

**BRIEF CROP GENETIC RESOURCES FIELD COLLECTING MANUAL**

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## Introduction

This manual is intended to give a general guide for germplasm collectors involved in collecting cereals, oil crops and root crops in Eastern African conditions. It is based principally on the author's personal experience and on literature written by various authorities on genetic resources, such as Hawkes (1980), Mehra et. al (1981), Frankel & Bennett (1970), and brief discussions with various consultants that have been to the Ethiopian gene bank.

An effort is made to depict the basic chain of activities that are undertaken in germplasm exploration and collecting expeditions. Nevertheless it should not be assumed to be complete. The author believes that this manual will provide substantial guidance to individuals who embark on collecting for the first time in the absence of a knowledgeable person in the team and institution or PGR centre.

## Planning Exploration and Collecting Expeditions

Plant Exploration requires meticulous planning to ensure the explorer is at the right time to capture and collect ripe seeds, pods, tubers, etc., and study the existing diversity right in the field conditions. In brief, as much time as possible should be allowed for expedition planning. For national collectors, 2-3 months may be sufficient depending on the knowledge and experience of the collecting team.

## Choosing the region for collection

It would be quite logical to acquire knowledge on the agro-ecological and altitudinal conditions in relation to the distribution and range of diversity of the crop/plants in question in the area to be explored. The cropping pattern and the crop calendar should help the explorer to familiarize himself with the agricultural system of the region. In this context, published reports of the Agricultural Development Office of the Ministry of Agricultural and annual statistical reports of the National Statistical office are of substantial assistance. The Relief and Rehabilitation commission's quarterly report on the crop situation in field condition is a valuable source of information in planning collection expeditions. More emphasis should be laid on obtaining information from PGRC/E in connection with systematic collecting operations. Furthermore, the regional priority set out in terms of the threat of genetic erosion and development activities should be consulted.

### Study relevant plant materials

In order to get conversant with the plant species of the area to be explored, a visit to the national herbarium is recommended. This helps to acquire a visual impression of the taxa that can be expected and will thereby facilitate work in capturing the material required in areas of diversity. The provenance data on the herbarium sheet can be a valuable source of information for maturity period, plant association, altitude and edaphic factors. This can also help to determine the range of distribution of a species within the target area.

### Establishing local contacts

The most relevant local agencies include, the Ministry of Agriculture, Regional Agricultural Institutions, the Relief and Rehabilitation's Early Warning and Service Unit, the Agricultural University and the Farmers Association Office, etc depending on the county. Information on harvesting period, type of crops, adequacy of road network and availability of hotel rooms can be discussed with the various staff members of these institutions.

### Collecting team

The principal factors in selecting a team of collectors are the objectives of the exploration mission, and a thorough knowledge of the specific crops with which the team is concerned. The collecting team must be technically competent to meet the objective of the mission. The presence of one or two highly specialized scientists in the team is very important with at least one of them having substantial and prior experience of the region.

The team leader should preferably be a botanist, a breeder or an agronomist. Some knowledge on the pathological and entomological aspects of the crops to be collected is also of great help. Whenever possible the team should include a local guide with some knowledge of the local floral and the road track network in the region. Such a person can perhaps be obtained from the various regional agricultural offices. In general, the team should be kept small for efficiency. A maximum number of four, plus a driver, is ideal.

### Planning itinerary

Working out a provision route and time schedule is essential before embarking on a mission and a road map can be very valuable. In some regions, however, the maps are unreliable and allowance should be made for this. In general, the recently published road map with contours is very useful. Some very recent roads may not be indicated on the map and provisions should be made to include these in the itinerary as they crop up. The feasibility of following certain routes can be clarified with local contacts.

### Timing the collecting expeditions

When planning collecting expeditions, allowance in timing should be made for climatic and seasonal differences associated with altitudinal factors. Since the altitudinal amplitude for various crops in this country is so wide and this in turn has an impact on their maturity period, proper consideration is required in order to capture maximum diversity for a given crop in a given region during one mission (expedition). Information on the harvesting period can be obtained from the sources mentioned above.

In a country like many of the countries in the sub-region (Ethiopia, Eritrea, Rwanda, Burundi etc) where the altitudinal range is so enormous for most crops, there will inevitably be certain areas where primitive or locally adapted materials flowering early or late, despite the harvesting period known for the general region. In circumstances such as these, it might be necessary for seasonal visits, or subsequent collecting may be arranged with local agricultural workers.

