The specific conditions of the area will influence on the production system, and specially, the cultivation of organic olive tree grove. The olive tree grove of Los Pedroches cannot be considered indeed as a monoculture because it includes also a large number of tree species (holm oak, cork oak, pine, gall oak,...) and of bushes species (rock rose, thyme, mastic tree, chaparreras...) located in intersperse areas of olive tree grove, on borderlines and in areas of steep slope. The result of all of these specific conditions is a different and an atypical landscape from the traditional olive grove of the countryside.

At the same time, this rich biodiversity of plant life provides for a rich variety of wildlife. This is of special interest not only in the quantity of mammals and birds found, but also is of maximum importance at the entomological level, since the quantity of useful or auxiliary insects will be essential to the cultivation practices developed.

The direct influence of this flora, as an aspect of soil management, will help us to fight against the worst problem found in this kind of olive groves: erosion.
Any production system, organic or not, should conserve and improve the agrosystem. In steep gradient conditions, the deterioration of the agrosystem is largely due to the strong erosion to which it is exposed. Practices of cultivation focus on using all means at our disposal to preserve and improve not only the soil, but also the entire agrosystem. We certainly focus on making the principle of ?Sustainability? or ?Sustainable development? the basic pillar of our production system.

**Sustainability or Sustainable development**, we will briefly explain the sustainability of management systems of natural resources as an overall picture and then, we will apply it to our particular case. There exist numerous definitions of sustainability; for example, the one given by the council of FAO in 1987 reads: ?Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations. This sustainable development (in the agricultural and forest sector) conserves land, water and vegetable and animal genetic resources, is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable? (quote by Ceña Delagado, 2001). Avoiding abstract definitions, a special mention should be made of the spatial component, in addition to the temporal component, which has
repercussions on the wealth created by the exploitation of the resource. Each region has a particular and unique set of agricultural systems that are the result of the local climate, topography, soil, economic and social relations and, finally, of its history. Due to this, it is difficult to find a concept of agricultural sustainability that can be applied satisfactorily at both a local and global level.

It is possible to consider it as a meeting point between Economics and Ecology, which tries to reach a model of development capable of establishing a balance between the system and uses of natural resources. At the same time, civil society becomes involved in the new demands of sustainability on the rural areas: foods healthy both in their composition and in their production and transformation processes, but which at the same time are friendly to the environment. This means many important changes in agriculture, recreational and leisure activities, landscape conservation and ecological balance. In short, an agriculture connected with the ecological system is demanded. To develop this production system, we will focus now on the management system in the countryside. It will focus both on quality of the raw material, where the olive fruit is from organic olive groves, and organic olive oil as the final product, considering other factors such as quality in the industry and commercial factors that are discussed in other areas of this website.

**Quality in the countryside**, as we have reiterated, the production system in the olive grove is focused on obtaining quality fruits, together with the conservation and improvement of the environment. The quality of the fruit will depend on the management of the olive grove, so we will explain how we manage the organic olive grove in Los Pedroches? conditions.

**Soil management**, as previously said, is of vital importance to fight against erosion and to improve fertilisation. The rich variety of both trees and bushes helps avoid soil loss. This flora interspersed in areas within the olive grove and at its borders encourages the retention of soil, preventing runoff. But it is right in the heart of the grove where these problems of erosion can appear. In this respect, the action of the weeds (a negative name for plants that can truly help!) that grow in the olive grove is essential. On a slope, these weeds slow the water flow and avoid substantial runoffs and corresponding loss of fertile soil. At the same time, they help the water penetrate through roots into the deeper layers of soil where the water is absorbed by the tree. They also soften the soil, and the soil-retaining effect of the roots prevents the loss of the topsoil layer, which is the most fertile. However, these weeds create a competition for water in the olive grove; for this reason it is important to reduce them (not to eliminate them)... but, when? In winter, from November onward, the olive tree is at rest during the harvest. In this season there is not any real competition and this is why we allow them to grow. During this period is when rains are abundant and erosion has a higher impact, for this reason the weeds are very beneficial for the soil. But from March onward is when the olive tree starts its vegetative growth and it needs as efficient a supply of water as possible. From
that time on there should be as little competition from the weeds as possible. This is the reason why in Los Pedroches we use a system of ?weed management? by livestock, especially sheep. Livestock is allowed into the olive grove after the harvest (January-February) and by means of grazing, weeds are eliminated, but not completely, because the idea is to keep a thin layer of short grass. Livestock may stay until April or at most May. During this period, weeds are diminished by a quantity of livestock appropriate for the conditions, and the competition for water is limited. The main problem involved in the introduction of livestock is the possible damage that it may cause to the olive tree. This damage is real, but it happens when the livestock does not have food on the ground, starting in April and May. For this reason, it is advisable to remove it to avoid these damages.

