Comparing the drying results of the two methods of drying rice, it can be seen that natural dry rice has a small amount of processing and slow precipitation, but it has a good protection effect on rice processing, germination, and taste quality. While mechanical drying is relatively large and rapid with respect to rice batches, it has a great influence on rice quality. With the increasing living standards of the people, more and more importance is attached to the quality of rice. Therefore, in the future research process, it is necessary to further improve the drying machinery technology and improve the quality of rice.

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Germination rates of frozen grain legume seeds in Cameroon

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Abstract

A project on collection and conservation of genetic resources was carried out in Cameroon in 2014 in villages around Yaounde, Mbalmayo, and Ebolowa. Samples of all grain legume species cultivated by the farmers were collected from the 15th of March till early May 2015. Farmers in these zones cultivate mostly ground nuts, followed by soybean and cowpea. A total of 39, 13, and 45 samples were collected from Yaounde, Mbalmayo, and Ebolowa, respectively. After collection, samples were sun-dried, treated, labeled, plasticized, and stored in the freezer at -20°C in the Institute of Agricultural Research for Development (IRAD) store room at Nkolbisson, Yaounde. A trial was carried out at IRAD Kumba experimental farms in 2016 to purify and maintain 14 cowpea and 12 groundnut samples from the freezer, under the C2D project. There were highly significant differences ($P< 0.05$) amongst samples (treatments) for the germination rate. Cowpea samples had a germination rate ranging from 0.33 to 47.67%, while germination rates for groundnuts were between16.67 to 68.33%. Out of the 26 samples, only 5 (19%) had germination rates above 50%. Due to irregular power supply, freezing turned out to be an ineffective storage method for grain legume seeds. Seeds are now being maintained in vivo in small quantities and on seasonal basis which renders the job of plants breeders very difficult and ineffective. Alternatives storage methods and facilities for grains and seeds in developing countries like Cameroon remain an urgent need to boost research and ensure food security.

Keywords: conservation, grain legume, germination, seeds, developing countries.

Introduction

Biodiversity is the third component of biological diversity (the other two being the specific diversity (the individuals) and ecosystem diversity (populations and their habitats)). Biodiversity may refer to wild biodiversity and agricultural biodiversity. Since the Conference in Rio de Janeiro in 1992 organized by the Convention on Biological Diversity (CBD), to which Cameroon is party, other international legal instruments have been put in place in order to ensure the implementation of the relevant provisions of the CBD. Among these instruments signed and/or ratified by Cameroon, we may cite the International Treaty on Plant Genetic Resources for Food and Agriculture on the

facilitated access and benefit-sharing in the multilateral system of the Treaty, and the Protocol of Nagoya on access to genetic resources and the fair and equitable sharing of benefits arising from their exploitation.

Genetic resources are, in effect, the basis of variation. The development of plant varieties and animal breeds constitutes the main axis of research in order to increase agricultural production to ensure the food security of populations. This can be done either by conventional selection methods or by biotechnology which lead to the creation of genetically modified organisms (GMOs). Therefore, genetic resources, both exotic and landraces, constitute the essential raw material for researchers in selection and improvement of cultivated plants and animals.

The diversity of cultivated plants, animals, fisheries, and forest products are the 4 main components of agricultural biodiversity, and also are essential to the satisfaction of tastes and preferences of consumers that change constantly following culture and economic fluctuations.

The diversity of landraces cultivated by farmers is not sufficiently known to researchers, but nevertheless represents a reservoir for the search for genes important in the creation of varieties adapted to the unpredictable changes in the environment. These landraces, having been cultivated for many years, have acquired a stability of performance (Marchenay and Lagarde, 1986).

In the context of Cameroon, Nya Ngatchou Fondoun published a report of 385 pages in 1987 entitled "Inventories of plant genetic resources in the structures of the Institute of Agronomic Research (IRA)". This document, devoted to plant genetic resources, contained collections in the fields and in the cold rooms with a total of 9500 accessions. Of these, 5240 accessions were unimproved genetic material and 4260 accessions were improved. At that time, the Institute of Agronomic Research (IRA) still enjoyed a relative comfort in terms of preservation infrastructures and financial and human resources. The economic crisis of the mid-1980s led to financial hardship, and the samples were abandoned in the cold rooms. These lasted for 20 years, during which significant losses of genetic material were recorded in both *in situ* and *ex situ* collections. Recently, few studies have been carried out on the collection and characterization of grain legumes in Northern Cameroon (Gonne et al., 2013) and nation wide (Atemkeng and Yousseu, 2017). The results indicated that most of the landraces collected in the 1980s have become extinct. There was therefore the need to recollect and conserve local plant genetic resources for the development of new improved crop varieties. The objectives of this project was to collect and ensure the conservation of the major grain legume genetic resources cultivated by farmers in Southern Cameroon.

