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Factors affecting diversity of *Dioscorea* species in Uganda

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Abstract

The effects of drought, famine, distribution of land races, pests and diseases, deforestation, over-cultivation, introduction of new high yielding *Dioscorea* varieties, change in economic base, change in consumer preference, change in land use, status of transmission of indigenous knowledge and agricultural modernization on the diversity of *Dioscorea* were investigated in nine districts of Uganda. Three approaches were used: extensive eco-geographical survey, exploration and physical assessment. A structured questionnaire was used to capture information from the farming communities, government offices and local opinion leaders on the status of the yam in relation to farmlands, open countryside, protected areas and government departments in the nine target districts. Out of the 14 species recorded in Uganda the study showed that only seven species were available in the target areas. These included *D. alata, D.dumetorum, D. odorotissima, D. bulbifera, D. rotundata, D. quartiniana, and D. schimperianana.* Reduction in the diversity of the yam was due mainly to serious genetic erosion at both inter- and intra-specific levels. Genetic erosion was mainly caused by lack of efficient propagation techniques, famine, pests, diseases, deforestation and lack of adequate promotion of the crop by the formal sector. The role played by the factors identified is discussed and recommendations for minimizing genetic erosion are given.

Introduction

Recent study (Mulumba Wasswa and Karamuura 1992) indicated that over 12 species of *Dioscorea* were available in Uganda. These included *Dioscorea abyssinica, D. alata, D. baya, D. bulbifera, D. bulbifera var. anthropophagorum, D. bulbifera var. bulbifera, D. cayanensis* (*Syn.D.abyssinica*- rotundata group), *D. dumetorum, D.* hirtiflora *ssp pedicellata, D. lecardiaii, D. minutiflora, D.* quartiana var. quaritiana and D. sansibarensis. Among these are the fully domesticated, the semi-domesticated and the wild species. Utilization of these resources is not well documented in Uganda. Indigenous communities, however, have for a long time exploited these resources and in many parts of the country it is known as a famine reserve crop. This is due to the fairly long period several of the species can retain their tuberous food reserves in the ground without getting spoilt. This particular characteristic makes Dioscorea a very favorable crop in raising house - hold food reserves and mitigating for famine. Apart from being a good source of carbohydrates, yams also contain relatively high levels of proteins.

Due to changes in land use, feeding habitats, economic base, lack of strong government backing, civil strife, human encroachment, over-cultivation, over-grazing, bush fires, drought and change in traditions and cultures, diversity of *Dioscorea* spp is bound to be affected.

Objectives

To assess factors affecting the diversity of Dioscorea.
To recommend appropriate conservation measures to arrest the genetic erosion.

Methodologies

Comprehensive information on distribution and diversity of Dioscorea species was compiled from Makerere University herbarium. Data on botanical and local names, habitat, altitude and location within Kampala, Mpigi, Mukono, Luweero, Nakasongola, Mubende, Kalangala, Hoima and Masaka districts were extracted from records. Exploratory expeditions involved taking

rapid assessment of the availability of the species in the documented areas. In the forest areas, this involved a quick eye assessment and recording of the route followed. The road was used as the transect to asses density of species. This was based on the survey findings that wild Dioscorea species prefer forest peripheries. On the farms, quick stopovers were made every after about 10 km or whenever domesticated cultivars were spotted. Farmers were asked about availability of the species. These were the focal points for the subsequent visits. Species identification and description was done using morphological characters. It involved on-site description and identification using farmers' descriptors, followed by the standard yam descriptors (IBPGR 1980). On site identification was further authenticated by use of herbarium specimens. Factors affecting genetic diversity were assessed using structured, open-ended questionnaire on biophysical, human and socio-economics of genetic erosion indicators.

Results

The survey revealed that domesticated Dioscorea species were scantly available with farmers, and were extremely limited in numbers in relation to human population. Some of the natural habitats documented in the eco-geographical survey were disturbed through human activity or totally destroyed. For example, Kajjansi Forest which in the past (Mulumba Wasswa and Karamuura 1992) had been recorded to be a habitat for Dioscorea baya no longer existed.

Seven out of the 14 species previously documented in Uganda were represented in the study areas. These were *D.* alata, D. dumetorum, D. odoratissima, D. bulbifera, D. cayanensis, D. quartiniana *and* D. schimperiana. *The* distribution of land races of Dioscorea is shown in

Fig. 1. Eighty three percent of the species were recorded as rare and 17% were locally common. There was however, no single dominant species in the study areas.

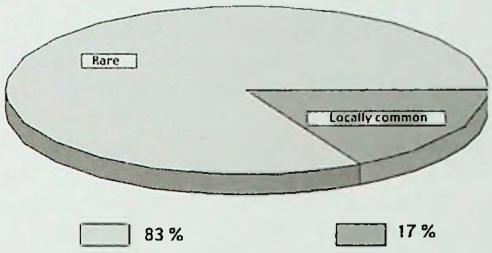
Drought rarely occurred in the study areas (Fig. 2). Most farmers indicated a frequency of once after every 10 years and where it occurred more than once in ten years it was not consecutive. Famine was common (42.6%) in some districts; occurred infrequently (36%), while some parts of the study areas experienced rampant famine (21.3%).

Poor soil, poor crop husbandry practices, lack of clean and enough planting materials; especially for cassava, bananas and cereals, lack of alternative incomes which leads to selling of subsistence food to buy other essentials, lack of enough labour, lack of economic means to grow enough food, limited land available, pests and diseases and drought were in that order cited as the major causes of famine in the districts of study.

