Food Security in Palestine: An Insight into Agroecological Tools and Practices
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INTRODUCTION

The present booklet intends to be a practical informative material tool about food security in Palestine, giving insight on agroecological tools and practices. In particular, it aims to increase the awareness of Palestinian farmers, citizens and students of the importance of food security in Palestine and to encourage them to be aware of and use innovative agricultural practices to achieve food security for their families and communities.

It includes five main sections:

• In the first section, the definition of food security in Palestine and its implications in terms of right to food, access to resources and food sovereignty is offered;
• The second section presents agroecology as a holistic approach to address the challenges of food insecurity in Palestine;
• The third section introduces techniques of agroecology for farmers and citizens, giving concrete example of implementation in Palestine;
• In the fourth section, the topic of Fair Trade in Palestine is tackled, stressing the importance of supply chains and producer-consumer relationships;
• The last section presents the PAL PASS project, in the framework of which the present booklet has been prepared and published.
**WHAT IS FOOD SECURITY?**

Food Security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets, on a continuous basis, their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept at the family level, with individuals within households as the focus of concern. The concept of food security comprises four distinct components:

1. **Food availability** – whether produced locally or imported
2. **Food accessibility** – where all individuals have access to adequate resources to meet appropriate dietary needs
3. **Food stability** – where access to adequate food is permanently secure, with no risk of shocks
4. **Food utilization** – the consumption of food with adequate sanitation, the food people can find is adequate to local culture and tradition.

**WHAT IS FOOD SOVEREIGNTY?**

Food Sovereignty is the right of people, communities, and countries to define their own agricultural, labour, fishing, food and land policies which are ecologically, socially, economically and culturally appropriate to their unique circumstances. It includes the true right to food and to produce food, which means that all people have the right to safe, nutritious, and culturally appropriate food and to food-producing resources and the ability to sustain themselves and their societies. Food Sovereignty means the primacy of the people’s and community’s rights to food and food production, over trade concerns.

**WHAT IS THE SITUATION IN TERMS OF FOOD SOVEREIGNTY AND FOOD SECURITY IN PALESTINE?**

A state or household can be classified into different levels of food security based on the degree to which they meet both of these definitions. For the occupied Palestinian territories (oPt), the World Food Program (WFP), and the Food and Agriculture Organization (FAO) divide Palestinian families into categories with respect to food security:

- **Food Secure**: Households with income and consumption above USD 6.2 / adult equivalent / day
- **Marginally Secure**: Households with either income or consumption (not both) above

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USD 6.2 /adult equivalent / day

- Vulnerable to Food Insecure: Households with both income and consumption below USD 6.2 / adult equivalent / day
- Food Insecure: Households with income and consumption below USD 5.1 / adult equivalent / day

Coping mechanisms adopted by individuals and households to alleviate their food insecurity can damage the long-term environmental sustainability of oPt. For example, if farmers lack the water necessary to supply their fields, their lands will produce lower yields. This leads to lower income, which decreases their ability to replant fields. Any fields that lie unused due to insufficient water or funds will suffer from decreased soil quality.

This process is intensified if farmers do not use proper crop rotation methods to maintain soil fertility, or if they overharvest their crops. This vicious cycle means increased soil degradation and soil erosion, which can damage the long-term environmental and agricultural sustainability of the land.

The absence of food sovereignty creates economic and social conditions that result in food insecurity. The main driver of Palestinian food insecurity is of a political nature, as key elements of vulnerability are rooted in the military and administrative measure imposed by the Israeli occupation - closure regime, permits, destruction of assets - as well as Israeli settlement expansion and derived infrastructure multiplication access to land and water, bypass roads, etc. From an economic perspective, the Oslo Accords and the Paris Protocol on Economic Relations (PER) of the early nineties locked in the adverse path of dependency of the Palestinian economy upon Israel. Palestinian trade, finance and monetary policy suffer from the provisions and benefit the Israeli economy. Agriculture is one of the sectors suffering the most in this framework.

Moreover, the basic laws of the PNA (Palestinian National Authority) function as a base to develop an economic model that adopts the strategy of free market and neoliberal economic policies regardless of the impact on income, the welfare system or protection of local economies.

Under these economic premises, the lack of food security is directly affected by the lack of food sovereignty.
WHAT ARE THE MAIN OBSTACLES FACED BY THE PALESTINIAN LOCAL FOOD PRODUCTION?

1. Obstacles related to natural resources:
   - Agricultural land in Palestine is limited and most of it depends on rain, as irrigated agricultural land constitutes only 7% of the total.\(^3\)
   - Water resources are limited and the quality is low. This is mainly due to unfair pumping and climate change.
   - Soil fertility is declining in Palestine, as a result of heavy dependence on fertilizers and consequential erosion.
   - Urban areas are expanding at the expense of agricultural land.

2. Technical problems:
   - Research on food and the agricultural sector is weak due to poor infrastructure and funding.
   - Production and storage steps in the food supply chain are weak.
   - The weakness of agricultural and industrial production activities.
   - Absence of good quality local seed banks and low productivity of livestock breeds.

LAND AND RESOURCES IN PALESTINE

Israel’s policies of land and resource confiscation are one of the major obstacles to Palestinian food security. These confiscations and restrictions have greatly reduced the ability of Palestinian people to effectively farm their land. Although 62.9% of all arable land is located in Area C,\(^4\) there is a greater rate of food insecurity in Area C than in the rest of the West Bank.\(^5\) Moreover, as the Jordan Valley is considered the “breadbasket” of the oPt and is primarily Area C, these policies of land confiscation and restriction prevent Palestinians from establishing agricultural policies that could significantly reduce food insecurity.\(^6\) It is estimated that if these policies and restrictions were removed, an additional 50,000 dunums (approx. 5,000 hectares) of the Jordan Valley could be cultivated. This would add 1 billion USD per year to the GDP (Gross Domestic Product) of the oPt, representing a potential 9% increase.\(^7\).
AGROECOLOGY: GIVING PALESTINIAN AGRICULTURE A SUSTAINABLE PERSPECTIVE

WHAT IS AGROECOLOGY?

“Agroecology is the integrative study of the ecology of the entire food system, encompassing ecological, economic and social dimensions.”

It is an important approach to move towards more sustainable food systems, whose practices, research and policies have seen exponential growth worldwide in the last decade.

