



**MOUNTAIN
HER**

Deliverable achievement report

**Engage women- and youth-driven
community enterprises in selecting
the best germplasm**

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Seed Production in Mountainous areas

Access to high quality seeds in remote mountain areas is often difficult. A strategic solution is to ensure the establishment of community seed enterprises. The procedure to commercialize locally high-quality technical seeds is not simple. It requires to first produce G1 seeds obtained from individual spikes, then to bulk these into G2, G3, and G4 seeds, while maintaining homogeneity, and finally to produce commercial R1 and R2 seeds that satisfy the clients in terms of purity and germination.

In the MountainHER project we propose to engage women and youth in the seed business through in-situ trainings performed in the living labs of the 5 countries involved and the development of audio-visual and written material. This document is considered a living document aiming to provide information and guidance for trainings.

Trainings

In order to develop a seed enterprise, the most critical field and storage practices must be mastered. For it, training regarding relevant field and storage practices are being delivered in the 5 countries. The trainings are addressing some of the following topics:

Varietal traits

Although seed companies do not need necessarily to be the developers of new varieties, knowledge on variety development and major relevant agronomic and morphological traits is needed to effectively identify the new variety's distinctiveness and uniformity, and assess the potential for adaptation of the new varieties to the local conditions and their market value. Therefore traits such as the following are being demonstrated to the cooperatives and farmers in the locations selected:

Phenology

The timing of the life cycle of crops and how it is influenced by seasonal variations in climate is capital for varietal adaptation and is a major trait influencing of productivity and end-use quality. For instance, in cereals, flowering time has capital impact on adaptation. Thus, under Mediterranean conditions, flowering too early can expose the flowers to cold damage, reducing the number of viable flowers and therefore grains and final yield. However, flowering too late can force the plants to fill the grains under increased drought and heat, reducing both productivity and grain quality. Therefore, identifying the optimum window of flowering in a specific location can help selecting the best adapted varieties and can also indicate seed companies to select varieties adapted to the expected climatic conditions, especially under Climate Change.

Spike and grain morphology

Besides its importance as a main yield and end-use quality component, spike morphology is one of the main drivers to assess uniformity in a variety (see DUS). Thus, major differences such as compact vs extended or 6-row vs 2-row spikes for the case of barley are highly genetically controlled and can have major impact in the productivity and use of a variety as well as for differentiating between varieties or assessing the purity within a variety. Relatively smaller differences such as color or pilosity are also important when assessing the uniformity of a variety.

Grain morphology is also a major trait for productivity and, often more importantly, for end use quality. For instance, in local sales, large durum wheat grains are more appreciated and therefore have higher price than smaller grains. Similarly, in the case of malt barley, industrial standards require grains larger than 2.5mm to perform the malting process, smaller grains are considered “feed barley” and loose thereby the malting premiums. Grain color is also a major trait for end-use quality, for instance in durum wheat, high yellow pigment is often preferred for pasta making although other local products can also have preference for other colors. In the case of barley, having blue aleurone is generally a negative trait for malt barley production. Some of these traits, like blue aleurone, can also important for determining variety uniformity and distinctiveness.

Other traits

In terms of marketability, grain production and quality is generally the major driver in cereals and other traits such as plant height or disease resistance are also capital. However, in the new Climate Change scenario, and especially in the Southern part of the Mediterranean Basin, straw yield is an important commodity. Animal feed is of capital importance in the area due to the predominant crop-livestock farming system. For it, straw is not only a major source of feed for the farmer’s livestock but is also a commodity that can increase farm’s profitability and in dry years can result in most of the farm’s effective income. Thus, helping the new seed production entrepreneurs to identify and value high straw yielding varieties can increase their market value and therefore the company’s market share and benefits.