Cumulative decline was evident in the number of varieties possessed by the community over the years. At every location there was at least one variety that had been lost over the years. Worse still there are not many farmers that mentioned of any new acquisitions either from the neighboring communities or any other source within the same period.

The factors causing loss of the genetic material of Dioscorea possessed by the communities were somewhat related to those causing famine in the districts. Namely lack of planting material, poor / degraded soils, lack of labour, lack of fertilizers, pests, sale of food

Figure 1: Land race distribution



before maturity, insufficient capital, rainfall unreliability, land fragmentation, neglect, civil strife, preference and lack of market. Most outstanding of the above was lack of planting material. All the respondents, to varying degrees, expressed desire to grow yams if quality seeds were provided.

With regard to pests and diseases, farmers gave the impression that there has been no serious outbreak of diseases and pests. Observations, however, indicated that Dioscorea species have a number of pests and diseases that farmers are not aware of. This ignorance was apparently due to lack of technical advice from the agricultural extension services.

Discussions

The threat to existing varieties was not easy to assess. The overall picture however is portrayed by the state of the whole range of genetic erosion indicators. It is

Figure 2: Drought frequency

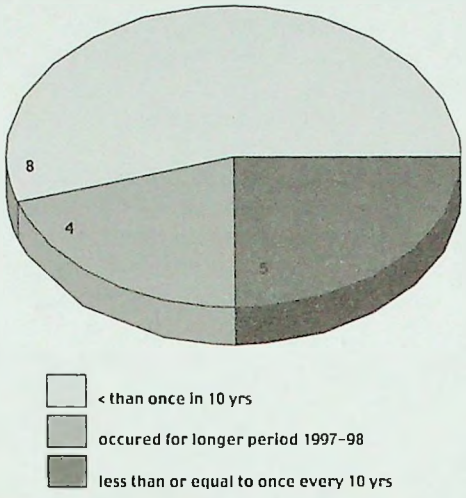
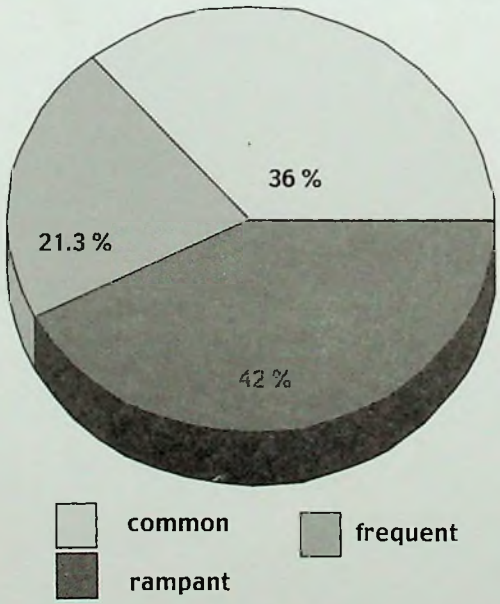


Figure 3: Famine frequency



however clear that the risk of partial or complete genetic erosion within the next 10 years is tremendous.

On the farmlands the land area under dioscorea has definitely declined and it continues to do so if no measures are put in place. At the same time many natural habitats have been converted into other uses thus reducing the available areas for the wild species.

There was no record of farmers having received high yielding varieties (HYV's) of Dioscorea. It is therefore apparent that disappearance of farmers' varieties is not at all as a result of displacement by improved varieties of the same species. Nor has there been major shifts from farming to other economic activities. Although a small percentage of farmers has gone into petty trade especially in produce marketing, low capital and retail shops, most still carry out subsistence farming.

It is not apparent that there is a shift in consumer preference against Dioscorea.

What was clear was that farmers eating habits have been conditionally modified to fit with availability of given foods. Since production of Dioscorea is very low, it can not sustain homesteads when required. Due to low, scattered and uncertain production, of course, the market forces would not favour Dioscorea.

Overwhelming majority (98%) of rural population in Uganda derive their livelihood from subsistence agriculture that is associated with customary inheritance of properties which allows sharing out land amongst bereaved families. This has led to serious land fragmentation with hardly any nutrient replenishment. Average land area per household therefore becomes smaller from generation to generation. Therefore commercial farming has not evolved. Dioscorea species have not benefited from this situation.

The major human threat to the diversity of Dioscorea was partial or total destruction of habitats for the wild species; especially natural forests. Many habitats especially those around the urban areas are now occupied by buildings and there was no trace of Dioscorea species in such places.

Cultures and traditions were still strong in the study areas. Eighty percent of the respondents still held to their traditions and applied them in the day to day management of natural resources. However, the study was unable to assess the quality of these traditions and to what extent present generations have emulated the traditions. Apparently the quality of traditions appeared to have gone down. This was supported by the low or failing indigenous knowledge (IK) transmission system (<45%) among the respondents.

Conclusions and recommendations

The study has revealed serious genetic erosion of Dioscorea species that has occurred over the years and continues unabated. This erosion is evident at both inter- and intra-species levels. Therefore, the following recommendations are made to remedy the situation:

1. Identification of possible sources of germplasm through a more elaborate inquiry system.
2. Mobilization and creating awareness on the importance of *Dioscorea* among farmers.
3. Development of rapid and effective germplasm multiplication techniques at farm level.
4. Promotion of on-farm conservation
5. Research in cryopreservation of *Dioscorea*
6. Research in true seed-setting enhancement.

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