Agroecology Series Module # 1

The Seed bank Strategy:
From Seed Saving to Seed Sovereignty & Autonomy



Learning Objectives:

To understand the concept of a community seed bank and its importance in achieving food sovereignty and seed autonomy

To appreciate collective work on seed bank management with emphasis on the role of women and youth in the community

Module 1a: Seed and Food Sovereignty

Seeds are the first link in the food system. Without seeds – and by this, we mean including asexual vegetative materials such as bulbs, cuttings, rhizomes, runners, etc. – we cannot grow crops that provide us sustenance. Our forms of sustenance are as varied as our cultures; some are largely vegan, others are more meat-based, some cultures rely more on root crops and plantains as staple, others on cereal grains and their many forms. Thus for many generations, numerous food cultures have sprung all over the world reflecting the diversity of seeds and cropping patterns unique to particular agro-climatic and agro-ecological zones.

Seed diversity is central to our survival. The seed diversity that existed, and that which continues to exist today, are products of constantly evolving efforts of farmers to conserve, improve, and utilise diverse range of seeds for equally diverse range of purposes. Throughout almost all the 10,000 year history of agriculture, the patient and careful work of millions of farmers produced an endless wealth of crop cultivars with their myriad colours, flavours, needs, uses, adaptive characteristics, sub-products, growth habits, etc. A very important part of this process has been the free exchange of seeds among farmers, which made the passing of knowledge, customs, traditions and culture possible from one farmer to another for countless generations.

***Exercise 1**: Discuss how much exchange of seed is happening right now among farmers in Pakistan, especially within the PKMT network. What seeds are being exchanged and why? Are there any conditionality attached to the exchange? If so, what are these? How often do the exchanges happen (every cropping season, every two years)? Do farmers exchange seeds of the same crops or of different crops?*

The rise of formal agricultural research in the late eighteenth to the mid-nineteenth century, reoriented agriculture profoundly and in various ways. Related sciences such as biology and chemistry (i.e. biochemistry) were applied to agriculture providing impetus for researches to focus on improving efficiency of agricultural production. With the Industrial Revolution in full swing, agricultural engineers used technologies to “mechanise” much of farming workloads by developing farm tractors and other machineries. At the same time, armed with the new knowledge of plant breeding, agricultural scientists took over crop improvement from farmers and bred modern seeds that can produce higher yield through efficient nitrogen uptake. All this gave birth to “modern farming” to replace traditional agriculture that was considered backward, cumbersome and inefficient. Modern seeds superseded landrace and traditional cultivars that were deemed late-maturing and unproductive.

The introduction of the first high-yielding varieties (HYVs) of cereal crops beginning in the late 1960s undermined the prevailing traditional seed systems and curtailed the flow of farmers seed exchange. Agriculture ministries and agricultural research institutions became the focal point of the new seed varieties and technology, while agricultural technicians became the new source of farming knowledge. Farmers were told to use these HYV seeds to increase production, but that they have to use fresh batch after two cropping seasons to ensure good productivity. HYVs are open-pollinated varieties, meaning they “breed true” i.e. when they self-pollinate, or are pollinated by another representative of the same variety, the resulting seeds will produce plants roughly identical to their parents. Although they can be saved and replanted, the succeeding generations (say after four cropping seasons) will no longer breed true. Some plants in the same population will start segregating (i.e. break down of uniformity) showing different physical characteristics, grain quality or maturity period. This variability can mess up a highly mechanised farming. Thus, agricultural technicians advice farmers to regularly replace the seeds of HYVs.

Then came the hybrids, which further shortened the seed cycle to a single cropping season. Seeds of hybrids are nearly sterile by design – if replanted, they may grow into a plant (if at all) but without the fruits or grains. Hybrids were designed not to reproduce, thus forcing farmers to buy new seeds every cropping. Then came GMOs that created another layer of corporate control with IPR-protected seeds (e.g. Monsanto's Bt cotton) prohibiting farmers from replanting them as stipulated in the contract or license that comes with buying the seed. This seed contract or license probably does not exist, or not enforced strictly, in Pakistan right now since Monsanto's Bt cotton in Pakistan are mostly smuggled from India and are grown illegally. This situation however is going to change once the amended seed law takes full effect.