### Basic equipment for collecting operation

The items indicated below include the most indispensable ones for an ideal collecting expedition.

#### Scientific equipment

1. Altimeter – to read up to 5000m
2. Soil kit
3. Camera (35mm, 3LR)
4. Compass

5. Films (slide, colour and black & white)
6. Hand lenses
7. etc.

#### Collecting equipment

1. Cloth bag with draw strings or tapes
2. Plastic bags
3. Plant press
4. Vasculum
5. Pair of scissors
6. Knife or secateurs
7. Digger
8. Pocket knife
9. Collection forms
10. Small pocket notebooks
11. Knapsacks
12. etc.

#### Transport

1. From experience, there is no alternative to a 4 wheel drive vehicle for collecting expeditions in many regions in Eastern Africa.
2. Good set of spare parts and tools
3. Two spare tyres, pump and pressure gauge
4. Puncture repair kit with lots of patches
5. Heavy duty hack & tyre leavers
6. Petrol cans, large funnel & plastic tubing.

#### Camping equipment

1. If the car is not provided with roof tent light-weight tents are essential
2. Double layer sleeping bags
3. Camp beds
4. Cooking equipment, gas stove & cutlery
5. Plastic cups, plates
6. Plastic water containers
7. Torches & plenty of batteries
8. Lamp

### Medical supplies

1. Insecticide sprays
2. Insect repellent creams
3. Antibiotic tables
4. Antacid tablets for minor stomach upsets
5. Anti malaria tablets
6. Pain killer such as aspirin, Panadol, baralgin
7. Bandages
8. Ban aid
9. Water purifying tablets
10. Snake bite serum

### Collecting Field Crops/Sampling strategy

Gene pool sampling as defined by Chandel (Mehra et al 1981) refers to a collection of population samples consisting of individuals showing genetic variation due to the presence of a single pair of allele or allelic combinations for polymorphic loci.

The strategy of sampling depends on the type, breeding system and degree of gene flow between populations of the species in question, thus the sampling strategy is different for cross-pollinated and self-pollinated species. In the former, there occurs free flow of genes within the same population as well as the neighboring populations, while in the latter free exchange of genes between individuals within a population is precluded. Thus, the population structure in such a situation will vary substantially in relation to variation pattern.

### Sampling technique

The optimum sample size per collection site would be the number of plants required to obtain all the alleles in a population that occur at 5 percent frequency or more.

In general, random sampling is practiced. Such sampling is undertaken by randomly selecting a starting point at the collection site and taking a single spike or pod at every so many places until at least 50 plants, but certainly not more than 100 plants, have been sampled along a number of transects through the crop. This gives a 95

percent certainly of capturing all alleles in the population that occur at 5 percent frequency or more, (Hawkes, 1980). If any plants are noticed that show characters not included in the random sampling three are sampled selectively and given a different collection number. However, some authorities (Bennett, 1970) argued in favour of enriching the random sample with a biased (selective) sampling.

When 50 or less plants occur in the field plot or wild populations, each plant is sampled where possible and the seeds bulked. In some circumstances in peasant agriculture and kitchen gardens it may not be possible to sample each plant because to do this will remove the whole harvest on which the farmer depends. A compromise must be worked out the farmers through friendly discussions.

#### Wild populations

Wild populations may consist of only a few individuals. In situations such as these, it is better to sample even these few plants, or even only one rather than none at all. Careful notes of what has been done should be made in the field record book.

#### Vegetables & some medicinal plants

Where a few individual plants (such as *Brassica carinata*, *B. nigra*, *Lepidium sativum*) used for flavouring or medicinal purposes or a few fruit trees occur in small villages, it may be very sensible to treat the village as a sampling site and bulk the seeds into one collecting sample.

#### Vegetatively propagated materials & root crops

The sampling of vegetatively propagated materials such as potatoes and sweet potatoes, and root crops such as yams, taro, etc., requires distinct sampling techniques since such crops do not occur as large populations, but as highly selected individual genotypes. These materials are sampled on the basis of information from local farmers on what & how many varieties they grow. In any one market all the possible morphotypes should be sampled. Morphotypes can be sampled without fear of possible duplication. Samples can be sorted out and discarded if duplicates occur. In general, it should be pointed out that vegetatively propagated material is often encountered in isolated conditions and sampling is often determined by the availability of material in the prevailing local conditions.