Agroecology can be defined as a cultural and political movement, as a scientific discipline and as a set, extraordinarily variegated, of practical agricultural techniques.

WHY AGROECOLOGY IS NEEDED?

The global food system is at a crossroads. As the new Sustainable Development Goals show, agriculture is a key in ending hunger and malnutrition in a socially, economically and environmentally sustainable way. This will include a shift from the sole focus on increasing production; today’s challenges – including climate change - demand a new, holistic approach.

Agroecology (agricultural ecology) represents a promising option, capable of providing ‘win-win’ solutions by enhancing food security and nutrition, restoring and maintaining health ecosystems, delivering sustainable livelihoods to smallholders and building resilience to adapt to climate change (and other kinds of pressures). Agroecology does not offer one-size fits all solution to whatever circumstances, but rather offers principles and processes that need to be locally adapted.

So, today, Agroecology is useful in two ways for Palestine: Palestinian agriculture needs tools in order to resist the Israeli occupation and to draw a new paradigm of agriculture which can provide new solutions in the global crisis framework, threatened by a growing population and climate change related issues.

HOW DOES AGROECOLOGY WORK?

The idea of Agroecology is to go beyond the use of alternative practices and to develop agroecosystems with the minimal dependence on high agrochemical and energy inputs, emphasizing complex agricultural systems in which ecological interactions and synergisms between biological components provide the mechanisms for the systems to sponsor their own soil fertility, productivity and crop protection.

Agroecology has therefore emerged as the discipline that provides the basic ecological principles for studying, designing and managing agroecosystems that are both productive and natural resource conserving, and that are also culturally sensitive, socially just
and economically viable\textsuperscript{11}. Instead of focusing on one particular component of the agroecosystem, Agroecology emphasizes the interrelatedness of all agroecosystem components and the complex dynamics of ecological processes\textsuperscript{12}.

The design of such agro-systems is based on the application of the following ecological principles\textsuperscript{13}:

- Enhancing the recycling of biomass and optimizing nutrient availability and balancing nutrient flow.
- Securing favourable soil conditions for plant growth, particularly by managing organic matter and enhancing soil biotic activity.
- Minimizing losses due to flows of solar radiation, air and water by way of microclimate management, water harvesting and soil management through increased soil cover.
- Species and genetic diversification of the agroecosystem in time and space.
- Enhancing beneficial biological interactions and synergisms among agro-biodiversity components thus resulting in the promotion of key ecological processes and services.

In order to implement these principles, Agroecology provides a wide set of agricultural practices including permaculture, agro-forestry, organic farming, biodynamic farming, ecological farming, organic manure, green manure, intercropping, biological pest control, and so on.

According to the principles and to this wide definition, it is important to narrow the concept and put into practice the Agroecological approach in order to propose solutions to both urban and rural agriculture.

\textbf{FOCUS ON AGROECOLOGY IN RURAL AREAS}

Rural agriculture will always be the backbone of the global food system and the same thing can be said concerning Palestine, where the use of land assumes special value in the slow and constant shadow of the Israeli land grab. Improved land use and productivity is one of the keys to augment the income of Palestinian farmers. Farm productivity and efficiency, from a point of view of economic sustainability, could be seen (and it is seen like that in conventional agriculture) as the mere results of more or less performing “machines” (the farms) in the shadow of an a-temporal and unethical production system. The agroecological approach grants the possibility of overcoming this limited definition of sustainability and makes it possible to propose several agroecological techniques which are able to boost the farmers’ productivity by improving at the same time their ecological and social sustainability.
Applying Agroecology: Some Agroecological Techniques

Achieving Palestinian Food Security and Sovereignty are consequent steps of complete empowerment for the Palestinians. A specific strategy has to be found in order to tackle the specific local constraints and to deal with the larger global food system crisis.

Agroecology represents a holistic approach and comprehensive framework to tackle food insecurity. In the following paragraphs five different agroecological techniques will be presented:

- Simplified Hydroponics
- Water Management Systems
- Fertilization Management Systems
- Cropping Systems: Intercropping
- Mixed cropping

Each technique will be introduced both at the theoretical level and the practical level. Special focus will be given to some concrete uses which are beneficial in the local context, providing similar practices which have been implemented in the Palestinian context in the framework of the PAL PASS project.
Simplified Hydroponics

The first documented experiences of soilless cultivation date back about three thousand years ago: the Babylonian hanging gardens, the floating islands of lake Titicaca in the Andes, or the Burmese Inle Lake in South-East Asia. During the twentieth century, the technology associated with soilless cultivation grew dramatically, putting the basis for the diffusion of High Technology Soilless Culture (HTSC) in intensive farming systems for the great advantages offered to growers. The main advantages of soilless cultivation are independence from fertile soils, reduced water requirements and high productivity, but all these benefits of HTSC depend on highly technological systems. So, in poorer contexts, another nuance of hydroponics has emerged: Simplified Soilless Culture (SSC, also referred to as Simplified Hydroponics, SH). It presents quite the same advantages of HTSC but also several other benefits, such as being easy to build and manage, requiring little labor, presenting lower incidence of soil-borne diseases, making use of low-cost/recycled materials to build growing containers, enabling growers to obtain higher yield and intensified productivity and shortening the chain between harvest and consumption, with reduced product depletion. Consistently, SSC is spreading in urban areas to find solutions to low fertility of the soils, low irrigation water availability, small extension cultivated lands and environmental pollution. However, it is necessary to keep in mind that soilless systems have to be designed and adapted specifically according to the requirements of targeted sites.
HOW TO BUILD A MICROGARDEN

**Vertical Bottles System**

**Tools & Materials**

**Box System**

1. **Soil**
2. **Permeable Polyethylene Plastic**
3. **Box with Holes**
FOCUS: PAL PASS PRACTICES IN SIMPLIFIED HYDROPONICS

Farming is not easy, wherever it is done. All farmers face problems of some sort: weather, pests, financing, access to water, land and seeds. In addition we can say that the problems faced by urban farmers are often greater than those faced by rural farmers. For example, access to land is more difficult and water costs are greater in urban areas. With special focus on water and land (space) access, cost and use efficiency and keeping in mind all the principles of Agroecology, the PAL PASS project has identified in Simplified Hydroponics (explained below) a useful technique in order to minimize water flows and to integrate agriculture to a specific urban environment. Simplified Hydroponics uses everything residual inside the city:

- People’s residual time: usually urban agriculture practitioners are people with a main job who use their spare time to grow plants at home or in community gardens;
- Residual space: house exteriors and surroundings are often under-used. Roofs and walls can be put into production with soilless cultivation techniques;
- Residual material: growth mediums and containers can be obtained by looking for common urban waste such as plastic containers, sand, kitchen organic waste and so on.

