Increasing Farmers' Access to Conserved Yam Genetic Resources in Ghana

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Abstract
A survey conducted in 2012 in three yam growing areas in Ghana revealed that, a greater proportion of yam genetic resources being conserved by farmers are getting extinct due to biotic and abiotic factors. Some of these yams are conserved ex-situ in the gene bank at the CSIR-Plant Genetic Resources Research Institute. A strategy was formulated to increase farmers' access to these materials through regeneration, multiplication and distribution to farmers to augment their dwindling yam genetic stock. A total of 89 accessions of yams - D. alata (40 accessions); D. rotundata (42 accessions) and D. esculenta (7 accessions) were multiplied, using the mini-sett technique. One thousand, five hundred micro tubers which were distributed to 30 farmers in three yam growing communities, to serve as a primary multiplication and distribution sites. In all, 330 farmers (110 farmers per community) received yam germplasm to replenish their genetic stock and thus to broaden the genetic base of their materials on-farm, for conservation, sustainable food security and income generation.

Key words: Conservation, Dioscorea species, Genetic resources, Planting materials, Yam.

Accroître L'accès des Agriculteurs aux Ressources Génétiques de l'igname Conservées au Ghana

Résumé
Une étude menée en 2012 dans trois zones de culture d'igname au Ghana a révélé qu'une plus grande proportion de ressources génétiques d'igname conservées par les agriculteurs s'éteint en raison de facteurs biotiques et abiotiques. Certains de ces ignames sont conservés ex-situ dans la banque de gènes du CSIR - Plant Genetic Resources Research Institute. Une stratégie a été formulée pour augmenter l'accès des agriculteurs à ces matériaux à travers la régénération, la multiplication et la distribution aux agriculteurs pour augmenter leur stock génétique d'igname en déclin. Un total de 89 accessions d'ignames - D. alata (40 accessions); D. rotundata (42 accessions) et D. esculenta (7 accessions) ont été multipliés en utilisant la technique mini-sett pour. Mille cinq cent micro-tubercules qui ont été distribués à 30 agriculteurs dans trois communautés de culture d'ignames, servant de sites primaires de multiplication et de distribution. En tout, 330 agriculteurs (110 agriculteurs par communauté) ont reçu du germoplasme d'igname pour réapprovisionner reconstituer leur stock génétique et ainsi élargir la base génétique de leurs matériels à la ferme, pour la conservation, la sécurité alimentaire durable et la

génération de revenus.

Mots clés: Conservation, Espèces de Dioscorea, Ressources génétiques, Matériels végétal, igname

Introduction

An important step in meeting the challenges of food security, agricultural sustainability and maintenance of genetic diversity, is to forge a partnership between the formal and informal sector. One way of achieving this, is to encourage farmers and scientists to collaborate and manage plant genetic resources, especially in marginal and heterogeneous environments where biodiversity loss is at an alarming rate (Adu-Dapaah, *et al.* 2007). The very survival of farmers for food and nutrition security as well as income, is dependent to a large extent on the sustainable use and maintenance of diverse crop genetic resources. Complementing the ex-situ conservation with a more dynamic conservation measure is therefore, crucial to sustaining diversity. This has led to the idea of in-situ conservation of farmers' varieties, which ensures evolutionary process through biotic and abiotic factors of an agro-ecosystem (Park *et al.,* 2005). Participatory varietal selection involving breeders, farmers and processors, results in diverse genetic resources, such as maturity period, storage characteristics and organoleptic properties (Otoo and Asiedu, 2009). The on-farm conservation approach is essentially linked to rural development, farmers' ethno-botanical knowledge, farming practices, selection criteria and the evolvement of new innovations (Dofoer, 1997). Farmers' participation in on-farm conservation thus represents a crucial input in ensuring the retention of diversity. Invariably, a lot of yam germplasm being held by farmers are getting extinct. It is a common knowledge that accessions under conservation in gene banks are also being lost due to improper conservation, especially under field conditions (Aboagye *et al.*, 2010). In Ghana, seven species of yam are cultivated for various uses. These are *Dioscorea alata* (Water yam), *D. bulbifera* (aerial yam), *D. cayenensis* (Yellow Guinea yam), *D. dumetorom* (Bitter yam), *D. esculenta* (Chinese or potato yam), *D. praehensilis* (Bush yam) and *D. rotundata* (White Guinea yam) (Aboagye, 2011). The two most important species in terms of production are the water yam and white Guinea yams (Dansi, 2000). Over concentration of production of white and water yams has rendered other species and their inherent diversity vulnerable to extinction (Mignouna and Dansi, 2003). A survey was conducted in yam growing communities in three communities of Ghana on the diversity of yam species, extent of production, preferences and challenges that confront yam production. It was revealed that some varieties of yams were being cultivated in a small area by few households, indicating loss of genetic diversity of yams, especially the lesser known species (Aboagye *et al.,* 2015, Otoo *et al.,* 2015). The objective of this study was to highlight the practicability of re-introduction of some yam cultivars, identified as getting extinct by farmers and breeders for sustainable yam production and conservation.

Materials and methods

Site selection: Three yam producing areas were selected. These were: Dinkro community near Maame Krobo in the Kwahu Afram Plains district of the Eastern region, Mfadwen/ Bontrase in the Ewutu-Senya district of the Central region and Nyankumase in the Upper Manya district of the Eastern region. At each location, ten farmers were selected taking into consideration their needs, farming systems and cultural practices. This was done with the assistance of Agriculture

Extension Agents (AEA) of the Ministry of Food and Agriculture (MoFA).

