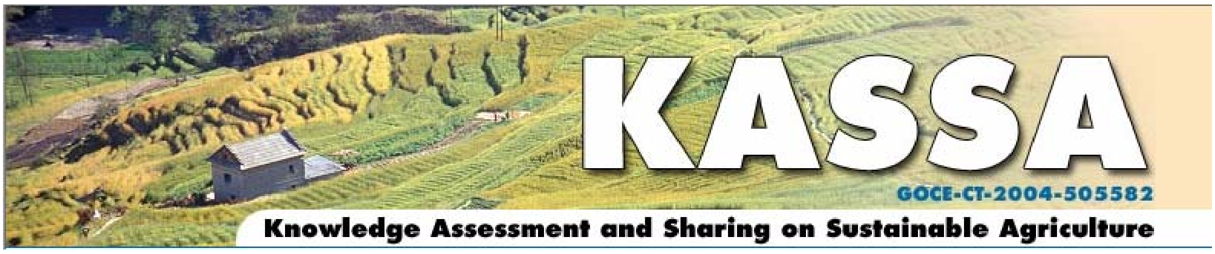

Deliverable 1.2 - Appendix A4

Conservation agriculture and organic farming in Greece

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The agriculture in Greece

The share of agriculture in the total economy of the country, although diminished considerably in the previous decade, continues to be at much higher levels in comparison with other Member States (Pezaros, 1995; European Commission, 2003). The agricultural output was 17% in 1980, but still accounts for 5-6% of GDP as compared to 1.5% of EU-15. The Utilised Agricultural Area (UAA) is 3.5 million hectares and represents only 27% of the country's total surface as compared to 55-60% in EU-15. 40% of the total surface is characterized as "grazing land" or "permanent pastures" (60% of the permanent pastures are state-owned), while forest areas account for 20% (Pezaros 2004). Actually, these numbers reflect the mountainous nature of the Greek landscape. In this respect, it should be noted that 78% of the agricultural land and 70% of the total holdings are found in less-favoured areas. In terms of land use, 35 to 40% of the total agricultural land is cultivated with arable crops, 20% with olive trees, 11% with cotton, 8% with fruits and vegetables, 3.5% with vines and 1.5% with tobacco. If these figures are analyzed further, 50-55% of the cereals, 60-65% of olive trees, 70% of sheep and goat herds, and 40-50% of bovine animals are cultivated or raised in the semi-mountainous and mountainous areas. (Pezaros, 2004). Yet, despite the unfavorable natural resources, the country is 97-98% self sufficient as regards to agricultural and food products (European Commission, 2001).

Statistically, about 800,000 of family-type holdings appear to still be active in Greece, a number disproportionately large in relation to the total Utilised Agricultural Area (UAA) of the country (Pezaros, 2004). Indeed, this number gives a very small average size of 4-5 ha/holding, as compared for instance to 10 ha in Italy and Portugal, 15-20 ha in Spain, the Netherlands and Austria, 40 ha in Denmark and 70 ha in the United Kingdom. However, when using the Farm Accountancy Data Network (FADN), it can be realized that almost half of the 800,000 holdings are on average less than 2 ha. These small farms should be characterized as plots, rather than real commercial holdings, used for providing perhaps supplementary income to ex-professional farmers. Indeed, research has indicated that, due to the exodus of farmers to urban areas, agriculture started becoming the most "popular" second occupation for almost all the professional categories outside agriculture.

The consumption of fertilizers covered 8% of the total inputs in 2000 and this share is close to the EU-15 average. This proportion represents a decreasing trend in their use in the 90’s as compared to that of previous decades (Pezaros, 2004). Indeed, due to the small size of holdings and the aging farmers, the increasing use of fertilizers in the '70s and '80s appeared to be a key factor in raising the yields in Greek agriculture (Beopoulos and Skouras, 1999). It should be noted, however, that the consumption of fertilizers was high in the plains of intensive farming and quite inadequate in semi-mountainous and mountainous areas. On this issue, research has found that the mean consumption of nitrogen (an input directly linked with water pollution) was about 100 kg per ha in the mid '90s, but ground water was not actually polluted as much as in other Community areas. The share of plant protection products appears to be about 6-7% of intermediate consumption. It should be stressed that the total sales of chemicals represent 2.5 kg per ha of Utilised Agricultural Area, this being one of the lowest in the EU. Although there is always a danger of increasing the use of chemicals for high yield crops (cotton, maize, tobacco, etc), their consumption currently remains at low levels. On the other hand, there was a great increase of irrigated areas during the last two decades indicating the importance of irrigation for the considerable improvement in the overall productivity of the sector. In 1961, irrigated areas covered 13% of the UAA. In the mid '90s irrigated areas reached 40% of UAA, and this was the result of irrigating not only vegetables and fruit trees but also arable crops (maize, sugarbeet, cotton).