Moving from this basis, the PAL PASS project proposes Simplified Hydroponics as a battering ram to face critical urban issues such as poverty and hunger by integrating soilless farming and human settlements. In particular, the PAL PASS project has adapted the microgardens technique and realized 20 microgardens in the villages of Artas, Marah Mualla and Zatara in the Bethlehem governorate.
**WATER MANAGEMENT**

As water scarcity is one of the main constraints in Palestinian agriculture and taking into consideration that oPt have real access to only one quarter of the total amount of accessible water due to Israeli occupation, on-farm Water Management (WM) is a key issue to be analysed and improved. Several methods can be used in order to improve the WM inside the farm borders, by simply relying on self-available water resources and by improving the efficiency of the local water resource utilization through improving water smart soil designs.

In fact, we always have to consider that more than half the precious rainwater is usually lost through evaporation or because it runs off.

Agroecology helps to conserve water and to use it efficiently in at least six ways:

- **More water in the soil**
  Crop residue or a cover crop protects the soil, prevents crusting on the surface and slows runoff. Roots, earthworms and other soil life maintain cracks and pores in the soil. Less water runs off, and more sinks into the soil. Ripped furrows and planting basins collect and store water.

- **Water concentrates in planting lines or pits**
  Rainwater collects in ripped planting lines or planting basins, where it sinks into the soil – just where the crop needs it.

- **Less evaporation**
  Reduced or no tillage means the soil is not turned and does not dry out. The cover protects the soil from wind and direct sun (you can often feel the temperature difference with your hand). Because there is no hardpan, water can sink deeper into the soil.

- **High efficiency irrigation system**
  Using the best available techniques for irrigation helps reducing water losses and enhances irrigation water efficiency.

- **Better use of season’s rainfall**
  Ripping (not tilling) during the dry season allows farmers to plant earlier – right at the start of the rains.

- **Roots can reach more water**
  Breaking the hardpan with a ripper (not a tiller) allows roots to reach water deeper in the soil.
FOCUS: PAL PASS PRACTICES IN WATER MANAGEMENT

Between these general methods of improving water availability for the farm and for plants, the PAL PASS project focused on methods a, b, c and d by:

- providing extension service on designing and implementing Swales and Biorolls;
- providing new micro-irrigation systems.

DIGGING WORKS (BIOROLLS)

Bio-rolls are made of several tree branches and other organic matter, sewed together and placed in the ground following the contour plan of key-lines (or level contours). The bio-rolls can be made of whatever is available locally. Their function is to deviate run-off water from its course, while reducing its speed and strength, in order to absorb and keep moisture, to create a network of life-linkages all over the field and finally to improve soil biodiversity.

SWALES
A swale is a low tract of land, especially one that is moist or marshy. Swales as used in permaculture are designed to slow and capture runoff by spreading it horizontally across the landscape (along an elevation contour line), facilitating runoff infiltration into the soil. This type of swale is created by digging a ditch on contour and piling the dirt on the downhill side of the ditch to create a beam. In arid climates, vegetation (existing or planted) along the swale can benefit from the concentration of runoff. Trees and shrubs along the swale can provide shade which decreases water evaporation, however they increase transpiration, so their net effect on the hydrologic cycle is probably to reduce infiltration.

**MICROIRRIGATION SYSTEMS**

In drip irrigation, water is applied to each plant separately in small, frequent, precise quantities through dripper emitters. It is the most advanced irrigation method with the highest application efficiency. The water is delivered continuously in drops at the same point and moves into the soil and wets the root zone vertically by gravity and laterally by capillary action. The planted area is only partially wetted. In medium-heavy soils of good structure, the lateral movement of the water beneath the surface is greater than in sandy soils.

The PAL PPASS project provided DRIP TAPES to three pilot farms.
OTHER BEST PRACTICES IN WATER MANAGEMENT

RAINWATER HARVESTING

Rainwater harvesting dates from ancient times, beginning in the Middle East more than 4000 years ago, in countries and regions such as Jordan, Mesopotamia and Palestine; these methods were further developed in Asia and America. Rain provides water at no cost for various uses, including irrigation.

There are four main components to rooftop rainwater harvesting systems: 1) a rooftop – the catchment area; 2) a gutter downspout – to divert the water to storage; 3) rain barrels or cisterns – to store the water; 4) a distribution method – to redirect water from storage to the landscape.

In order to reduce energy use, it is important to observe the landscape to install a rainwater catchment system that takes advantage of the landscape’s slope and gravity.

TERRACING

Palestinians know this technique very well but nowadays this type of landscape is under threat due to the abandonment of lands.

Terracing is a large scale, simple application of rain catchment which is useful on medium/steep slopes. Walls are built along the contours of the slope by using stones and rock fragments. Their horizontal sections are filled with soil collected from the slope between the terraces.

This method transforms slopes into a series of horizontal terraces that can be easily cropped and, at the same time, serve as a water catchment and infiltration areas.
WATER RETENTION

High soil organic matter enhances its productivity and permeability, resulting in increased water infiltration and retention. We already described several landscaping techniques and topographical features that improve water infiltration and retention: such as swales. Here we describe some other relevant and easy-to-implement solutions. These techniques help diminish the amount of runoff and improve soil conditions. \(^\text{19}\)

SHEET MULCHING

Soil health and fertility are key for high crop yield. Sheet mulching, an on-site composting technique used to amend soil and increase water retention, improves soil structure by enhancing nutrient recycling. The technique involves composting organic materials rich in nitrogen and carbon that establish beneficial nutrient cycling and microorganism habitats within the soil (Elevitch & Wilkinson 1998). Sheet mulching is accomplished by creating a landscape “lasagna;” the layers are made up of cardboard, compost, and mulch (Figure 6) (Kaplan & Blume 2011 p. 62).