Multiplication of the yam setts: The mini-sett technology was used to multiply the following accessions: *D. alata* (40 accessions), *D. rotundata* (42 accessions) and D. esculenta (7 accessions). The yam setts were cut (Plate 1) and treated with a mixture of Kocide 101 (Fugicide) and Karate 2.5 EC (Insecticide) (Plate 2). The pre-sprouting technique of the mini-set seed yam was done on seed beds (Plate 3). The yam setts were transplanted three weeks after sprouting (Plate 4). Staking was done when the vines were 1m (Plates 5, 6 & 7).

Plate 1: Cut minisetts

Plate 2: Setts treatment

Plate 3: Nursing of setts

Plate 4: Field transplanting

Plate 5: *D. Alata*

Plate 6*: D. Esculenta*

Plate 7*: D. Rotundata*

Results and Discussion
A total of 1500 setts were obtained from the 89 selected accessions of the three yam species. (Table 1), out of which six hundred setts each of D. alata and *D. rotundata* and; 300 setts of *D. esculenta* were distributed to 10 farmers (Plates 8 & 9), at each of the three localities, for further multiplication and distribution to other farmers in the catchment area.

Table 1: Species of yams, number of accessions and number produced

Yam Species	Number of accessions multiplied	Number of yam sets produced
D. alata	40	600
D. rotundata	42	600
D. esculenta	7	300
Total	89	1500

Plate 8(a): Farmers receiving minisetts

Plate 8(b): Farmers receiving minisetts

Two hundred setts of *D. alata* were distributed in each community (Table 2). Three hundred setts of *D. esculenta* were distributed (100 per community). Of the *D. rotundata* varieties, the highest sett distributed was

Table 2. Cultivar, locality and quantity of yam seeds distributed

Cultivar	Specie	Locality	Quantity		Total
		Mfadwen/ Bontrase	Dinkro	Nyankumase	
Afase	*D. alata*	200	200	200	600
Dente	*D. rotundata*	200	80	100	280
Pona	*D. rotundata*	20	-	-	20
Labrako	*D. rotundata*	20	-	20	40
Serwaa	*D. rotundata*	30	20	30	80
Brass	*D. rotundata*	30	20	50	100
Ntonto	*D. rotundata*	-	80	-	80
Oboaduonum	*D. Esculenta*	100	100	100	300
Total		500	500	500	1500

Dente followed by Brass and least in Pona. Of the eight cultivars, seven were distributed in Mfadwen / Bontrase and 6 each in Dinkro and Nyankumase.

At Mfadwen / Bontrase seven of the beneficiaries were men, while three were women (Table 3). However, at Dinkro, all the beneficiaries were men and at Nyankumase, eight out of the ten beneficiaries were men. In all, 25 beneficiaries were men, while five were women. The materials distributed were to be cultivated by the 30 farmers and each farmer was to distribute to 10 other farmers. In spite of the key role of women in the management of genetic diversity of crops through their intimate knowledge of diverse uses and in their role in seed systems (Okoye *et al.,* 2009), production of yam in the study areas appears to be the preserve of men. Women were responsible for the transportation, processing and marketing of yams. The low number of women may be due to their non-involvement in the decision making process in their communities.

Given the central and multiple roles that women play, participatory methodologies for the management of plant genetic resources must include gender analysis in order to present an accurate picture of the social factors that direct the conservation and use of such resources (Ogata, 2009). Three hundred and thirty farmers actively participated and benefited from the yam setts, through continuous multiplication and further distribution to other farmers in the communities. The value of farmers' yam genetic resources lies in their utility as a dependable source of planting and breeding materials. It is therefore, important that locally adapted materials are multiplied for distribution to farmers whose requirements have not been adequately met by modern high-input

Table 3. Gender of beneficiaries

Locality	Male	Female	Total
Mfadwen/Bontrase	7	3	10
Dinkro	10	0	10
Nyankumase	8	2	10
Total	25	5	30

cultivars. These materials are potentially marketable and would improve the income and livelihood of the farmers. The most important reasons for linking the gene bank to farmers and farming communities was based on the mutual benefits between breeders and farmers. (Adu-Dapaah *et al.,* 2007). Breeders need to evaluate their materials to fulfil their research objectives. Farmers need to have more choices in crop improvement for their particular environments and needs. This is the most cost-effective research approach and for the eventual acceptability of the materials when released to farmers.

Increasing farmers' access through collaboration in the organization of farmer field schools, and field days, establishment of demonstration plots in communities, distribution of easily understandable manuals and leaflets, builds the capacities of both the farmers and the breeders (Keynon, 2000, Aboagye, 2007). Farmers adopting more scientific approach in production and eventually, higher yields and the indigenous knowledge acquired through the interaction with the farmers when incorporated in breeding programmes will be acceptable to all stakeholders along the value chain of yam production.

Conclusion

The major constraint to yam production is the availability of good quality planting materials Farmers access to planting materials could be greatly enhanced through capacity building for planting materials production, insect pests and diseases management, storage techniques and awareness creation of new technologies in yam production. These will ensure the sustainable access, production and conservation of yam genetic resources.

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