As practical rule take sample where: -

1. the varieties are morphologically distinct and different.
2. there is a marked change in altitudinal and eaphic factors.
3. geographical hindrance to communication is met.
4. the local people are ethnically and culturally different from those in the previous collecting sites.

### Sampling sites

Germplasm material can be collected from five srces:

1. farmers fields
2. back yards
3. farm stores
4. village markets
5. threshing grounds

### Bringing in the collected samples to the Centre

The collected samples must be brought back to the Centre and further study of the material is essential before handing over to the seed processing unit. This can include visual assessment of the range of variation in spike size & colour, own length, seed size and colour, number of spikelets per spike, tuber size, shape, & colour, etc.

### Handing over the collected samples to the seed processing unit

After visual and preliminary assessment, the material is handed over to the seed processing Division. Prior to this, the relevant seed receiving format has to be filed properly.

### Collection Data

During all field and market collecting of seeds crops, tubers and root crops and their wild relatives, it is essential to record collection data on standard data forms (Appendix II). All the relevant data should be included right at the site of sampling.

### Voucher Specimens

Voucher specimens should be made whenever desirable so that they may be used for later taxonomic work. Moreover the range of variation within a population for particular seed accessions can be shown with voucher specimens and these can be kept for future reference.

Since the specimen is intended for the herbarium, the size of the collected sample is important and this has a direct relation to the size of standard herbarium mounting paper (29 x 40) cm). The specimens should have all their plant parts, such as flower, fruits, leaves, etc. In tall plants, the sample may require representation from the top, middle and base of the plant to exhibit variation in leaves, petiole length, peduncle, inflorescences, etc. Four or five voucher specimens should be taken to illustrate the range of phenotypic variation in the population, and proper data on the site & plant characters, including flower colour, plant height, associated plants, etc., should be recorded.

The voucher specimens should be dried properly with a plant press and drying papers. Identification tags must be tied to each specimen until it is mounted and an ideal label is fixed.

### Photographs

For the voucher specimen of a big plant, prepare compact representation by a combination of photographs of the important components of the plant. Taking digital photographs of some unique plants is also helpful for future studies.

### Preservation of specimens

The plant specimens collected can be preserved as plants or pressed and mounted on herbarium sheets. Large fruits and other plants can be kept as pickled material in big bottles.

To save the plant specimens from fungal and insect attack, should be dipped for a few seconds in a solution of  $HgCl_2$  is rectified spirit. Rubber gloves should be used and the specimens must be held with a pair of forceps  $HgCl_2$  is poisonous and harmful to the skin.

To prevent fungal and insect attack the specimen can be kept in a deep freeze for 5-6 days.

Quick reference guide before commencing collecting expedition

1. Obtain letter from the PGRC/E administration office or the Directors Office
2. Make sure you have travel permit from the National Security Office for foreign collectors. Passport should always be kept with you.
3. Make sure the car is serviced greased, and fuelled, etc.
4. Make sure all the basic collecting equipment such as altimeter, cloth bags, maps etc., (see list above) are put in the car.
5. Check sufficient fuel coupons are obtained from the transport officer.

## Modus Operandus

### Code of conduct

This code of practice has been produced to help avoid misunderstanding among field exploring and collecting team members when they are out on a field collection mission. It must be made clear that the essence of team field work is a proper understanding of the objective with everybody working together towards a common goal.

### Preparation for a field trip

Any person or team planning a field trip should notify the concerned administrative unit, in writing, of the following information before departure; List of participants, time & date of departure; mode of travel to and from sites, anticipated date of return, etc. This enables a record of the details of an expedition to be kept for reference in case of an emergency.

### Chain of command

#### Team leader

The team leader is responsible for the Exploration and Collection mission and, likewise, the team members are responsible to the team leader. He/she gives directives pertinent to the field activities and fixes time to start work. Work in the field usually starts at 7.00 a.m. However, it can be either earlier or later, depending on the local situation, but never later than 8.00 a.m. Calling off the day depends on the circumstances and the decision of the team by and large. The team leader decides on matters in connection with the purpose of the trip after proper consultation with the other members of the team has been made. Collective decisions are binding. At critical times the final decision rests upon the team leader.

#### Team members

- All team members must accept directives, within the framework of their responsibilities, from the team leader and perform accordingly. This should not create any inconveniences.
  
- Any member of the team can be assigned to execute the duty of the team leader whenever it is deemed necessary.