Weed management with equine livestock is also very interesting, because they consume a large quantity of grass, but these animals do not attack the olive tree. It is possible to maintain this kind of livestock year-round because weeds are not uprooted, so the beneficial effect of weeds lasts all year. The use of livestock is very important for two aspects: from an agronomic point of view, to reduce the competition of weeds with the olive tree, and from the point of view of animal husbandry, to use the energy from herbaceous species for animals and to reduce the need for feed. In spring, weeds are reduced as far as possible to avoid any competition with the olive grove. In summer, it is also important to limit them due to the danger of fire. However, their presence continues to provide benefits because as ground cover they avoid a direct impact of the sun and the evaporation of water. In addition, they can prevent strong runoffs caused by summer rainfall and storms which are usually strong and cause much damage. And of course, their later incorporation into the soil (when tilled under) makes them a good ?green fertilizer? when they decompose. In addition to the effects that they have on the soil, weeds play a key role as host and feeder plant, as do bushes, for a large number of insects which are beneficial in the fight against blights. Thanks to these insects, the olive-grower will have to make fewer and more specific controls. The umbelliferae, leguminous and composite family are especially noteworthy. In addition to the livestock as the basis of the soil management, there are other complementary cultivation techniques. At the end of the summer, the farmer runs in the olive groves a rolling spiked harrow or ?wheels? to till the weeds under into the soil and to prepare the soil for the coming season. These wheels are a tool made by the olive-grower recycling three truck wheel-rims, in triangular shape, which when they pass through the vegetation, break and incorporate it into the soil. At this time, these tools do not cut deeply, but they soften the soil. It is possible also to plough, to further help eliminate weeds, during February ? March if the livestock have not done that work sufficiently, perhaps due to the environmental conditions of abundant rainfall. These tools are adapted to the regional conditions in such a way that their purpose is to break vertically and at a shallow level, without a deep turning of the soil, to avoid loosening the soil and increasing the risk of runoffs. It is also very common to use an old traditional horse-drawn plough because in numerous areas it is impossible to use a tractor to work. This plough, always adapted to hilly conditions, does its work in narrow passes and each time it
leaves a trench of soil un-ploughed, helping avoid erosion. From a practical point of view, this ploughing of lines has the great advantage of providing small steps to help the workers. Otherwise, on completely smooth and steep ground, it is very difficult to maintain a vertical position, making even more difficult the various agricultural tasks such as pruning, shaking the boughs and particularly the harvest.

With respect to **soil fertility**, the presence of livestock brings manure through the *majadeo* (fertilising of the soil with sheep manure), producing a double beneficial effect. In addition, this quantity of manure is spread throughout the cultivated area; it is also complemented by the addition of organic elements from composting, placed directly under each olive tree. This extra fertilization is performed every three years because the beneficial organic matter lasts that long in the soil before being expended. It is also common to bring in manure from the extensive livestock of the region, if we have not had livestock actually present grazing over the soil. Los Pedroches valley is par excellence a livestock region. For this reason, the manure produced in many livestock farms is used by olive growers as a source of organic matter. In this way, relationships among farmers are strengthened through this *mutual assistance*, exchanging manure for grazing.