Sustainability and Greek agriculture

Greek agriculture today is mainly focused on the production of high quality, competitive, certified, labelled products produced by innovative procedures compatible with sustainable development principles. Improved quality and the resulting increase in value of Greek agricultural products will be achieved through technological innovations resulting from focused and well-coordinated agricultural research.

According to Zanou et al., (2003) the management practices evaluated for a cost-effective sustainable agriculture can be categorized as follows:

1. Changes in the mode of cultivation (reduction of fertilizers, few changes in farm practices, reduction of manure use and adoption of new tillage practices).

In Greece the agricultural holdings are small and the farmers cannot plough the farms parallel to slopes and therefore mold board plough usage which is the principal cause of soil erosion contributes to great leaching of nutrients when it rains and displacement of soil leading to soil degradation. The non-usage of mold board ploughing (tractor) or the conjunction of exploitations could provide a solution to this problem Reduction of conventional tillage and adoption of conservation tillage practices, (mulch tillage, no-till, ridge tillage) have to be introduced.

2. Changes in land use (change of crops, conversion of arable land to grassland, organic farming).

The growth of organic farming is influenced by many factors like subsidies, payments for training and advice on good organic farming practices, governmental efforts to develop market demand for organic products, support for the collection and processing of products, alliance between farmers and supermarkets e.t.c. It has to be noted that the market will determine the extent of organic farming. The environmental awareness of consumers (food quality and human health factors) can be the basis of their willingness to pay a higher price for organic products

3. Land reclamation works as prevention environmental measure as well as for the support and promotion of the agricultural efficiency.

Farming across much of the Southern Mediterranean has evolved with small units, part-time farmers and diverse cropping in response to the uncertainty of its natural and climatic conditions. The agricultural land in Greece has suffered intense degradation from the man through the millennia, with climax the last decades. The thoughtless exploitation of hilly regions in combination with the high slopes, the intensive cultivation, the over-pasturing and the unfavourable climatic conditions had as result the reduction of productivity, low quality, lack of certified agricultural products, soil erosion, and the abandonment of land. In certain cases, Galanopoulou-Sendouca et al., (1999) supported that the complete abandonment and desertification of remote sensitive areas can be prevented. A two year investigation was carried out in some mountainous villages of the Pindos, in Thessaly (Central Greece). Crop production of various annual and perennial plants was mostly for family needs and rarely for sale in local markets. Animal manure and crop rotations were used for soil improvement instead of manufactured fertilizers. Chemicals were rarely used since cultivation practices and local varieties give satisfactory crop protection. It was concluded that area provides the most important parameters for a pilot programme for the integrated development of sensitive ecological agrisystems, capable of preventing environmental pollution and improving farmer's and complementary incomes, as well as food quality and biodiversity conservation.

The intensive exploitation of flat regions accelerated the degradation of the physicochemical properties of soils and the quality of water with unfavourable repercussions in the growth of plants and the production. The sustainability of soil is continuously decreased by the degradation of structure of soil and the accumulation of toxic substances. Thoughtless and in a lot of cases excessive use of fertilizers had as result the increase of cost of production of agricultural products, the reduction of their qualitative value, soil degradation (acidic soil, toxicities), and the pollution of the surface and underground waters. The off-hand or insufficient planning of land use contributed in the removal from the agriculture of productive land and the concession of this in other sectors of economy (industy, built-up regions, public work, etc.) that do not require productive land (Kosmas, 1998).

