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EXPLOITING INDIGENOUS KNOWLEDGE FOR THE MANAGEMENT AND MAINTENANCE OF *MUSA* BIODIVERSITY ON FARM

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ABSTRACT

Studies on indigenous knowledge about the banana (*Musa* spp.) crop were carried out in *Musa In situ* project sites in Tanzania and Uganda. The purpose of the study was to investigate and analyse traditional banana farming practices that (a) create and maintain specific agroecological niches for distinctive cultivars of *Musa*; (b) encourage the exchange and introduction of *Musa* germplasm; and (c) favour the maintenance of diverse cultivars within small scale banana production systems. Participatory methods were used with initially a total of 135 households from the 4 sites to determine the different traditional practices carried out through the entire life cycle of the banana crop. Interviews and discussions with different households were based on semi structured questionnaires and checklists. Later discussions were extended to 150 farmers divided into groups to critically examine the derived information from different households. The group discussions were focused on ; i) introduction and exchange of cultivars ii) the selection and planting of cultivars; iii) maintenance of banana groves and iv) the utilisation options of bananas at the farm level. Preferences among the widely selected cultivars was also assessed. Correlations between the criteria and preferences used to select the widely grown cultivars were determined. The selection and source of planting materials were very important practices because they determined the proportion of cultivars on farm, although could be influenced by the person who selects and the criteria he or she uses. In all sites women were reported to be 100% responsible for the day- to-day management of banana gardens. A woman's success as "a home maker" depends on how efficiently "food"(=banana) security is maintained at the home. In the quest to effectively carry out this task, women spend over 90% of .heir spare time in banana groves, checking mats and taking any remedial actions needed. In spite of this commitment, women were found not to be the direct beneficiaries from banana income, except in one area of handicrafts. Associated biodiversity in the benchmark sites was used variably. Some farmers used trees as high canopy shade for bananas while at the same time improving soil fertility through leaf fall. Others used some annuals as cover crops to control weed growth; and yet others used some fungi to monitor soil fertility in the groves. Further studies are recommended to understand the relationship between the crop, the farmer and the environment.

Key Words: Agroecological niches, cultivars, *Musa* germplasm, traditional practices

RÉSUMÉ

Les études sur la connaissance indigène à propos de plante de banane (*Musa* spp.) étaient faites dans les sites de projet *Musa In situ* en Tanzanie et l'Ouganda. La raison de l'étude était d'examiner et analyser les pratiques traditionnelles de culture de banane qui (a) crée et maintient les niches agro écologiques spécifiques pour les variétés distinctives de *Musa* ; (b) encourage l'échange et l'introduction de germplasme de *Musa* ; et (c) favorise la maintenance des diverses variétés dans une petite échelle des systèmes de production de banane. Les méthodes participatives étaient utilisées avec initialement un total de 135 ménages de 4 sites pour déterminer les différentes

pratiques traditionnelles faites le long d'un cycle de vie entier de la plante de banane. Les interviews et discussions avec les différents ménages étaient basées sur des questionnaires et check-lists semi structurés. Les discussions avancées étaient étendues à 150 fermiers divisés en groupes pour examiner de manière critique l'information dérivée des différents ménages. Les groupes de discussion ont focalisé sur i) l'introduction et l'échange des variétés ii)la sélection et la plantation des variétés ; iii)la maintenance des bosquets de banane et iv)l'utilisation des options des bananes au niveau de la ferme. Les préférences parmi les variétés largement sélectionnées étaient aussi évaluées. Les corrélations entre les critères et préférences utilisées pour sélectionner les variétés largement cultivées étaient déterminées. La sélection et la source des matériels de plantation étaient des pratiques très importantes parce qu'elles déterminent la proportion des variétés sur la ferme, même si elles pourraient être influencées par la personne qui sélectionne et les critères qu'elle ou il utilise. Dans tous les sites les femmes étaient rapportées être 100% responsable pour la gestion quotidienne des champs de bananes. Le succès d'une femme comme pourvoyeuse de foyer dépendant de comment la sécurité alimentaire (banane) suffisante est maintenue dans la maison. Dans la recherche à accomplir effectivement cette tache, les femmes passent plus de 90% de leur temps libre dans les bosquets de banane, vérifiant les mats et prenant toute action nécessaire pour remédier. Malgré cet engagement, les femmes étaient trouvées n'étant pas les bénéficiaires directs de revenue de banane, à l'exception d'une aire d'artisans. La biodiversité associée dans les sites de référence était utilisée de manière variable. Certains fermiers ont utilisé les arbres comme ombre élevée pour les bananes pendant qu'en même temps l'amélioration de la fertilité du sol à travers la chute des feuilles. D'autres ont utilisé certaines plantes comme couverture des plantes pour contrôler la croissance des mauvaises herbes ; et déjà d'autres ont utilisé certains champignons pour surveiller la fertilité du sol dans les bosquets. Plus amples études sont recommandées pour comprendre la relation entre la plante, le fermier et l'environnement.