HALF-MOON MICROCATCHMENTS

Half-moon micro-catchments are small, semicircular earth bunds. They are quite common on the desert margins of the Sahel, where they are called “demilunes”. The half-moons catch water flowing down a slope. Crops such as sorghum, millet and cowpeas can be planted in the lower portion of the half-moons, using conservation agriculture techniques. Half-moons are helpful to rehabilitate degraded land. \(^\text{20}\)
Composting is a biological process that occurs under aerobic conditions (presence of oxygen). With adequate moisture and temperature, a hygienic transformation of organic wastes into a homogeneous and nutrient rich material takes place. Composting can be interpreted as the sum of complex metabolic processes performed by different microorganisms that, in the presence of oxygen, use the nitrogen (N) and carbon (C) available to produce their own biomass. In this process, additionally, the microorganisms generate heat and a solid substrate, with less carbon and nitrogen, but more stable, which is called compost. Upon decomposition of C, N and all initial organic matter, microorganisms release measurable heat through temperature variations over time. Depending on the temperature generated during the process, three main phases are identified in composting, besides a phase of maturation of variable duration.

Three stages must take place if we claim to be producing compost.

The different phases of composting are divided according to temperature in:

1. **Mesophilic phase.** The composting process starts at ambient temperatures and in a few days (or even hours), the temperature rises to 45°C. This phase lasts a few days (two to fifteen days) in the Palestinian climate.

2. **Thermophilic and Hygienization phase.** This phase can last from days to months, depending on the parent material, climatic and site conditions, and other factors. This phase is also called hygienization phase since the heat generated (above 60°C for at least 10 days) destroys bacteria and contaminants of faecal origin such as Escherichia coli and Salmonella spp. Similarly, this phase is important as temperatures above 55°C eliminate the helminth’s cysts and eggs, spores of phytopathogen fungi and weed seeds that can be found in the parent material, giving rise to a hygienic product.

3. **Cooling phase (or Mesophilic phase II).** Once the carbon and nitrogen sources in the composting material are exhausted, the temperature drops again to about 40-45°C. This cooling phase requires several weeks and may be confused with the maturation phase, which follows and can last for several months.

In the Palestinian climate, the whole process can be undertaken, if properly supervised, in 3-6 months (summertime-wintertime).
PAL PASS PRACTICES INFERTILIZATION MANAGEMENT

As to fertilizers and fertilization management in Palestine, we clearly see that farmers have two possible solutions: on the one hand they can follow the mainstream model of intensive agriculture, getting hit by unethical import restrictions and definitely polluting Palestinian soil or, on the other hand, they can shift to organic, and in doing so realize “soil fertility sovereignty”. Mankind has not always needed chemicals in order to produce food. Mineral fertilization started in about 1880, became common practice in the 1920s and was adopted on a larger scale only in 1950. Since the “cradle”, mineral fertilizers seemed to be the final answer to hunger but the events of the last 2-3 decades have proven that hunger is not a problem to be solved with higher productivity. Hunger is to be solved by alternative production/distribution food systems. According to this new vision and focusing on production, the “inevitability” of mineral fertilizers underwent a critical review and “old” natural methodologies for conserving, enhancing or regenerating soil fertility were reconsidered.

In the very last decade the impossibility to further enhance productivity via the mineral fertilization technique appeared clear and nowadays international organizations, and more and more local farmers associations, are trying to define new methodologies to fertilize crops without impacting the environment.

One of the most popular and diffuse techniques is composting.

The PAL PASS project granted three pilot farms advisory service related to:

• The choice of a consistent site on (or off, for Al Khader farm) the farm, following the needs for a comfortable, wide, accessible place where they could stock and manage the organic matter devoted to composting.

• The construction of needed shading and watering infrastructure.

• Support in planning the consistent supply of organic matter to be composted, on a yearly basis, in order to meet the farm needs (or at least the target experimental field needs).

• Extension service was provided on two main composting methods:
**Turned Windrows Method**

Windrow composting is suitable for big quantities. It consists of placing the mixture of raw materials in long narrow piles or windrows which are turned on a regular basis. The turning operation mixes the composting materials and enhances *passive aeration*. Typically the windrows are initially from 0.9 meter high for dense materials like manures to 3.6 meters high for fluffy materials like leaves.

The width varies from 3 to 6 meters. The equipment used for turning determines the size, shape, and spacing of the windrows. Plastic cover sheets can be used to reduce evaporation but anaerobic conditions can slow the process and produce lower quality final compost. For this reason, a cover made of straw is recommended.

**The Pit Method**

Generally, composting is carried out in a corner of a field and in a circular or rectangular pit. Straw, animal dung, green manure crops are used. The pits are filled layer by layer, each layer being 15 cm thick. Usually, the first layer is of a green manure crop, the second layer is a straw mixture and the third layer is of animal dung. These layers are alternated until the pit is full, when a top layer of mud is added; anaerobic conditions slow the process but at the same time help to reduce losses of nitrogen.

Approximate ratio of the different residues per pit are: dry straw 1, animal manure 1,5, green manure 1,5. Three turnings are given in all, the first one month after filling the pit. Water is added as necessary. The second turning is done after another month and the third two weeks later. The material is allowed to decompose for three months. The minimum quantity of organic matter per pit, in order to steadily start the composting process, is 1 cubic meter.
WHAT DO YOU NEED TO PRODUCE YOUR OWN COMPOST?
• A clear idea of the quantity of compost you need, every year.
• A clear idea of the N-rich and C-rich organic matter to be mixed (ratio 3:1).
• A sound site where to start, according to the space you need to produce the quantity you need.
• A clear organic waste harvest plan to meet needs.
• Consistent machinery or manual tools to manage the organic matter.
• (not mandatory) pH-meter and hygrometer.
• A near-by water point.
• A shading/rain protection structure.
• Patience (3-6 months) and careful attention.
Sustainable intensification of the farming system in Palestine is an important tool for fostering overall productivity, improving food security and the resilience of Palestinian farmers. Some kind of intercropping is typical of traditional agriculture worldwide. In Palestine the most common traditional intercropping pattern is the one related to olive trees with grape and vegetables, during the first years of tree growth. Intercropping (IC) enables diversified production and reduces the need for chemicals in plant nutrition and defence. Intercropping is the agricultural practice of growing multiple crops in the same field at the same time. Intercropping is sometimes complemented with double cropping and transforms itself into crop rotation, wherein a farmer may alternate cropping of different crops over time. Both practices can improve overall nutrient and light utilization of the system and increase pest control for crops (due to dilution effects of species-specific pathogens). In fact, when one grows diversified fields, either vegetable gardens or open field crops, a new agro-ecosystem has been designed full of small and segmented micro-zones with different microclimatic and soil features. This diversity grants the possibility to host a full range of beneficial insects, bacteria and fungi that will compete or actively fight against crop pests. Benefits come also at soil level, where the constant presence of active root nets smoothly span the soil, improving structure and other soil physical and chemical features. IC can be practiced at several degrees of complexity by applying different schemes of planting. Each planting scheme can be obtained by the use of specific machinery but it is also feasible by hand, depending on the cropping areas.