Lemon et al., (1995) argued that much of European agricultural policy has been based upon efficiency criteria which had resulted in standardization and higher unit production. Using the Argolid Valley in Peloponnese (South Greece), as an example it was shown that the adoption of policies directed at the farmer can encourage intensive monocropping practices which exert considerable strain upon the natural resources of the area. A notable step towards integrating environmental requirements into agricultural policy was the 1992 CAP reforms. Regulation 2079/92/EEC, constituted a first and positive step towards integration of environmental components into agricultural policy. An even bigger step was undertaken towards full integration of environment into the European agricultural policy. This was achieved under the approved CAP reform in the context of Agenda 2000. The directive requires that member states maintain and restore the quality of both their aquatic and adjacent terrestrial ecosystems and establishes protection and enhancement of these ecosystems relative to their water requirements. The Communication paper 'Indicators for the Integration of Environmental Concern into CAP' (CEC, 2000) reasserted the Commission's interest in development of agri-environmental indicators (EEA, 2001).

Although considerable effort has been made to identify appropriate agri-environmental indicators, final selection was not been made. Zalidis et all, (2004) proposed a methodology for assessing the environmental state and impacts of current land use and management when implementing agri- environmental measures of CAP. The proposed methology applied in Mygdonia Watersed located 20 Km of Thessaloniki, North Greece, included a modifying Driving Forces –Pessures-Impacts-Responces (DPSIR) framework, identification of Zones of Specific Functiona Interest (ZSFI) and criteria for selecting agri-enviromental indicators, which assessed the functional performance of each zone and meet existing legislation.

In addition the level of farmer environmental awareness has a significant impact on the effect of farming practices on the environment. An investigation into farmers' knowledge of the environmental impact of modern agriculture was carried out using data from wetland and plain farmers in Greece (Pyrovetsi and Daoutopoulos 1997, Pyrovetsi and Daoutopoulos, 1999). The majority of farmers ignored the environmental impact of modern agricultural practices. Sustainability of agriculture is at risk as present practices result in impoverished soils, salinization of the fields and waste of water resources. Wetland farmers were more ignorant and practiced more intensive farming practices that those on the plain. Moreover, their awareness and willingness to adopt an environmentally-friendly type of farming was very low.

The progressive transformation of conventional agriculture in sustainable and biological will be based on knowledge, human resources, management, planning and co-ordination. Measurements have to be taken like the configuration of suitable institutional frame, technocrasy support to the sustainable and biological agriculture, education, information, training, co-ordination of public services and taking of budgetary measurements (Bizantinopoulos 1998). Rozakis et al., (2001) explored alternatives to cotton mono-culture in Thessaly (Central Greece) in order to provide important information to farmers for selecting rotations and management practices but also to public decision makers for establishing agri-environmental measures. Current practices as well as best management practices (BMP) are compared, based on biological growth model estimations. Economic performance and environmental effects such as water deficit due to irrigation and nitrogen leaching are evaluated for a typical farm. Quantification of trade-offs between economic and environmental objectives, was attempted through bio-economic modeling.

Conservative Agriculture in Greece

From the literature review and according to Gemtos et all, (1998) the main problems for the application of minimal or zero tillage systems could be related to:

a) *Effect of soil characteristics on the the wear of soil tillage tools. Evaluation of energy and cost savings*

A three-year reduced tillage experiment was carried out in Central Greece, in order to evaluate the benefits (energy and cost savings) of minimizing tillage (Gemtos et all, 1999) The methods used were: Conventional tillage (CT) using plough, reduced tillage with a heavy cultivator (HC), rotary cultivator (RC), disc harrow (DH) and no-tillage (NT). HC, RC, DH and NT required 24.2%, 44.1, 72.0 and 53.8% less energy consumption, respectively. Natsis et al., (1999) investigated the influence of soil type and soil water on the wear of soil tillage tools. The soil water had a positive efect for loam and clay soils because the wear decreased as the water content increased. For sandy soils however, wear increased with soil water. As the thickness of the cutting edge of the plough increased, draught force and fuel consumption increased considerably, while rate of work and tillage depth decreased. The quality of the tillage was seriously reduced, that is, the size of the soil clods increased as the thickness of the cutting edge of the plough increased. The best overall performance of the plough was obtained from the sharpest share cutting edge with a thickness of 1 mm.

b) *Residue removal or management, weed populations and the need to avoid fields with a lot of weeds, seed emerging in the vicinity of decaying cellulosic material, which can be damaged.*