Mots Clés: Les niches agro écologiques, variétés, germplasme *Musa*, pratiques traditionnelles

INTRODUCTION

Indigenous knowledge (IK) in this paper are factors conceived through socio-cultural studies that bring out the interactions between the banana crop, the natural environment and the communities. Indegenous knowledge was considered unique to a given community, adapted to local culture and environment, formed the basis for a people's decision making , complex and dynamic (Nyiira *et al.*,1999). Through IK farmers know that there is need for constant and diverse supply of germplasm to meet their household needs or livelihoods. Such knowledge will not only give ideas about the best ways of maintaining the crop's genetic diversity but also the potential utilisation options (Hammer and Mbewe, 1992). Therefore IK has been considered an important component of *Musa* conservation strategy. Studies on indegenous knowledge among farmers were aimed at developing a deeper understanding of the underlying factors influencing farmers' decisions to conserve cultivars on-farm and increasing efficiency in *Musa* germplasm conservation and use strategies in small-holder banana-based farming systems. The objectives of the study were to understand traditional systems that allow introduction and exchange of *Musa* germplasm; to understand crop and environment management practices that create and maintain specific agro-ecological niches for distinct cultivars and to document socio-cultural utilisation options that favour the maintenance of diversity within small holder systems.

METHODOLOGY

Participatory methods were carried out in four *Musa In situ* project sites of Masaka and Bushenyi in Uganda and Chanika and Ibwera in Tanzania. Initially 135 households from the four sites were used to determine different traditional practices carried out through the entire life cycle of the banana crop. Interviews and discussions with different households were based on semi structured questionnaires and checklists. The interviews were later extended to group participatory discussions of 150 farmers in 10 clusters at the same sites. Group discussions were to carefully build on and critically examine derived information from individual farmers of different households. It was also intended to clear conflicting ideas on issues like culinary attributes and names of cultivars. The group discussions critically focused on i)

introduction and exchange of cultivars, ii) the selection and planting of cultivars through time; preferences among the widely selected cultivars, iii) maintenance of banana groves through time, and iv) the utilisation options of bananas at the farm level. Focus group interviews, key informants and transect walks were other methods used to understand the underlying factors influencing farmers' decisions to conserve cultivars on-farm. The correlation coefficeint analysis was used to determine correlations of use among the widely selected and grown cultivars.