Variety release and seed quality regulations

Variety release is the process that certifies that a variety is legally allowed to be multiplied and sold to the public. Besides performance indicators that typically must be met by the variety in official variety registration trials (Value for Cultivation and Use or VCU test), for seed producers, other aspects of the variety registration process are also important. These processes are also being described to the potential seed growers in trainings as part of the project:

DUS

The DUS process or Distinctiveness, Uniformity and Stability testing process is a system present in most countries by which the variety developer must ensure that the new variety submitted to registration is different from others registered previously (Distinctiveness), that its characteristics are expressed uniformly in the plant population (Uniformity) and that these characteristics are maintained over generations (Stability). It is based on the variety’s morphological description on a pre-established set of heritable traits that can vary from country to country and while it is a requirement for variety registration, it is also used during seed certification on regular field inspections. While most countries still use morphological traits to ascertain the DUS performance of a variety, genetic markers are starting to be used in countries like United Kingdom since they provide a more accurate determination of the uniformity of a variety. For it, it is critical that new seed producers are aware of the DUS requirements and the characteristics of the varieties they are multiplying, since DUS testing is the basis of the quality assurance under the seed certification scheme.

Seed Multiplication

Once a breeder or breeding company has developed a variety and that variety has been registered, seed multiplication generally starts. While the regulations and steps can vary from country to country,

they generally follow a similar structure. The seed producer receives what is considered the core seed of the variety, named *breeder seed* or *pre-basic seed*. Since normally this breeder seed is not provided in high quantities, several steps of multiplication need to be done before achieving retail seed level. Also, even if the breeder seed was enough to cover the needs in one single multiplication, it is generally considered that maintaining the level of purity required in one large but single multiplication event, would be challenging. For it 3-5 multiplication steps are generally performed, being the first 3 or 4 multiplication events are generally non-commercial ones. These first multiplication events are generally used to increase the seed amount under controlled conditions to ensure purity after every multiplication event. These first events can be designated G1-G3/G4, pre-basic and basic or other local terminology. It is also during these multiplication events that the purity of the seed is controlled, requiring normally 99.9% to 99% purity from basic seed to certified seed. To avoid mixtures or outcrossing events, the seed multiplier would normally engage in isolation barriers, whether these are based on time, distance or physical barriers.

ISTA

Seed quality evaluation is generally regulated by National laws. However, there are international organizations that were created to homogenize the seed quality evaluation. For instance, the International Seed Testing Association (ISTA) is a consortium of international laboratories that promote the uniformity in seed quality evaluation. The ISTA rules indicate the standard procedures and requirements for testing and reporting seed quality results. This allows inter-country recognition of seed quality and facilitates trade.

Seed purification, storage and treatment

In the case of the MountainHER project, small seed enterprise would need to produce high quality seed to serve the community. For it, trainings in seed purification are being provided to the communities.

Spike selection and planting

A training on spike selection based on morphological markers is being given to the communities. Using the barley and durum wheat elite trials carried out in the project, farmers and communities are being trained to identify homogeneous and representative spikes in the plots, collect them and store them. In addition, trainings are being given to identify mixtures and off-types that need to be rogged out to maintain purity.

Once the spikes are collected, a training on single spike planting and identification of off-types is also being provided, together with management solutions to enhance seed quality and yield.

Seed Storage

Seed storage is probably one of the most critical processes in seed multiplication as it will determine seed quality. One of the most important steps in seed storage is timely harvesting. Harvesting under high moisture conditions will lead to high humidity in the grain and therefore low seed germination and longevity. In order to avoid this, ensuring harvesting after 3-4 days of high temperatures and sun can prevent high moisture content in the grain. Alternatively, the desiccation rooms can be used to reduce moisture, although it generally requires energy, increasing the costs. Ideally, seed moisture should be below 15% at harvesting time and ideally below 12% at storage.

After harvesting, seed storage must be done in a dry and well ventilated place to prevent reduced seed quality. In general, for every percentual point of moisture decrease, storage life is doubled and the same applies for every 5C of temperature decrease. The storage unit should be rodent-proof and eventual fumigation may be applied to control insects and other pests.

Ignoring these recommendation can result in irreversible deterioration of the seed quality as once the germination capacity falls below the established standard for the species or the insect damage is too high, the seed lot will not be acceptable.