Wheat was grown after at least one year of cotton with conventional tillage or sowing by broadcasting or linear drilling with or without chopping of cotton stalks (Gemtos et al, 1998). Plant emergence and development were not significantly affected by tillage treatment. Yields were highest in plots with unchopped stalks and linear drilling than with conventional tillage. Papamichail et all, (1997) investigated the effects of various herbicides on weed control in cotton under different tillage systems. At final harvest, cotton yield was greatest under conventional tillage following treatment with alachlor + fluometuron. Skorda et all., (1997) compared five tillage treatments and two levels of N fertilizer in two sites planted with continuous wheat and barley. The soil tillage treatments tested were two conventional treatments, a reduced system and two direct-drilling treatments after glyphosate or paraquat spray to kill weeds. No-tillage resulted in weed flora poor in species diversity but highly specialized for survival, because herbicide efficacy was not sufficient. All tillage treatments attained similar yields with wheat and barley and plant density was unaffected by tillage or by N levels. A three-year reduced tillage experiment was carried out in Central Greece, in order to evaluate the benefits (energy and cost savings) of minimizing tillage (Gemtos et all, 1999) The methods used were: Conventional tillage (CT) using plough, reduced tillage with a heavy cultivator (HC), rotary cultivator (RC), disc harrow (DH) and no-tillage (NT). Emergence was satisfactory for all treatments but growth and yields were better for CT and HC. Weed populations were lower for CT, followed by reduced tillage plots with NT having the worst problem. In no-tillage (NT) plots, seedling emergence of barley was better than in rotary hoed (minimum tillage; MT) and ploughed (conventional tillage; CT) system treatments in a field study (Sidiras et all, 2000). Application of farmyard manure (30 t ha-1) improved seedling emergence of barley planted on a second sowing date by up to 27, 21 and 21% in CT, MT and NT, respectively, in comparison with plots without manure. Only in the NT system did all three physical properties dry bulk density , penetration rate and mean weight diameter of aggregates,of soil play a significant role in the seedling emergence processes of barley, of which penetration rate was the most important parameter.

c) *Land degradation causes lower yields and may increase soil erosion.*

The dramatic change of agricultural practices during the last 50 years is one of the main driving forces for environmental degradation in the Mediterranean region especially through its impacts on soil and water resources. Agriculture in Mediterranean countries is characterized by farm holdings of small sizes. There are a large number of holdings of less than 10 ha, which are less efficient in terms of economic costs than larger farms. Although the farms are of a small size, the traditional methods of farming have changed over the last decades. Today, the duration of rotations has been minimized to 2 or 3 years and farming has been focused on more commercially productive crops (Papadopoulos and Salapas, 1978). In addition, agriculture has become more intensive with extensive use of heavy machinery, fertilizers, agrochemicals, and large irrigation schemes. As a result of the small farm size it is rather difficult to apply a management plan on a watershed scale in order to sustain the agricultural production and minimize the environmental risks (EEA, 1995). Soil quality is a critical component of sustainable agriculture. Especially in the Mediterranean region, the soil quality assessment is a difficult task. The area is characterized by high soil and climate diversity which results a large number of management practices in a narrow area. In addition, the small size of farm holdings creates a complex web in which the scientists should be able to study and assess the soil quality and the stakeholders should be able to adopt sustainable management plans.

In the last decades there is an increasing interest in crop production systems that optimize yields while conserving soil, water, energy, and protecting the environment (Stamatiadis et al., 1996). This interest for sustainable agriculture is garnering support and acceptance within mainstream agriculture. Conventional tillage may often lead to soil degradation for various reasons (e.g. soil compaction, hardpan formation, organic matter oxidation, etc.). In crops grown in wide rows, such as cotton (90–97 cm apart), soil erosion risks are particularly high In such cases, soil structure deteriorates due to repeated soil disturbance by mechanical weed control and to aggregate deterioration by irrigation water. Because of its high economic value, the crop is grown in most cases as a monoculture for more than 5 years. Three different tillage practices, conventional (mouldboard ploughing at 22–25 cm plus one rotary hoeing at 5–6 cm, CT), minimum (one rotary hoeing at 12–15 cm, MT), and no-tillage (direct drilling in soil covered by vetch residues, NT), combined with three fertilization treatments, inorganic (50 kg N/ha as ammonium sulphate), cattle manuring (30 t /ha), and control (no-fertilizer), were applied on a cotton crop grown on a clay loam soil (Karamanos et all, 2004). Soil (gravimetric water content, bulk density, and penetration resistance in the top 40 cm) and plant parameters (root growth, leaf water potential, leaf area growth and seedcotton yield) were recorded throughout the cultivation period in all treatments. The systems of no-tillage and, in second instance, of minimum tillage produced significantly higher root and foliage growth and final yields than conventional tillage in this work. These differences were plausibly associated with an improved plant water status in the reduced tillage systems thanks to an improvement in soil properties, and higher soil water levels which favoured a more profuse rooting in the top soil layer. Manuring had less spectacular, although positive, effects on most soil and plant characteristics which were induced by means of an improvement in soil physical properties.