RESULTS

There were two most important practices carried out by farmers concerning the introduction and exchange of cultivars. These were selection and collection of planting materials. Based on the different household interviews, men did the selection of cultivars much more than women (Fig. 1). This was found to be unusual because at all sites women were found to be 100 responsible for these gardens. Although selection of cultivars can go on through out the year by observation, the intensive selection and planting is done during the long rainy season. The selection of cultivars to be included in farmers' gardens is critically important because it is the process by which germplasm accumulates in the garden and it also determines the proportion of cultivars on farm, although this proportion can be influenced by the utilisation needs of the household. Farmers grow a complex mixture of the East African highland (*Musa* AAA-EAH) banana cultivars in addition to fewer other cultivars of different genome groups within their banana stands. Preliminary observations from a survey study (Davies, 1995) suggested that different clones have distinct strengths and weakenesses and that farmers use a variety of criteriafor selecting thecultivarproportions found in their fields. The selection criteria is based on a long time experience on the growing of different cultivars by the farmers. Among the cultivars grown on all sites 39 cultivars were widely selected and grown on farms. The widely grown cultivars were thought to be based on the seven major selection criteria (Table 1) put down by the same farmers. However, farmers in different discussion groups provided other reasons why they grow each of the 39 named cultivar widely grown. They provided preferences used to grow those cultivars (Table 1). The correlation of use of each of the widely selected cultivars was worked out based on the different preferences given for each cultivar and the criteria used to select the respective cultivars. Out of the 39 cultivars, 19 had high correlation of use and the cultivars which were very marketable were not necessarily the ones most preferred (Table 2). Major commercial cultivars were Enshakara, Enyoya, Enshansha, Nakunyika, Nakitembe and Mbwazirume but they had lower correlations of use. These commercial cultivars have usually bigger bunches and are high yielders. Some of them were found to be planted separately for

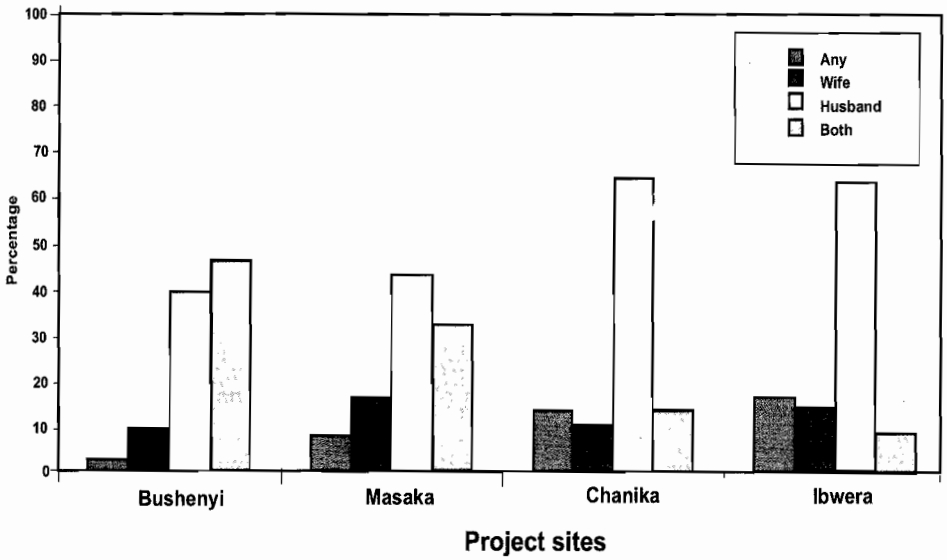

Figure 1. Decision making in the selection of planting material at the project sites

better yield perfomances at some sites like Bushenyi and Masaka. They were planted in new groves further away from the grove used for food. In such cases men were responsible for such commercial groves and women remain in charge of the old food groves. Understanding farmer cultivar selection criteria for bananas grown in complex mixtures provides a necessary foundation for the establishment of conservation and breeding strategies.

From the household interviews, majority of farmers select and collect materials from their own gardens or next from their neighbour's gardens (Fig. 2). The source may influence the planting materials level of cleaness from pests and diseases, in which case measures may need to be taken to address the problem of infestation/ infection. Secondly the source of planting material may influence the utilisation options the culviar will be put too. In general a lot of information needs to be gathered at the source where the cultivar is collected. The source of planting material determines many things which might affect the management of this cultivar.

