodes on each cutting. Variability in practice depends upon local habitat: shorter in regions of general well-distributed moisture supply, longer in regions where moisture is a stress.

No post-cutting maturation time is required for cuttings. They may be planted immediately after severance from the parent plant. If it is possible to arrange schedules of harvesting and planting of adjacent fields, it is generally preferable to go directly from stems cut during harvesting to planting of the new adjacent field.

Time of planting of cuttings of manioc (yuca, cassava, mandioca, etc.) varies from habitat to habitat. It is typical to plant cuttings at the end of the dry season, but in those climates where no really marked differentiation into dry and wet seasons occurs, planting may be continuous. Variations in positioning of the cuttings in the soil depend to a large extent on the local rainfall patterns. Plantings in Northeastern Brazil, for example, will be typically of rather long cuttings, planted horizontally, the cuttings totally covered by soil to preserve moisture in the cutting. Cuttings may be inserted in the soil at 45° angles (perhaps the most common practice) or vertically. One to several cuttings may be inserted in a hill, the more common practice being a single cutting.

#### Variation in cultivars

It is important to emphasize that the number of variations in the species Manihot esculenta is very large, and that common names of cultivars are no indication of the uniqueness of a particular cultivar. In order to provide proper documentation of the work done on any cultivar, or group of cultivars, the investigator should provide well-described herbarium

specimens not only to his local herbarium (if any), but also should submit duplicate documenting herbarium specimens to some large herbarium in his own country or in one where he can be certain that the specimen will be maintained. (Descriptions for proper preparation of documenting herbarium specimens are included.) This is the only satisfactory means by which any one worker in one area can share his knowledge accurately with any other worker, either in his own country and institution, or in any other country. Many valuable research trials have lost their major significance because the worker did not complete his scientific job of proper identification of the basic materials, the plants, on which he based his findings. A recent classification of the cultivars (Rogers and Fleming) will soon appear in the first issue of the journal ECONOMIC BOTANY, volume 26, 1972. This will aid the worker in placing his own cultivars into an internationally-based classificatory scheme, but this classification by no means obviates the needs to prepare good herbarium materials.

#### Restrictions on exchange of cultivated materials

The diseases in the cultigen Manihot esculenta are poorly known. As for any other crop, it is very dangerous to transport viable materials from one area or country to another until the material can be certified free of pests or diseases. Because the various virus diseases, particularly damaging in Africa and the Eastern Tropics, are the most pernicious problems in manioc, it is particularly important to emphasize the need for quarantine of materials to be sent from these areas to any of the Western Hemisphere tropics where these viruses are not particularly destructive.

#### Procedures for cuttings

Select vigorous, healthy, mature stem materials. Cut cleanly into lengths of 15-20 cm, including 6 to 10 nodes. Be careful not to damage

or bruise tissues. Do not include any branched cuttings. Wrap in moist (not soaking wet) newspaper (actually this is best because the newsprint acts as a partial antibiotic agent) or paper towellings. Do not wrap in plastic. Do not use moist sawdust or any of the popular synthetic materials (ex. vermiculite).

Cuttings may be dipped in melted wax to prevent dessication, but this is not necessary if time between cutting and planting can be predicted to be less than 3 to 4 weeks.

By all means be certain that the cuttings are sent through a quarantine process, even if shipment is made between the different districts of the same country.

#### Procedures for seeds

Since the fruits of manioc are explosively dehiscent at maturity, place musline bags securely around immature fruiting inflorescences, and allow seeds to mature on the parent plant. Otherwise, no significant treatment is required.