**MONOCROPPING (“the worst thing you can do”)**

Example in open field: planting wheat, or tomatoes, year after year in the same field.

Example in house gardens: planting peppers, or potatoes, or garlic or whatever in big, separated monotone plots.

This is where the field is used to grow only one crop season after season.

This has several disadvantages: it is difficult to maintain cover on the soil; it encourages pests, diseases and weeds; and it can reduce soil fertility and damage the soil structure. So avoid monocropping if you can. It is much better to rotate crops, or use intercropping or strip cropping.
CROP ROTATION

Example in open fields or house gardens: planting wheat/tomatoes one year, and beans/lettuce the next.

This means changing the type of crops grown in the field each season or each year (or changing from crops to fallow). Crop rotation is a key principle of conservation agriculture because it improves the soil structure and fertility, and because it helps control weeds, pests and diseases, reducing the need of chemicals.

INTERCROPPING

Example in open field: planting alternating rows of maize and beans, or growing a cover crop in between the cereal rows.

Example in house gardens: planting tomato plants with a wider offset intercalating beans or onions/lettuce plants.

This means growing two or more crops in the same field at the same time. It is possible to do this in different ways: Broadcasting the seeds of both crops (mixed cropping), or dibbling the seeds without any row arrangement. It is easy to do but makes weeding, fertilization and harvesting difficult. Two similar good practices are: (1) planting the main crop in rows and then broadcasting the seeds of the intercrop (such as a cover crop); (2) planting both the main crop and the intercrop in rows. (This is called row intercropping) The rows make weeding and harvesting easier than with mixed intercropping. A possible problem is that the inter-crop may compete with the main crop for light, water and nutrients.
STRIP CROPPING

Example in open field: planting alternating strips of wheat, soybean and finger millet.

Example in house gardens: planting tomatoes multiple strips intercalated by beans or onions multiple strips.

This involves planting broad strips of several crops in the field. Each strip is 3–9 m wide.

On slopes, the strips can be laid out along the contour to prevent erosion. The next year, the farmer can rotate crops by planting each strip with a different crop. Strip cropping has many of the advantages of intercropping: it produces a variety of crops, the legume improves the soil fertility, and rotation helps reduce pest and weed problems. The residues from one strip can be used as soil cover for neighbouring strips. At the same time, strip cropping avoids some of the disadvantages of intercropping: managing the single crop within the strip is easy, and competition between the crops is reduced.
ADVANTAGES AND DISADVANTAGES OF INTERCROPPING

Advantage of Intercropping:

◊ Intercropping gives additional yield income/unit area than sole cropping.
◊ It acts as insurance against the failure of crops in an abnormal year.
◊ Inter-crops maintain soil fertility as the nutrient uptake is made from both layers of soil.
◊ Reduction in soil runoff and control of weeds.
◊ Intercrops provide shade and support to the other crop.
◊ Intercropping systems utilize resources efficiently and their productivity is increased (Reddy and Redid, 1992).
◊ Intercropping with cash crops is more profitable.
◊ It helps to avoid inter-crop competition and thus a higher number of crop plants are grown per unit of area.

Disadvantages of intercropping:

◊ Good management of IC systems need precise timing and detailed preparation. Therefore, it can be difficult task.
◊ Higher amounts of fertilizer or irrigation water cannot be utilized properly as the component crops vary in their response to these resources.
◊ Mechanization can be more difficult due to the eterogeneity of the filed (harvest, weeding, etc)". 
INTERCROPPING IN HOME GARDENS, WHY?

- **Vertical spacing.** When you intercrop your vegetables consider the vertical spacing available in your garden. Squash, beans, cucumbers, peas, melons and tomatoes can be grown on trellises.

- **Direct Sun.** During the main growing period, usually May through August the sun is at its brightest. Locate tall plants on the north side of the garden. The sun will heat the south part of the garden for heat loving plants. Shade-loving plants that can be intercropped with sun-loving plants include beans, beets, chard, leeks, lettuce, peas, radishes, and turnips.

- **Structure and foliage.** Intercropping also involves using plants with opposite structure and foliage. Plants that have large structures or leaves, such as corn and squash, can provide shelter and filtered sun for lower, larger leaved plants such as lettuce. Corn stalks also provide support for vegetable vines.

- **Timing.** If you time your plantings correctly, this will also help to inter-plant your vegetables. Lettuce can handle the light sun of spring and fall, but requires protection during the heat of summer. When lettuce receives too much heat they tend to bolt (go to seed). Also keep in mind the length of time it takes a vegetable species to mature; radishes for example are super-fast maturing, while peppers may take the entire summer. Try to intercrop slow growing vegetables with fast growing vegetables.

- **Inserted vegetables.** Many narrow leafed plants such as onions, leeks, shallots, and garlic can easily fit between many leafy vegetables. But, consider the plant’s feeding requirements. Plants placed close together will compete for nutrients in the root zone. Select plants that have different feeding requirements and different root development structure.

FOCUS: PAL PASS PRACTICES IN INTERCROPPING

The PAL PASS project provided extension services to three pilot farms in order to improve their intercropping system. In fact intercropping is not a new technique in Palestine. Several farms already implement a simple intercropping pattern or crop rotation. The goal was to augment the biodiversity and to introduce new intercropping schemes. PAL PASS focused on 9 crops to be intercropped in the three pilot farms.

On pilot farm 1 in Wadi Fukin, the farmer grew almonds and grapes in intercropping with species from the Fabaceae family (such as chickpeas, favabean and peas). The project proposed that he enhance the situation with the introduction of vegetables strips at the centre of the existing intercropping scheme (Almond and Grape with beans in winter, with favabean, sweet/hot pepper and eggplants in summer).