Traditionally, women have always been in charge of banana groves and this takes up most of their time. They travel long distances towards the end of the dry season to collect planting materials from far relatives and friends. This would assure them of probably picking materials which would be pest free since they were from a different location and the materials would be of a different genotype to increase diversity so as to cater for the different needs. The situation seems to be changing in that farmers pick planting materials from their own gardens these days for reasons which are not well understood.

Successful management and maintanence of banana groves was thought to be due to careful implementation of a number of traditional practices tc be carried out by women. There were of two types; those connected to the crop, and those controlling the natural resource base. Those connected to the crop involved; garden location and composition; sucker preparation and planting; de-suckering; de-belling and de-trashing (Table 3). All these are carried out at a defined particular time in between seasons. Banana gardens have

TABLE 1. Major cultivar selection criteria and preferences by farmers at the project sites

Selection criteria	Farmers' preferences
Bunch size/Marketability	Cultural functions/ceremonies
Maturity period	Medicinal uses
Palatability	Maintaining diversity
Resistance to pests and diseases	Appropriate environmental balance in the garden
Resistance to stress/drought	Meet respective gender needs/ or play gender roles
Adaptation to different types of soil	Social status
Good ratooning	

TABLE 2. Correlation of use of 19 of the widely selected and cultivated clones at the project sites

Cultivar	Correlation of use	Cultivar	Correlation of use
Enzirabahima	0.7784	Mbwazirume	0.7333*
Mtuishe	0.7715	Enshansha	0.7284*
Nsikila	0.7715	Mujuba	0.7284
Bukumo	0.7668	Enzirabushera	0.7138
Nakitembe	0.7620 *	Nakabululu	0.7013
Entalio	0.7620	Nakinyika	0.7013*
Enyitabunyonyi	0.7620	Entundu	0.6554
Enshakara	0.7578 *	Enkundi	0.6375
Nyoya	0.7514 *	Mukubakkonde	0.5717
Entobe	0.7514		

*Major commercial cultivars

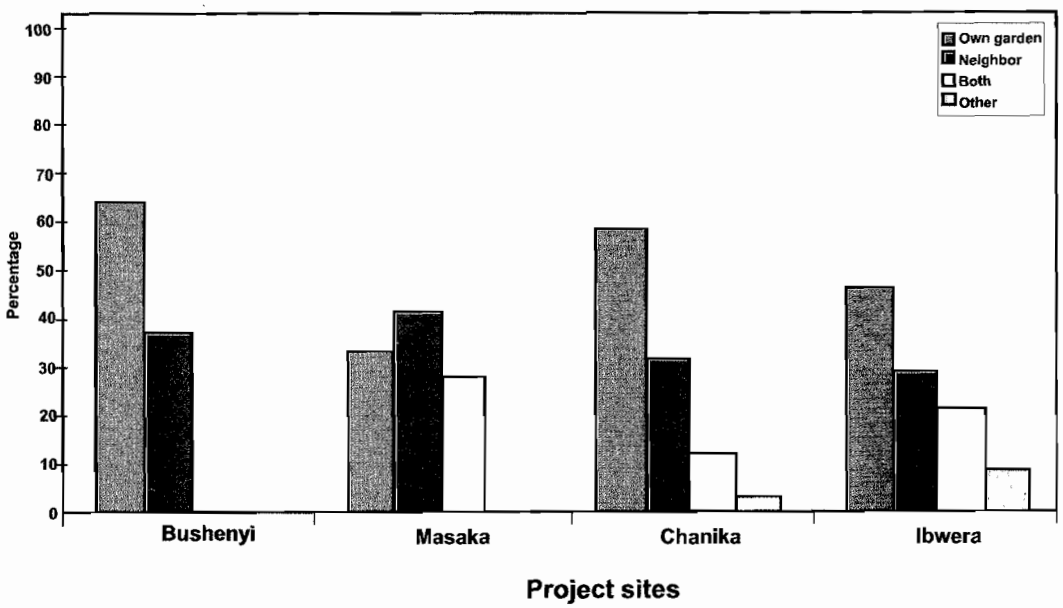

Figure 2. Source of planting materials by farmers from the Musa In Situ sites.