**Pest and disease control** is another essential aspect of the management of the organic olive grove. In organic olive grove management, as in any other organic agriculture, it is very common to try to adapt conventional techniques by replacing some products by others that are authorised by A.E. (Organic Agriculture), but most of the time that will lead us to failure. Unfortunately, there are many farmers who try to replace organophosphorus insecticide with Bacillusth., rotenone, pyrethrin, etc., and they want to use them the same way as the others, but they are different products, and consequently they need to be used differently.
In our case, in "Los Pedroches," we understand "key pests and diseases" to be those that could damage the quantity and the quality of the olive production. Among those are especially the olive fruit fly (Bactrocera olea Gmel.) and the olive moth (Prays oleae Bern.) and among the diseases the olive leaf spot (Spilocaea oleagina Fries). In addition to these there exist others of less importance that appear occasionally, the damage from which is not important. When we have to control pests, we simple resort to the large biodiversity of the region. We have already discussed the beneficial effect of the entire flora, both weeds and desirable plants native to the area, as a reservoir of useful insects that not only control pests but can actually maintain them at a level below that resulting from possible treatments. The clearest case is that of the olive moth or Prays oleae?. Since the incorporation into Organic Agriculture of zones where treatments with dimethoate were once employed, once the pesticide was discontinued, the level of the beneficial insects increased at the same time as the population of the olive moth decreased. With the organic management system, the auxiliary entomofauna is strengthened, both that which is associated with the olive grove as well as other insects, resulting in levels of olive moths below the point requiring any kind of treatment. For this reason the olive moth, although we do continue to monitor its presence, does not present any risks, and it is recommended to not use any kind of treatment. In rare cases, it is suggested to use Bacillus considering the larval state of the insect. Another case of the power of the auxiliary insects and their capacity to keep the balance was the case of the Olive Psyllid (Euphyllura olivina Costa.). One year there was a high population caused by weather conditions, causing damages on buds and flowers, and also citrus black scale on branches. Although olive-growers became alarmed, it was recommended to not use any kind of treatment against it, because they began to see in the olive trees a large presence of auxiliary insects (spiders, ants...) which finally controlled the pests. When it rained in the spring, the olive trees were cleaned, and the next year the levels were normal, as in other years, returning to a balance of insect populations. The same year of the pests, we had the third best harvest of the Cooperative’s history... The only action...
that farmers have taken was against the olive tree fly (Bactrocera oleae Gmel.). In this case, the auxiliary insects are not completely able to control this pest, which is the one which causes the most damage. The olive tree fly is of utmost importance because of the poor quality that it gives to the olive oil coming from the bitten fruit, and even more in the case of organic olive oil, where the majority is marketed as extra virgin. Due to the great importance of this pest, at the Olivarera Los Pedroches, working together with the Department of Plant Health of Cordoba, a research and experimental project was developed. This project would determine an environmentally sustainable control system, with good efficacy and viability to use it on the field. During six growing seasons, different tests were made using aerial treatments with authorized products (which didn’t work as expected?) and massive traps, which could be the most suitable. With this research it was demonstrated that the Olipe trap, developed right there in the cooperative, is the most efficient, and its low costs guarantee the viability in the field. The Olipe trap consists in a plastic bottle, filled with a 3% diammonium phosphate solution, with some 5 mm. holes at the top which guarantee that larger insects won’t be mistakenly trapped. These traps are placed one per every two olive trees, obtaining very good results, and their cost is around 0,15 € per protected olive tree. This study received two research awards in Organic Agriculture, which demonstrates the reliability of the method. This method is being tested in places as varied as Malaga, Cordoba, Seville, Teruel, Tarragona? to prove its effectiveness in other conditions, and we know that it is being used in Italy, Portugal and California (USA). The olive leaf spot (Spilocaea oleagina Fries.) is the most important disease. Control has always been by means of preventative copper treatments. At the present time, there are products made only of copper which are allowed in Organic Agriculture. However, if we analyse these treatments we notice that the most of them are employed too late, and when the fungus is fully developed there is no cure. As very important complementary measures, cultivation techniques are being continually developed, such as the cleaning of the olive trees, which together with pruning helps with ventilation and a better reception of the sunlight. With these techniques of cultivation one can almost avoid the risk of the olive leaf spot and, consequently, treatments with copper are limited. In short, the management employed in these organic olive groves of Los Pedroches? has a global character where all the techniques are interrelated. We can use the idea from holistic theory that explains that the Whole is not equal to the sum of the Parts, but rather that there also exist relationships among the different Parts that make the Whole not be merely the sum of the different components. With this production system in the field we achieve an improvement in all the productive factors of the ecosystem; above all we achieve the following fundamental objectives:

- **Conservation of the soil sloping terrain** avoiding erosion via the management of the weeds and the original spontaneous flora. With this preservation we avoid reaching the levels of degradation of the agricultural system that are present in other regions. For example, in those regions the depletion of the soil and the soil loss are increasing, due
to the use of weedkiller and mineral or chemical fertilisers, and damage has passed the point of reversibility. Thanks to this organic production system, we maintain a low and completely reversible level of depletion of the ecosystem. An abandoned olive grove is, in a few years, totally invaded by the nearby vegetation, the olive grove fading away and the original flora reasserting its presence.

- **The strengthening of the entomofauna** when the wild vegetation is associated with the olive grove, providing alternative food sources and being a shelter for natural enemies of pests. This helps provide a balance, and even if there are harmful insects, they do not reach damaging levels. At the same time, the ecosystem generates a great capacity for resilience; this is the ability to recover after a period of stress or imbalance occasioned by environmental causes.

- **We find stability in the ecosystem**, we understand this as the ability to keep a dynamic balance, maintaining productivity at a stable, non-decreasing level over time, in normal conditions.

- **The increasing of the fertility of the soil**, this is the basis for obtaining an energy flow which is positive. With the contribution of organic matter, among other things we increase the water retention capacity and improve the structure of the soil. All of these aspects will avoid energy leaving the system by leaching or erosion, counterbalancing the extraction of energy due to the cultivation of olives and other products.

- **We obtain quality fruits**, free of any waste and in optimal conditions for the extraction of organic extra virgin olive oil.

The Olivarera Los Pedroches SCA, by means of its Technical Department, is vigilant to ensure that these conditions are maintained. It supports and advises the association on any subject, offers training courses, and is continuously present out in the field, where the relationship between the technician and the olive-grower is one of close collaboration.
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