Exercise 2*: Name some of the traditional seed varieties of wheat, rice, vegetables and fruits that you know of. Identify some of the distinguishing characteristics compared to the modern varieties, for example: root system, size of leaves, tolerance to drought or flood, resistance to pests, etc. Compare how you cultivate them: amount of labour required, cost of fertilisation and pest control, etc. Are there any particular cuisine / traditional food that no longer exist because of the disappearance of these seeds?*

With the task of feeding the growing global population, agricultural scientists put emphasis on productivity measured by volume yield per unit area rather than systems productivity measured by total farm outputs (including production of animal forage and firewood). This meant shifting the focus on monoculture production of staple cereal crops (maize, rice, wheat) mostly in the lowland, and veering away from the traditional diversified production systems. With most government support channeled on modern farming, farmers were virtually forced to adopt the new package of technology composed of high-yielding seeds, chemical fertilisers and pesticides, irrigation and machineries ushered through the Green Revolution of the late 1960s. The shift not only led to the decline of traditional agriculture and loss of farming knowledge, but most importantly, loss of biodiversity. It is estimated that since the Green Revolution, about 75% of agricultural biodiversity on earth has been lost.[1] More than 90% of crop varieties have disappeared from farmers' fields, while half of the breeds of many domestic animals have been lost. Today, 75% of the world's food is generated from only 12 plants and 5 animal species. Of the 250,000-300,000 known edible plant species, only 150 to 200 are used by humans. Of these, only three – rice, maize and wheat – contribute nearly 60 percent of calories and proteins obtained by humans from plants.[2]

Seed and food sovereignty are both a movement and a set of alternatives taking place across the globe to reverse the trend of massive and compounded erosion: of seeds and genetic resources, of local farming knowledge and processes, of food cultures and traditions, that were built and sustained communities for generations. Carrying on with this objective starts strategically with the conservation and management of biodiversity through the establishment of seed banks.

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1 Hoidal, Natalie. 2015. *What's in a seed? The critical role of seed politics in the food sovereignty movement.* Sustainable Food Trust. http://sustainablefoodtrust.org/articles/food-sovereignty-seed/

2 The Center for Health and the Global Environment. 2016. *Biodiversity and Food Production.* Retrieved 15 September 2016 from http://www.chgeharvard.org/topic/biodiversity-and-food-production

Module 1b: What is a seed bank?

Seeds are a codification of genes. Seed banks that store seeds are essentially storage of genetic diversity. They function like “seed libraries” and contain valuable information about the seed itself and its evolution. Embedded in the seeds are not just genetic diversity but cultural knowledge of communities that reflect breeding and selection practices according to specific crop improvement objectives. While there are many types of seed banks, they can be generally categorised as either ***ex-situ*** (off-site) where seeds are stored in a room with low moisture and low temperature to keep them dormant, or ***in-situ*** (on-site) where seeds are planted on the field in natural conditions much like farmers have done for countless generations.

An example of ex-situ seed bank is the Plant Genetic Resources Programme of the National Agriculture Research Center (PGRP-NARC) in Islamabad, Pakistan, which maintains and preserve 2092 rice collections, representing all of 24 *Oryza* species, of which 1897 collections are *Oryza sativa* species (the cultivated species). Other examples of ex-situ seed bank are that of IRRI (International Rice Research Institute) in the Philippines, which maintains and preserve all known rice species in the world, and the Global Seed Vault in Norway, which contains approximately 1.5 million distinct seed samples of agricultural crops from various parts of the world. These seed banks depend on massive amount of resources to maintain its energy, infrastructure and personnel requirements. Our interest is not on this type but on the in-situ seed bank in farmers' fields, the one that can be done and replicated in villages.