On Pilot farm 2 in Al-Khader, a new planted grape yard was used to experiment with the intercropping of vegetables lines (such as cabbage in winter; cucumber, squash and tomatoes in summer).
On Pilot farm 3 in Frush Beit Dajan, a date palms yard was used to intercrop palms with vegetables (such as Zaatar, cauliflower, cabbage in winter time and Sweet pepper, hot pepper, eggplant in summer time).

Year by year, as the farmers get used to composite intercropping, several new species, trees or shrubs can be planted increasing functional biodiversity.

**GOOD COMPANIONS**

<table>
<thead>
<tr>
<th>Plant</th>
<th>Companions</th>
<th>Incompatible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>Tomato, Parsley, Basil</td>
<td>N/A</td>
</tr>
<tr>
<td>Carrots</td>
<td>Peas, Lettuce, Onion, Sage, Tomato</td>
<td>Dill</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Carrot, Radish, Strawberry, Cucumber</td>
<td>N/A</td>
</tr>
<tr>
<td>Peas</td>
<td>Carrots, Radish, Turnip, Cucumber, Beans</td>
<td>Onions, Potato</td>
</tr>
<tr>
<td>Spinach</td>
<td>Strawberry, Fava Bean</td>
<td>N/A</td>
</tr>
<tr>
<td>Beans</td>
<td>Most Herbs &amp; Vegetables</td>
<td>Onion</td>
</tr>
<tr>
<td>Celery</td>
<td>Nasturtium, Onion, Cabbage, Tomato</td>
<td>N/A</td>
</tr>
<tr>
<td>Onion</td>
<td>Beets, Carrot, Lettuce, Cabbage</td>
<td>Beans, Peas</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Aromatic Herbs, Celery, Beets, Onion Family,</td>
<td>Strawberries, Tomato, Dill</td>
</tr>
<tr>
<td>Cucumber</td>
<td>Beans, Peas, Sunflower, Radish</td>
<td>Aromatic herbs, Potato, Chamomile, Spinach, Chard</td>
</tr>
<tr>
<td>Parsley</td>
<td>Tomato, Asparagus</td>
<td>N/A</td>
</tr>
<tr>
<td>Potato</td>
<td>Beans, Cabbage, Horseradish, Marigolds</td>
<td>Sunflower, Cucumber, Tomato</td>
</tr>
<tr>
<td>Radish</td>
<td>Peas, Nasturtium, Lettuce, Cucumber</td>
<td>Hyssop</td>
</tr>
<tr>
<td>Tomato</td>
<td>Onion, Marigold, Asparagus, Carrot, Parsley, Cucumber, Basil</td>
<td>Cabbage, Fennel, Potato</td>
</tr>
<tr>
<td>Turnip</td>
<td>Pea</td>
<td>Potato</td>
</tr>
</tbody>
</table>
Mixed Cropping

Evolutionary Populations and Self-Made Seeds

Agroecology helps farmers to improve productivity in a sustainable way. To optimize the application of agroecology principles, farmers need seeds selected for low input agricultural systems, able to respond to climate change. Both the food and agricultural systems today are ill-suited to cope with the impact of climate change, because of the great uniformity that characterizes them. In fact, despite scientific journals often reminding us that biodiversity is essential for life on this planet, biodiversity in general and in particular agro-biodiversity is facing a constant decline. Cultivating evolutionary populations in mixed cropping systems is a strategy to allow our crops to evolve and adapt over time to any type or entity of climate change.

Mixtures: Seeds Able to Evolve

Evolutionary populations start from a mixture of old and traditional varieties (also called farmers’ varieties). What is a mixture? It is a mix of different varieties of the same specie (hard wheat, soft wheat, barley, tomatoes, etc.) tilled in the same field, with plants close to each other.

The use of traditional varieties has largely disappeared in countries with industrialized agricultural systems and formal seeds markets, but some farmers have not stopped cultivating varieties with specific cultural significance. Furthermore, gene banks preserve different type of plants. Together with the conservation in gene banks, diversity should also be preserved in its original locations, where flora populations can continue to evolve.

The old varieties are not genetically uniform, but consist of many plants that appear quite similar, but which in reality are not similar from a genetic point of view. The mixtures are even much more complex than the old varieties, due to the great diversity of types that they contain. In nature it always happens at the crossroads between plants of the same species (in some species more and in some less). The seeds collected will never be the same as that was sown; in a nutshell, evolutionary populations will evolve.

Mixtures will evolve in the direction of better adaptation to the specific conditions of climate, soil, agronomic techniques (organic or biodynamic agriculture): this evolution simply happens because some plants, in a given year, might feel more comfortable than others and so will produce more seeds.

If a year is particularly dry, more drought-resistant plants will develop. If the following year is going to be more humid, plants derived from those which in the previous year had generated few seeds, will produce even more. The evolutionary population moves on, adapting and ensuring the harvest. Diversity and heterogeneity serve to disperse or buffer the risk of total crop failure due to unpredictable environmental variations.

In modern varieties, it is the opposite. Genetically uniform varieties, developed by
standard pedigree breeding methods, dominate commercial production due, in large part, to their high yields, wide geographic adaptability and high technological performance, at the expense of nutritional values. However, they typically do not perform well in marginal environments or without the external inputs for which they were selected. Because of their genetic uniformity, they have lost the ability to adapt. Serving the needs of producers in marginal environments, where farm conditions and practices minimize chemical inputs, has become a critical challenge to plant breeders.

The evolutionary populations can be considered a gene bank in the hands of the peasants, allowing farmers to regain control of seeds without any external support.

**WHY MIX OLD VARIETIES SEEDS?**

Mixtures help organic and low input farming in different ways:

- **Resilience**

  The diversity of mixtures in the field is an element of resilience. Resilience is defined as the capacity of an ecosystem to respond to a perturbation by resisting damage and recovering quickly. A resilient system will reorganize itself, while undergoing change so as to still retain essentially the same function, structure, identity and feedback. Thus resilience is linked to the adaptive capacity of a system in the face of change.