For the purpose of disseminating the most important processes for seed production, videos are being developed in the countries involved and will be made available to the communities and the general public.

Identification of suitable candidates to develop seed enterprises

Based on the requirements above mentioned and the general needs for a small community-based seed enterprise the MountainHER project established the requirements to identify the most suitable candidate in the communities or nearby to potentially develop a small seed company. The terms of reference (TOR; <https://hdl.handle.net/20.500.11766/68438>) developed involved the suitable experience the individual should have as well as the equipment. Following the philosophy of the project, women and youth were targeted, however, in some communities, no candidate fulfilling these requirements could be found. In those cases, a joint venture between the individual selected and the local cooperative will be fostered to ensure co-ownership of the company.

The details of the candidates selected and the requirements met are shown in Table 1.

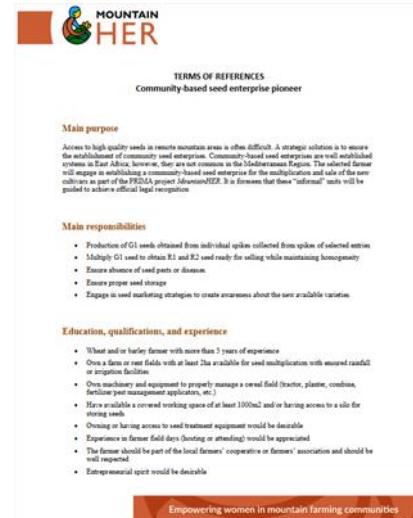


Figure 1 TOR of the small seed enterprise candidate requirements

Table 1: Description of selected candidates to engage in community based seed enterprise and TOR requirements fulfilled.

Criteria	Algeria	Croatia	Italy	Lebanon	Morocco	Tunisia
Gender	Man	Man	Woman	Man	Man	Woman
Age	45	47	38	20	43	54
Already a seed multiplier?	Y	N	N	Y	Y	N
>5 years of experience?	Y	N	N	N	Y	Y
Own or rents >2ha (irrigation?)	Y	N	N	Y	Y	Y
Own machinery and equipment?	Y	N	Some	Some	N	N
Covered working space of 1000m ² ?	N	N	N	Y	100m ²	Y
Owning / access to seed treatment?	Y	N	N	Y (project)	N	Y (project)
Experience in farmer field days (hosting or attending)?	Y	Y	Y	Y	Y	Y
Part of the local farmers' cooperative/association?	Y	N	Y	Y	Y	Y
Entrepreneurial spirit ?	Y	Y	Y	Y	Y	Y

Status of activities per country

Algeria

Trainings on varietal traits, variety release and seed quality regulations have been done at community level. The homogeneous spikes have been collected. A video is being made in Arabic describing some of the methods used.

Croatia

Trainings are being carried out with some delay due to the extended plant cycle due to the late rains and low temperatures. The homogeneous spikes have been collected. A video is being made in Croatian describing some of the methods used.

Italy

Trainings on varietal traits and variety release and seed quality regulations have been done. The homogeneous spikes have been collected. A video is being made in Italian describing some of the methods used.

Lebanon

Trainings have been put on hold due to security reasons. The homogeneous spikes have been collected and the multiplication is ongoing. A video is being made in Arabic describing some of the methods used.

Morocco

Trainings on varietal traits, variety release and seed quality regulations, and seed purification, storage and treatment have been done at community level. The homogeneous spikes have been collected. A video is being made in Arabic describing some of the methods used.

Tunisia

Trainings on some aspects of varietal traits, and seed purification, storage and treatment have been done at community level. The homogeneous spikes have been collected. A video is being made in Arabic describing some of the methods used.

Additional information

Miguel Sanchez-Garcia. (17/5/2023). Terms of References: Community-based seed enterprise pioneer. <https://hdl.handle.net/20.500.11766/68438>



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HER**

Empowering women in mountain
farming communities



PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION
IN THE MEDITERRANEAN AREA