Seed banking is a complex and laborious process involving systematic collection, identification, multiplication, evaluation and maintenance of various seeds. Restoring seed diversity is not as simple as recollecting traditional or heirloom seeds and putting them in bottles or planting them on a plot of land. It requires knowing each variety's local specificities and characteristics and understanding in which conditions they grow best and exhibit local adaptability. In this sense, its important to understand the 10 different agroecological zones in Pakistan (please refer to the previous module on *Agroecology*). For rice, which is the second most important crop in Pakistan, there are four distinct rice growing zones in the country (Box 1).

Box 1: Rice Growing Zones in Pakistan

Zone I: Consists of northern high mountainous areas (Swat and Khaghan) with sub-humid climate and average rainfall of 750-1000 mm. Best suited for short-duration, cold-tolerant varieties.

Zone II: Lies between broad strip of river land of Ravi and Chenab, with sub-humid, sub-tropical climate and average rainfall of 400-700 mm. Suitable for some coarse and fine grain aromatic varieties (Basmati) mainly grown along the Kallar Tract consisting of Salikot, Sheikapura, Narowal, Gujranwala, Hafizabad and Lahore districts.

Zone III: Large tract of land on the west bank of Indus River with high temperature and sub-tropical climate, and average rainfall of 100 mm. Consists districts of Larkana, Jacobabad, Nasirabad and Jaffarabad. This zone is best suited for medium long, heat-tolerant coarse varieties.

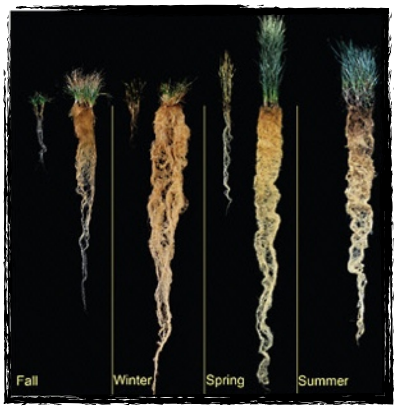
Zone IV: Consists of spill flats and basins of Indus Delta (Badin and Thatta districts) with arid tropical climate. Best suited for coarse varieties.

Most seed banks were established to collect and conserve germplasm (i.e. genetic resources) that are used for breeding and selection. This is the case with nearly all formal seed banks (e.g. all government research and agricultural institutions, the Global Seed Vault, and the institutes under CGIAR system like IRRI and ICRISAT) that are involved in crop improvement. However, in our case, the focus is not so much to breed and improve crops but to conserve and select from various native seeds (landrace, traditional, heirloom, heritage, or farmers selection) cultivated in Pakistan prior to Green Revolution (Box 2) This may also include improved varieties from pureline selection (those that did not require breeding such as Basmati 370 developed in 1933). Pureline method of selection means selecting the seeds with uniform quality (in terms of colour, sizes, shape), from the landrace and replanting them in rows, and further selecting those with uniform qualities until they are “purified” in physical terms.

Box 2: Examples of pre-Green Revolution cultivars of major crops in Pakistan

Crops	Cultivars
wheat	Bansi, Dharra, Gandausi, Katia, Kandhwa, Lal Kanak, Lal Pissi, Malwi, Pakwani, Pusa, Sharbati
rice	Basmati, Dhud Malai, Jhona, Kasarwala, Mallar, Mushkan, Palman, Sathra, Son Pattar, Suffaid
maize	Azam, Jalal, Mansehra, Mingora, Parachinar, Swabi
Source: *various Pakistan literatures dated 1982-2014*	

It is important to emphasise that these pre-Green Revolution seeds are crucial in pursuing seed sovereignty. Breaking away from chemical fertilisers and pesticides requires abandoning the use of “modern seeds” – or those that came after Green Revolution that were bred to respond to chemical inputs, more specifically nitrogen fertilisers that enhances plant growth, development and reproduction. The pre-Green Revolution seeds may not give as much production as the modern seeds, especially in the beginning. Traditional or heirloom seeds tend to be late-maturing and less productive. However, they have natural resistance and can tolerate the different agro-ecological and climatic conditions in Pakistan, and thus can survive without chemical fertilisers and pesticides. Once they get adapted into the local condition, taken care of properly, provided the best nutrition in the soil, they can also reach optimum production. It is always important to remember that when farmers have control over the seeds, it becomes possible to take control of the food and farming systems.