- Readiness and punctuality are key factors in field work and thus every team member is expected to be punctual and ready to execute his responsibilities.
- Data collection formats should be properly filled by the relevant assistant at the site of collection. If collection data is not completed at the site of collection, the person responsible for it should complete the form before starting the following day's work.

#### Driver

- The driver is responsible for the safety of all the team members while he is driving, and for the general safety and security of the vehicle.
- The driver receives directives from the team leader and is not permitted to move the vehicle without obtaining prior permission from the team leader.
- The driver makes sure that all the relevant spare parts and accessories are brought along and performs the routine car check procedures.

#### Permission to take samples

Usually, most farmers are cooperative and allow crop samples to be taken from their fields. However, occasionally some farmers are unhappy about these activities and permission should be acquired prior to sampling. Gentle persuasion is a good policy whenever uncompromising farmer is encountered.

#### Procedure in the event of an accident

The first aid kit should be readily available and medical and relief help should be sought if necessary.

If a major accident or injury involving any person or vehicle should occur during a collecting trip, the team leader or any other appropriate person must telephone the Director and/or the Administrative Officer of the Centre.

## Reporting

An exploration and collecting expedition team should submit a report back to the concerned body within one month of the completion of the trip if it was funded from local sources and undertaken by the Centre. Expeditions carried out by international co-operators should, as a courtesy, report to the center within a reasonable period of time. A copy of the collaborating collector's report should be sent to the right body with a critical analysis of the collection expedition and the outcome of the expedition as soon as possible, preferably well before the following collecting season.

Appendix I

PGRC/E COLLECTION RECORD SHEET

Acc. No. \_\_\_\_\_

COLLECTION NO. \_\_\_\_\_ CROP \_\_\_\_\_  
 DATE \_\_\_\_\_ GENUS \_\_\_\_\_ SPECIES \_\_\_\_\_  
 COUNTRY \_\_\_\_\_ LOCAL/VARIETY NAME \_\_\_\_\_  
 REGION \_\_\_\_\_ ETHNIC GROUP \_\_\_\_\_  
 WEREDA \_\_\_\_\_ LANGUAGE \_\_\_\_\_  
 VILLAGE/SITE \_\_\_\_\_ SAMPLE TYPE: 1 SINGLE  
 PLANT \_\_\_\_\_ 2 Pure Line/clone  
 3 Population/mixture  
 4 Other (specify)

MAP NO. \_\_\_\_\_

LAT. \_\_\_\_\_ LONG. \_\_\_\_\_ GENETIC STATUS:

ALTITUDE \_\_\_\_\_ (m) 1 Wild

2 Weed

TOPOGRAPHY: 1 Swamp 3 Primitive cultivator landrace

2 Flood plain 4 Breeders line

3 Plain level 5 Advanced outliver

4 Undulating

5 Hilly

6 Hilly dissected

7 Steeply dissected

8 Mountainour

9 Other (specify)

SOURCE OF COLLECTION

1 Field

2 Backyard

3 Farm store/threshing place

4 Market

5 Agricultural Institution

6 Natural vegetation

7 Other (specify)

SITEL 1 Level

2 Slope

3 Summit

4 Depression

SOIL TEXTURE:

1 Sand

2 Sandy loam

3 Laom

4 Clay loam

5 Clay

6 Slit

7 Highly organic

MATERIAL: 1 Seed

2 Spikes

3 Pods

4 Other (specify)

HERBARIUM SPECIMEN YES ! NO

PHOTOGRAPH YES ! NO

SOWING MONTH: 1 2 3 4 5 6 7 8 9 10

11 SOIL COLOUR:

1 Black

2 Brown

3 Red

4 Orange

5 Yellow

6 Other (specify) \_\_\_\_\_

12 EARLY/MID/LATE

ORIGIN OF SEED: Local/Elsewhere \_\_\_\_\_

USAGE \_\_\_\_\_

(specify) \_\_\_\_\_

STONINES: 0 None \_\_\_\_\_  
1 Low \_\_\_\_\_  
2 Medium \_\_\_\_\_  
3 Rocky \_\_\_\_\_

DISEASES AND PESTS \_\_\_\_\_

NOTES: (Associated wild weedy species Crop,  
Local Flora, Disturbance Factors,  
Morphological variation Husbandry)

DRAINAGE: 1 Poor \_\_\_\_\_  
2 Moderate \_\_\_\_\_  
3 Well drained \_\_\_\_\_  
4 Excessive \_\_\_\_\_

SOIL PH \_\_\_\_\_

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