Materials and Methods

With funding from the public investment budget (PIB 2014), a project was carried out entitled: collection and conservation of genetic resources in Cameroon. A team made up of researchers, technicians, agricultural extension workers, and village facilitators worked as three groups in villages around Yaounde (Nkolfoulou, Minkoameyos, Elig Essomballa, Elumdem, Nkometou III, Mendong, Simbock), Mbalmayo (Nkolnguet, Melombo, Ekombitie) and Ebolowa (Nkoemvone, Biba, Assoo'seng, Ndengue). Samples of all grain legume species cultivated by the farmers were collected from the 15th of March till early May 2015. Farmers were contacted on the farm, market, and at times at home in the evening. In the process, the objective of the project was explained to farmers and some incentives in form of in-kind donations given to them to supply the samples. After collection, samples were sun-dried, treated, labeled, plasticized, and stored in the freezer at -20^{o}C in the Institute of Agricultural Research for Development (IRAD) store room at Nkolbisson, Yaounde (Figure 1). A trial was carried out at IRAD Kumba experimental farms from September 2016 to December 2016 to purify and maintain 14 cowpea and 12 groundnut samples from the freezer, under the C2D project. The data collected were germination rate, days to first flowering, days to 50% flowering, number of seeds per pod, number of pods per plant, pest and disease scores, and grain yield per hectare. Here only data on germination rates is reported.

Data analysis

Analysis of variance was done using the R – package version 2016 and multiple mean separations were done using the Tukey test.

Fig. 1 Grain Legume Samples frozen at -20°C.

Results

Farmers in these zones cultivate mostly ground nuts, followed by soybean and cowpea. Very few farmers cultivate common bean. The samples ranged from 20 to 50 grams per sample (Figure 2). A total of 39, 13, and 45 samples were collected from Yaounde, Mbalmayo, and Ebolowa, respectively. There were highly significant differences (P< 0.05) amongst samples for the germination rate in cowpea, while no significant differences existed among groundnut samples. Cowpea samples had a germination rate ranging from 0.33 to 47.67% (Table 1), while germination rates for groundnuts were between16.67 to 68.33% (Table 2). Out of the 26 samples, only 5 samples (19%) had germination rates above 50% (Tables 1 and 2).

Discussion

The results indicate that only 19% of the frozen samples had germination rates above 50%. This might have been caused by irregular power supply and low voltage. Consequently, freezing, which is very effective for storing grains for years, turned out to be an ineffective storage method for grain legume seeds in Cameroon. The efforts of the team went in vain, and the budget allocated for the project was sort of wasted as phase two of the project could not be implemented due to low germination rates. Seeds are now being maintained *in vivo* in small quantities and on a seasonal basis which renders the job of plant breeders very difficult and ineffective. Alternative storage methods and facilities for grains and seeds in developing countries like Cameroon remain an urgent need to boost research and ensure food security.

Fig. 2: Grain legume samples from farmers ranged between 20 to 50 grams per sample.

Tab. 1: Germination rates of cowpea seeds frozen for two years at -20°C.

Cowpea gerplasm	Germination rate
Accession 1	0.33a
Accession 2	16.67ab
Accession 3	30.00ab
Accession 4	47.67bc
Accession 5	20.00ab
Accession 6	15.00ab
Accession 7	36.67ab
Accession 8	13.67ab
Accession 9	17.00ab
Accession 10	21.67ab
Accession 11	14.67ab
Accession 12	9.67ab
Accession 13	16.67ab
Accession 14	20.33ab
Accession 15	**76.67c**
DF	14
F	1.715
P	<0.001

Means followed by the same letters are not significantly different ($P< 0.05$). Highlighted samples had germination rates above 50%.

Tab. 2 Germination rates of Groundnut seeds frozen for two years at -20°C

Variety	Germination rate (%)
Aboul Niveau	**68.33**
Afoumou	36.33
ICGV 86003	**59.67**
JL 24	50.67
Manipinta	**58.00**
Mfoumou	29.33
Minkonga	**54.00**
Ngomomou	20.00
Ngomomou Congo	25.67
Ngoxomou	34.00
Ossa owondo	45.33
Zebedee	16.67
DF	11
F	0.959
P	0.506

Means are not significantly different ($P< 0.05$). Highlighted samples had germination rates above 50%.

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