General characteristics[3] of a landrace / heirloom / traditional cultivars may include:

- It is morphologically distinctive and identifiable (i.e. has particular and recognisable characteristics or properties) yet remains *dynamic*. At the level of genetic testing, its heredity will show a degree of integrity but still some genetic heterogeneity (i.e. genetic diversity) since they have wide genetic base.
- It is genetically adapted to and has a reputation for being able to withstand the conditions of the local environment, including climate, disease and pests, even cultural practices.
- It is not the product of formal (governmental, organizational, or private) breeding programs and may lack systematic selection, development and improvement by breeders.
- It has a historical origin in a specific geographic area, usually it will have its own local name or names and will often be classified according to intended purpose (e.g. used for making flour, animal feed, traditional rites, etc.)
- It has high stability of yield, even under adverse conditions, but a moderate yield level, even under carefully managed conditions.

Exercise 1: *Visit a rice or wheat farm that cultivates heirloom, landrace or traditional varieties. Do this a couple of weeks before harvest. Observe the field. How is it different from a field of HYVs or hybrids? Is there uniformity or variability? Walk around. What insects can you see? Any pest and disease that you notice? Are there spiders, grasshoppers, praying mantis, etc.? Now pull out a whole plant. Was it easy or hard to pull out? Notice the root system. How does it look like? Summarise all your observations and compare and contrast them with the HYVs and hybrids that you know of.*

3 https://en.wikipedia.org/wiki/Landrace

Module 1c: Organising a community seed bank

A community seed bank may range from a small plot with only a handful of seed varieties to a few acres of land containing 50 or more varieties. There is no standard size of what is considered a seed bank for as long as it fulfils the objectives of the community. When establishing a seed bank, it is always important to consider the capacity and the available resources in the community to manage it. There is no sense to aim for something big at once but cannot be sustained by the community in the long haul. On the other hand, it makes much sense to start something small that can be done with little amount of resources and expand later as capacities build and resources improve. This is the same context with individual farmers. Most resource poor farmers will be hesitant to experiment on their farms because any crop failure could make them end up in further debt. This should not be the case if only farmers will do it one step at a time, taking small manageable steps rather than giant leaps.

With a community seed bank, farmers can learn how to observe, measure and monitor agronomic traits like (in the case of cereal crops such as rice and wheat) maturity days, crop height, length of panicle (rice) or spikes (wheat), number of grains per panicle or spike, etc. The knowledge they gained from it will be used to identify locally adapted varieties to avoid or minimise potential crop failure, loss of income or consequential hunger. Interestingly, the majority of farmers in Pakistan tend to plant only a single variety of wheat or a single variety of rice, even those who are already participating in the Roots/ PKMT seed bank initiative. They are afraid that if they plant more than one variety, they will have production losses. This is not a very encouraging thought. How can they have production losses? The reason there is a seed bank (and a range of varieties to try) is to be able to select a handful of varieties that are most adapted to local farmers' conditions precisely to avoid production losses. At the same time, planting more than one variety is an insurance that if one variety is ravaged by pest, the other varieties may survived and save the farmer from production losses.

Done correctly and with a strategic purpose, the community seed bank can be a very powerful organising and advocacy tool in itself. Farmers can be easily convinced of changing varieties, or trying a more pesticide-free system, if they can see the tangible benefits of, and have access to locally adapted varieties. It is in this context that a seed festival is most useful. Farmers from other areas will be invited to evaluate the performance of the varieties in the seed bank. All this within the backdrop of larger issues like genetic erosion, incursion of GMOs, corporate agriculture, and the necessary transition to agroecology in achieving food sovereignty.

Exercise 1: *Draft a hypothetical community seed bank plan. Suggest a location and identify specific details (size of land, type of soil, presence or absence of irrigation, etc.) and rationalise why it's an ideal location. List a number of people in the community who will be involve in the seed bank operation. What are their roles? Why are they given those roles? Briefly outline the data collection, recording and monitoring system?*

Collectivising and systematising the seed bank

Like any bank, a seed bank's existence should be based on the objective of serving the community. This means that although an individual farmer may provide the land for the seed bank, he should share the responsibilities of managing it with other members of the community. This way it becomes a shared process, and the seed bank itself represents the interest of a a group rather than of an individual. The danger of an individual seed bank is that there is no collective reflection on the experience and therefore very little opportunity for learning and improvement.