- **Robustness**

  Robustness is the ability of plants to maintain performance when facing perturbations and uncertainty: robust plants will have a high level of resistance and tolerance to pests and disease, improved crop establishment under increased variable weather conditions, more effective and efficient use of nutrients and water. Robust plants are one of the required components for organic and low input agriculture. Mixed crops can be a tool to provide robustness through genetic diversity. Genetic diversity allows evolution and adaptation of crops across time and systems, which leads to stability of performance.

- **Specific adaptation**

  Specific adaptation and mixed crops are closely related. In addition to diversity in space, farmers also contributed to diversity in time because the varieties produced by their selection were not genetically uniform and therefore continued to evolve, becoming increasingly better at adapting to the specific area of cultivation. Populations evolve over time and space through selection by natural factors and farmers practices, genetic process and seed exchange between farmers.
FOCUS: PAL PASS PRACTICES IN MIX CROPPING

Within the PAL PASS project, two farmers’ varieties of hard wheat were mixed and this mixture was tested in the two different areas of Bani Naim (Hebron) and Tyasser (Nablus), using an organic method. The crop resilience, crop robustness and the yield were evaluated. This is only a starting point. Farmers can enrich the mixture with other farms’ varieties and year after year create a landrace specific for their clime, their soil, their way of cultivation. Year after year, they can use their own seeds, becoming independent from seeds companies.

Let’s look for farmers varieties, mix them together and bring back seeds, and finally breed, into farmers’ hands.

BETHLEHEM SEEDS BANK

In 2013, the Bethlehem Farmers Association established a seed bank for producing, improving and distributing organic local seeds. This step is important for Palestinian farmers as well as for agroecology. Establishing a seed bank enabled farmers to count on local resources for production. Moreover, it will preserve local and traditional products and prevent them from disappearing. Without the seed bank, all these efforts will be useless. The Bethlehem seed bank is currently producing the following traditional seeds:

FAIR TRADE

Fair Trade is a global movement connecting producers and consumers all over the world. Over a million small-scale producers and workers are organized in as many as 3,000 grassroots organizations and their umbrella structures in over 70 countries. Their food products and handcraft are sold in thousands of shops run by fair trade organizations as well as in supermarkets and other sales points in Europe, US, Japan and, increasingly, in the developing economies. The educational, campaigning and advocacy activities of fair trade organizations has made institutions, mainstream business and the general public more aware of their social and environmental responsibility: “buying is voting”.

According to the World Fair Trade Organization (WFTO), fair trade is defined as a trading partnership, based on dialogue, transparency and respect, that seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions to, and securing the rights of, marginalized producers and workers – especially in the South.

The history of fair trade dates back to the post second World War era when Ten Thousand Villages and SERRV in the United States and Oxfam in the UK started importing needlework, crafts and cane sugar and running the first Fair Trade shops in the late sixties. During the seventies and the eighties, Non-Governmental Organizations (NGOs) and socially motivated individuals in many countries in Asia, Africa and Latin America perceived the need for fair marketing organizations, which would provide advice, assistance and support to disadvantaged producers. Many Southern Fair Trade Organizations were established, and links were made with similar organizations being created in the North. International trade relationships were based on partnership, dialogue, transparency and respect. The goal was greater equity: “trade, not aid” was the motto.
**PRINCIPLES**

**Principle One: Creating Opportunities for Economically Disadvantaged Producers**

The organization should support marginalized small producers, whether these are independent family businesses, or grouped in associations or co-operatives. It seeks to enable them to move from income insecurity and poverty to economic self-sufficiency and ownership.

**Principle Two: Transparencies and Accountability**

The organization is transparent in its management and commercial relations. The organization finds appropriate, participatory ways to involve employees, members and producers in its decision-making processes. The communication channels are good and open at all levels of the supply chain.

**Principle Three: Fair Trading Practices**

The organization trades with concern for the social, economic and environmental well-being of marginalized small producers and does not maximize profit at their expense. Suppliers respect contracts and deliver products on time and to the desired quality and specifications.

**Principle Four: Payment of a Fair Price**

A fair price is one that has been mutually agreed by all through dialogue and participation, which provides fair pay to the producers and can also be sustained by the market. Where Fair Trade pricing structures exist, these are used as a minimum.

**Principle Five: Ensuring no Child Labour and Forced Labour**

The organization adheres to the UN Convention on the Rights of the Child.
Principle Six: Commitment to Non Discrimination, Gender Equity and Women’s Economic Empowerment, and Freedom of Association

The organization does not discriminate in hiring, remuneration, access to training, promotion, termination or retirement based on race, caste, national origin, religion, disability, gender, sexual orientation, union membership, political affiliation, HIV/AIDS status or age.

Principle Seven: Ensuring Good Working Conditions

The organization complies, at a minimum, with national and local laws and ILO conventions on health and safety.

Principle Eight: Providing Capacity Building

The organization develops the skills and capabilities of its own employees or members.

Principle Nine: Promoting Fair Trade

The organization raises awareness of the aim of Fair Trade and it advocates for the objectives and activities of Fair Trade.

Principle Ten: Respect for the Environment

Organizations which produce Fair Trade products maximize the use of raw materials from sustainably managed sources in their ranges, buying locally when possible. They use production technologies that seek to reduce energy consumption and use renewable energy technologies. They seek to minimize the impact of their waste stream. Fair Trade agricultural commodity producers minimize their environmental impacts, by using organic or low pesticide use production methods wherever possible.
FAIR TRADE IN PALESTINE

The Fair Trade movement in Palestine started as a spontaneous relief intervention during the first Intifada (1987-1993), at a time when Israeli-imposed curfews, mass arrests, and widespread unemployment caused extreme economic hardship for many Palestinians. During that period, the Palestinian Agricultural Relief Committees (PARC) and United Agricultural Work Committee (UAWC), among others, started to support and spread the concept of household economies, especially based on home gardens, and of rural productive cooperatives as means to avoid land confiscation and to enhance food security.

As the Intifada ended the focus shifted to sustainable development and therefore on selling. “Al Reef for Investment and Agricultural Marketing” and “Mount of Green Olives Company” were the marketing vehicles created to meet international quality, fair and organic standards by providing technical and logistical support to thousands of disadvantaged small-scale farmers and women in rural areas of Palestine. In the last fifteen years other fair trade actors linked to agricultural production grew, especially the Palestine Fair Trade Association (PFTA) and its Canaan Fair Trade (CFT), and Palestinian Farmers Union (PFU).