TABLES 3. Traditional practices connected with the banana crop

Farming practice	Usefulness of the practice
Garden location around the house dynamic ecological system	To make a homestead which is an integrated Smoke from the Kitchen contributes something to the garden Kitchen refuse contributes manure to the system New cultivars planted and evaluated near the house Garden provides fresh air to homestead
Garden composition ; with a mixture of banana cultivars B-genome cultivars at periphery of garden Multipurpose trees and shrubs in the garden Store for various vegetatively propagated seedlings	Many rituals performed in the garden and on particular stools a) To target different needs b) To reduce competition c) To contribute shade and fertility of soil and to act as indicators of soil fertility and soil deterioration d) For preservation
Sucker preparation and way of planting it Trim top slant wise Plant sucker slant wise	Allows quick water surface run off to prevent sucker from rotting Rapid multiplication of suckers
Desuckering	Reduces intra mat competion A certain desuckering system results in a fairly steady supply of bunches through out the year
Debelling	Faster maturity, big sized bunches and reduces spread of diseases
Detrashing	Reduces fungal diseases

always been located around the house. The nearer to the house the garden is the more likely it is that the woman is responsible to it and would have more knowledge about the diversity in that garden. In all sites, women were reported to be 100% responsible for the day- to-day management of banana gardens. A woman's success as "a home maker" depends on how efficiently "food"(=banana) security is maintained at the home. In the quest to effectively carry out this task, gardens are placed near homesteads and women spend over 90% of their spare time in banana groves, checking mats and taking any remedial actions needed. In spite of this commitment, women are not the direct beneficiaries from banana income, except in one area of handicrafts and probably have more indigenous knowledge than men.

The natural resource base, mainly the soil, must be protected to maintain or increase soil fertility. Different annuals and trees are planted in the garden to reduce surface run off, to keep the soil moist, to add fertility to the soil and to reduce weed competition (Table 4). There are also a number of plants and mushrooms which grow in the garden at successive stages of the plantation to indicate the status of soil fertility. These help women to keep improving the status of their soil (Table 5). During maintainance of gardens, different cultivars perform differently on different soils, in different seasons and under stress of various kinds. There was no native strategy for controlling pests and diseases quoted by the farmers but a number of farmers do sprinkle wood ash to control the banana weevil. During the dry and rainy seasons cultivars differ in the way they struggle for survival. Some change stem or leaf colours during either the dry or rainy season. Others get leaf rosettes in the dry periods and they end up producing either no bunch or just small bunches. While others topple either in the dry spell or the rainy season. All these changes make farmers able to know and make decisions on how to manage particular cultivars.

Women are a reserve of indigenous knowledge especially with regard to utilisation - crafts, food-wrappings, medicine, beverage preparation, toiletries, etc. In this regard, certain cultivars are associated with specific uses and in this way the same cultivars may be conserved by the farming communities.

Similarly men have specific interests in beer-related utilisation options. Local banana beer is important in the socio-economic set up of the farming communities in Great Lakes region of East Africa. In rural areas it is common to find community based labour/activities being exchanged for local beer. For example, activities like shelter and feeder roads construction can be accomplished when local beer is served to people instead of cash payments. In addition to exchange for labour needs, local banana beer plays a major

TABLE 4. Trees and shrubs farmers plant in their banana gardens

Name of tree/shrub	Use in banana garden	Name of tree/shrub	Use in the banana garden
Ficus natalensis Hochst.	Improve soil fertility	*Crassocephalum crepidioides*	Supresses other weeds
Albizzia coriaria	Provide shade Improves soil moisture conservation		*(Benth.) S. Moore*
Markhamia lutea	Controls soil erosion	*Namere*	Increases soil fertility
Sapium ellipticum	Pest control		

TABLE 5. Indicators of degree of soil fertility

Plant species	Indication	Plant species	Indication
Commelina africana. L	Soil fertility	*Digataria velutina* Beauv.	Soil deterioration
Galinsoga parviflora. L.	Soil fertility	*Biden pilosa* L.	Soil deterioration
Volvariella species	Soil fertility		

role in social gatherings such as funerals, festivities and solving various disputes among rural communities. During festivities, people contribute either local beer or cooking banana bunches to their hosts instead of money in cash, which is a limited resource in most communities. It is a requirement to contribute local beer processed from bananas before dowry is accepted in most parts of the Great Lakes region of East Africa where banana is an important crop. Local beer bananas are also widely used as medicine (Table 6).