Collectivising and systematising the seed bank are two sides of the same coin. It is impossible to collectivise the seed bank operation without a system, at the same time because of its laborious nature, it makes little sense to systematise the operation without a group of people to share tasks and responsibilities. By collectivising the seed bank, village-based structures can be promoted that will allow the PKMT members to own the process and push it as a strategy to resist market-based modern seeds.

The key to having a successful community-owned seed bank is when it is managed by everyone, and there is constant flow of communication and knowledge transfer to the community. The objective of the seed bank must be clearly understood and appreciated by all. Every aspect of operation – e.g. setting the criteria for collecting traditional varieties, distributing tasks and responsibilities, keeping records in the database – should be known to everybody and involves everybody. It's important to invest on trainings, exposure visits and learning exchanges with groups who have more experience in community seed banking to augment the technical capacity and political understanding of seed banks.

Regular communication and monitoring are also crucial. In this context, characterisation of traditional varieties should be continuous and standardised. Since they were collected from other areas (with different agro-climatic conditions) they may take some time to adapt to new conditions where the seed bank is located, and therefore may exhibit characteristics that otherwise were not present when they were collected. For example, wheat varieties from Sindh may perform differently in the beginning when planted in KPK. The length of the stem or the period of maturity may also vary. Farmers in charge of the seed bank should be able to take note of all this. Apart from changes in every variety's characteristics, other agronomic traits must also be observed and monitored such as pest or disease resistance, flood or drought resistance, salinity tolerance. A scale can be used for this such as 1-being highly susceptible or intolerant and 10 being highly resistant or tolerant. Farmers can then grade each variety from 1 to 10 according to their field performance.

In the future, organising a seeds network might be an idea to further exchange seeds and refine the seed bank management system. Farmers can have meetings to take stock of their experience, strengths / weaknesses, issues and difficulties, lessons learned and areas for improvement, and to map out a strategy for better organising themselves.

Community seed bank as a resistance strategy

It is often said that seeds are the foundation of agriculture; that whoever controls them can virtually control agriculture. Our objective for seed banking is to break free from modern seeds that are dependent on chemical fertilisers and pesticides, and are at the core of farmers' cycle of indebtedness. By changing the seeds, we can transition to a fully diversified and integrated farming system. When farmers have autonomy over seeds, it becomes possible for them to have a sovereign food and farming system.

A cornerstone of food sovereignty is having the right to a healthy, sustainably produced food. Yet without access to quality, affordable seeds and the self-determination to save, select and share these seeds to others, no farmer or consumer can fully attain this sovereignty. Farmers seed systems are therefore integral to the sustainability of their agroecosystem. The Lexicon of Food defines seed sovereignty as *the farmer's right to breed and exchange diverse open source seeds which can be saved and which are not patented, genetically modified, owned or controlled by emerging seed giants (i.e. corporations)*. In this sense, we need to ultimately transition from seed banks to "seed sanctuaries" – communities that cultivate, nurture, exchange and improve seed diversity for the food and nutrition security of future generations.

Some examples of farmers' seed alternatives in Asia

❀ ***Women-led ecological agriculture in India***

The Deccan Development Society (DDS), is a grassroots organisation working in about 75 villages with women's s*anghams* (voluntary village level associations of the poor) in Medak District of Andhra Pradesh in India. The women members of the Society represent the poorest of the poor in their village communities. Since 1985, the *sanghams* have cultivated actively over ten thousand acres of degraded agricultural lands, and raised over three million kilos of grains every year. About 3000 women in 50 villages have enhanced the productivity of over 3500 acres of land, mostly fallow or highly marginal, to grow more than a million kilograms of extra sorghum in their communities every year. This activity has translated into production of nearly 1000 extra meals per each participating family per year, thereby demolishing the myth of the need for permanent government patronage for their food security.