Among agricultural products, olive oil is by far the most important in terms of quantity, revenue and employment, although sales of maftoul, zahtar, almonds and dates have been increasing: some of these products are also certified by Fair Trade International. At the same time, traditional handicrafts (embroidery, olive wood, ceramics and glass) have also been marketed successfully through organizations such as the Arab Womens Union (AWU), Artas Folklore Center, Bethlehem Fair Trade Artisans (BFTA), Holy Land Cooperatives Society (HLCS), Palestine Heritage Center (PHC) and Sunbula. Some of these organizations belong to the World Fair Trade Organization (WFTO), which also certifies the fairness of non food products.

As Palestinian products are now available in Europe, the United States, Canada, Japan, New Zealand and the Gulf region, the attention in recent years has been shifting to supply chains with the aim of keeping some more added value locally and of developing the local fair, organic and social market. Although there have been some small entrepreneurial initiatives taking place, most of the work remains to be done in the fields of education and consumer awareness as well as in the organization of the local commercial networks.

In this sense, one action of the PAL PASS project concentrates specifically on the maftoul supply chain from wheat cultivation to final packaging, trying to add value to the final products by shifting to organic and by defining and implementing the whole packaging...
process locally according to international safety and quality standards. The first step is to work with wheat producers in Jenin in order to reach the organic certification of the grain, then the grinding process at the mill and the storage of the flour have to follow specific organic protocols. This will allow the farmers and the transformers to receive a higher price for the product in the market. After the maftoul is actually done, half kilo packs with final labels and design have to be filled and sealed using a vacuum packaging machine, which allows proper conservation in time. This will allow exporters to be awarded a better price internationally as the product will be delivered ready for the shelves, without farther work once imported. On the contrary, the previous process ended with the export of 20 kilo packs, leaving to the importers the work and the added value of the final packaging.

PALESTINIAN ACTORS

There are several actors in the Palestinian context working in the field of ethical production, but few of them are certified organizations and members of WFTO.

Al Reef for Investment and Agricultural Marketing Company is a private shareholder limited company owned 100% by the Palestinian Agricultural Relief Committee (PARC), which is a member of the WFTO, in an attempt to provide promotional, marketing, and manufacturing services for Palestinian agricultural products, which are also FLO certified. The company exports its products and those of the Palestinian Farmers Union (PFU) to numerous international organizations: www.alreeffairtrade.ps

The Palestinian Fair Trade Association (PFTA), located in Jenin, is an association of agricultural coop producers and processors, which created an exporter named Canaan. PFTA products are FLO certified: canaanfairtrade.com

The United Agricultural Work Committee (UAWC) is an agricultural organization, based in Ramallah, which controls an export company named Mount of Green Olives.

Bethlehem Fair Trade Artisans (BFTA) is one of the more active fair trade organizations of artisans in Palestine and a member of the WFTO: http://www.bethlehemfairtrade.org

Holy Land Cooperatives Society (HLCS) is a fair trade organization of artisans based in Bet Sahour.

INTERNATIONAL NETWORKS

Since the nineties, fair trade organizations have been putting a lot of effort in trying to define and structure their very complex global networks and interactions according to their mutual, common values and respecting their local, cultural and social differences. These ongoing efforts ended up in two main global organizations:

Fair Trade International is the fair trade labelling organization (FLO), specialized in certifying fair food products: www.fairtrade.net;

The World Fair Trade Organization (WFTO) is the organization of around 400 fair trade guaranteed organizations from more than 50 countries: http://wfto.com.
The PAL PASS project for fair and safe food in Palestine: in favour of Safe and Fair Food in Palestine is a project financed by the Milan Municipality, Lombardy Region and Cariplo Foundation.

The project is implemented by Chico Mendes together with several Palestinian partners such as Al Reef for Agricultural Marketing, Palestinian Agricultural Relief Committees (PARC), Palestinian Youth Union (PYU) and the Palestinian Ministry of Agriculture- Padriff and Italian partners such as Cooperazione per lo Sviluppo dei Paesi Emergenti. (COSPE), the Italian Association for Organic Agriculture (AIAB), the Agronomy Department of the Milan University and the Milan Municipality.

The beneficiaries include Palestinian families, farmers (women and men), students and cooperatives in addition to Palestinian citizens and agricultural engineers.

The overall objective is to increase security, quality and innovation of the supply chains of food production, in arid and semi urban areas in Palestine, enhancing biodiversity, local cultivation and food traditions combining them with modern agronomic techniques. The project aims at the following:

- Improvement of the level of food security of some marginalized families: by implementing 20 microgardens and 20 home gardens in the villages of Zatara, Marah Mualla and Artas in the Bethlehem governorate;

- Enhancement of productivity, energy efficiency and the quality of some fruit and vegetable supply chains: by improving three pilot farms’ production in Frush Beit Dajan in the Jericho governorate, Wadi Fuqin and Alkhader in the Bethlehem Governorate through the introduction of agroecological techniques; by realizing training and technical assistance on agroecological approaches and techniques in all the involved villages; by favouring organic production and biodiversity on two farms in Beni Neim
in the Hebron Governorate and Frush Beit Dajan in the Jericho Governorate.

- An increase in the export potential of a women’s cooperative in Jericho: by restructuring the maftoul (cous cous) production plant and introducing packaging machines for maftoul;

- An increase in the quality and safety standards of three food supply chains (maftoul, dates and almonds)

- Support of the institutional coordination, increasing the skills of functionaries from the Ministry of Agriculture - Padrif: by realizing an exchange program between the Municipality of Milan and the Ministry of Agriculture - Padrif, building the capacity of some Palestinian functionaries on Geographic Information System (GIS) technologies.

- Dissemination of the information related to food security, with particular attention to young people and those working in the agricultural sector, in Italy and Palestine: by realizing interactive awareness sessions on the topic of food security, fair trade, agroecology for young students in Palestine in several schools located mainly in the area of the Bethlehem governorate and the Milan Municipality; by promoting the topics of the project with the broadcasting of radio episodes realized by Radio 24 FM in Palestine (http://www.24fm.ps/) and Radio Popolare (http://www.radiopopolare.it/) in Italy; by participating in Italian events, especially in the framework of EXPO2015 in Milan.
REFERENCES


19. Ibid.

20. Ibid.