DISCUSSION

Traditional farming practices with the indegenous knowledge about them have been found to have two broad objectives; increasing diversity to meet diverse households needs and improving yield for food security and income generations. Indegenous knowledge can be used to enhance *Musa* genetic resources which in turn will contribute to the global initiative of conserving diversity of crops on farm. But it is being realised that as more people of older generation die, the less the knowledge that was available (Hammer and Mbewe, 1992). Although women still have control over banana gardens, they can no longer have priority on selecting cultivars they want in these gardens. They stopped collecting missions to get different cultivars so as to increase diversity. In fact in Bushenyi site, some men have decided that women should have their own gardens where they can plant any cultivar they wanted, creating two plots - one for the man and another one for a woman. Mens plots would have one to three cultivars only selected and grown purposely for commercial interests. However, on some farms fields of monoculture were not only for commercial purposes but there are cultivars which preferred to be planted alone such as Mbwazirume. Mbwazirume cannot compete with other clones. Short cultivars were also either planted in monocluture fields or at the boundaries of mixed fields. Nakyetengu is the commonly known short cultivar. The different traditional farming practices can no longer be carried out at the right time of the year while some are no longer carried out at all. This is mainly because the underlying value of these practices is no longer known.

Culturally farmers particularly in sites where the crop has been adopted for years are supposed to plant clones near homesteads. Bananas produced in gardens near the homesteads ranged from 50 to 100 mats, received mulch of different types at regular intervals. This gave chance for a farmer to see the perfomance of most cultivars and enables him to select those for commercial purposes. Cultivars around the homestead were always in mixed stands of 4-12 clones distributed at random. Growing cultivars in mixed stands has another advantage of conserving a wide genepool, a practice which ensures that some cultivars will give the farmer something to eat in the event of environmental disasters such as drought, pest and disease attack. Farmers alleged that it was also important for each garden to have a male plant in it. Beer cultivars were considered to be the male highland banana cultivars by farmers. If a garden lacked a male plant, it would not survive long. The East African highland beer bananas are mutants from cooking cultivars of the same group. They have a lot more tannins than the cooking types and hence they are astringent. Because of this character

TABLE 6. Some of the medicinal values of bananas

Plant part used	The way plant part is used
Rachis of beer bananas	Wound dressing Stimulant preaprations Facilitate faster cooking of beans
Roots of beer bananas	Stitch animals Stitch calabashes
Negatively geotropic roots	Treat stomach ailments
Corm water of beer bananas	Treats Flu

they are used in various ways to strengthen different mixtures of drinks, medicines and others. Mutations are increasingly being sought to improve or extend the commercial or utilisation aspects of the existing cultivars (Langton, 1986).

This is particularly so in vegetatively propagated crops. Beer bananas can be exploited to increase their utilisation on farm. In Bushenyi district, farmers had removed all local beer cultivars because they were not contributing towards family income. But farmers have come to find out that male buds of local beers bananas if fed to diary cows, can increase milk production by 50% of the original production.

CONCLUSION

Traditional practices enhance/strengthen conservation strategies through; broadening the biodiversity base; sustainable access to new genotypes; provision of incentives for sustainable conservation of the resource base; sustainable utilisation and early warning systems. With respect to *Musa* genetic resources and other crops, a comprehensive investigation of traditional knowledge of traditional farming practices needs to be carried out using different methods of ethnobotany.

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