By growing diverse crops on their marginalised lands, over 1500 women farmers have established community "gene banks" in 60 villages and have retrieved over 80 native varieties. This effort has not only retrieved biodiversity on their farms but has also reestablished women's control and leadership over their community germplasm and knowledge. Since 1996, they have also designed and managed local production, storage and distribution systems to reverse the trend of increasing centralisation of food grains. The women's groups have shown that even the very poor farmers, once in control of their agriculture and natural resources, with a bit of help and access to financial resources, can feed themselves and the non-food producing members of their community. They have proved that even in some of the most degraded land areas of the world, people do not have to seek out genetically modified crops or transnational companies to feed them.

❀ ***Community-managed seed wealth centres in Bangladesh***

Nayakrishi Andolon or the “new agricultural movement” is an effort of Bangladeshi farmers to produce healthy, environmentally conscious foods in harmony with nature. It is a movement for new agricultural practices and a new relation with nature. The movement promotes traditional knowledge of farming such as crop rotation, green-manuring, pest control, etc., through its seed wealth centres that act as main hubs for training and seed exchange. It is also increasingly becoming a place for the women farmers to gather and share knowledge. Beside general discussions on agricultural practices, they share the knowledge on horticulture, seed preservation, food processing, medicinal plants, etc.

Through sharing of information, training and exchanges between farmers from different, areas *Nayakrishi Andolon* has spread to every region of the country and has encouraged a decentralised seed system. In every village there is a seed hut where seed preservation and seed storage takes place. Individual households also have their own collections. This effort came from the realisation that so much has been lost, and therefore there is so much to bring back, and that there are so many ways to enhance biodiversity. The movement itself is the physical articulation of their fight against the transnational corporations that are destroying agriculture.

❀ ***Farmer-led breeding in the Philippines***

The Farmer-Scientist Partnership for Agricultural Development (MASIPAG) is a farmer-led network of people's organizations, non-government organizations and scientists working towards the sustainable use and management of biodiversity through farmers' control of genetic and biological resources, agricultural production and associated knowledge. It is widely known for its successful work on farmer-led research and crop improvement initiatives involving conservation and management of the country's rice biodiversity. For more than 20 years, MASIPAG has established itself as an “alternative to IRRI” but with a much broader vision of putting the seeds back in the hands farmers, by promoting farmer-led breeding (rice and corn) in the Philippines.

Its breeding programme is designed to breed varieties that are suitable for particular conditions. Breeding is done in a participatory way involving farmer breeders with some help from scientists. This allows farmers to regain control of their seed and allows for a truly participatory structure and farmer empowerment. Over the years they have managed to retrieve thousands of native varieties and improves them to be high-yielding, nutritious, and resistant to pests and diseases.

MASIPAG is not confined to breeding rice varieties. The improved seeds serve only as entry point for the development of sustainable agro-ecosystems, which they define as a sustained process of conversion both in the lowland and upland ecosystems. This means a conscious shift from conventional (chemical-based) to organic farming, from mono-cropping to diversified and integrated farming system, and from individual farm ecosystem to community-wide agro-ecosystems. For this, the organisation conducts various forms of on-farm trainings, seminars, workshops and cross-visits to broaden awareness, impart technical knowledge and develop farmers' skills in managing biodiversity.

We should always remember that seeds work is also political work. Seed banks are not just a collection of seeds but an articulation of community resistance. It is a springboard for the construction of alternatives that we want to grow, spread and become the basis for overhauling an exploitative agricultural system that supports the elites and the corporates and perpetuates the vicious cycle of poverty amongst peasants. That is why when we talk about sharing and exchanging "seeds" we should not just be referring to its literal meaning. We should also talk about the seeds of consciousness, seeds of self-determination being sown in the minds of fellow peasants across Pakistan.

"The Seed bank Strategy: From Seed Saving to Seed Sovereignty & Autonomy" was researched, written and developed by **Vlady Rivera** for **Roots for Equity** as part of a training module series on agroecology. For comments and questions, contact: rivera.vlady@gmail.com