A detailed study of land degradation by extensive agricultural practices was given by Yassoglou, et all, (1997) on the properties and their management of red soils which are distributed throughout the country, mainly in the southern provinces and constitute important soil resources supporting several land utilization types. Red soils can be grouped into two categories: the authochthonous and the allochthonous. Large portions of the allochthonous soils have been desertified or have been severely graded and their extensive exploitation is not recommended. It was suggested that soil management for the rainfed lands should include erosion control, preservation of organic matter, minimum tillage, split application of nitrogen etc

A comparison of soil quality and plant growth in 2 adjacent vineyards, in Greece, was presented by Stamatiadis et all, (1996). The sustainable vineyard received poultry manure and reduced tillage while in the conventional vineyard only herbicides were applied on the soil surface. Tillage improved soil physical properties and application of poultry manure increased soil nutrient content only and enhanced plant growth however vine yields were similar in the two vineyards. Soil invertebrate populations were 2 times greater in the reduced tillage field. It was concluded that soil degradation will continue in the conventional vineyard if management practices remain unchanged.

Because of the unique site characteristics and the agricultural peculiarities of the Mediterranean, the main impact of agriculture on soil quality is erosion, salinization, compaction, reduction of organic matter, and non-point source pollution. As a consequence, the degradation of soil quality impacts water quality through leaching of pesticides and excess nutrients into surface and ground water along with seawater intrusion into aquifers. Therefore, there is a need to develop a coordinated and multidisciplinary approach to assess the quality of soil and water resources and evaluate their potential and limitations. Zalidis et all, (2002) proposed a simple and cost effective assessment methodology that could provide information about the status of the soil resources, correlate soil quality with management and aid with the development of sustainable management practices.

Under dry climatic conditions, which generally prevail in Greece, production of rainfed wheat rapidly declines cultivation of the land is no longer profitable.The spatial pattern of ^{137} Cs inventories (Cosmas et. all, 2001) suggested that displacement of soil by moldboard ploughing is an important land degradation process on hilly agricultural land in Greece. Displacement of soil materials from the upper convex landscape positions and deposition in the lower parts of the landscape cannot compensate. Protection from further deterioration of such cultivated hilly areas from tillage erosion can be achieved by applying the appropriate management practices such as ploughing the soil only in the up-slope direction, reducing plough depth, or direct seeding without tillage.

The effect of land use (rainfed cereals, vines, olives, eucalyptus plantation or shrubland) and precipitation on runoff and soil erosion was investigated in eight different sites along the northern Mediterranean region and the Atlantic coastline (Cosmas et all, 1997). Olives can greatly protect hilly areas from soil erosion. In several cases, olives grow under semi-natural condition or even abandoned (minimal or no tillage) due to low income. The trend today is to replace them with other more profitable crops ignoring their importance for protecting the land from erosion.

d) *Drilling wheat in narrow rows can be beneficial to crop and increases yields.*

Cotton and durum wheat are the main arable crops in central Greece. In recent years, lateness of cotton harvesting, owing to the use of late maturing varieties and cultural techniques pushes farmers to speed wheat sowing without appropriate soil preparation, especially in wet years (Gemtos et all 1998). Additionally, after the change of the Common Agricultural Policy, which caused a considerable decrease of wheat prices, farmers were obliged to consider alternatives to reduce their production costs. One possibility appeared to be the use of minimal tillage methods for wheat establishment. After a cotton harvest, they distribute wheat seed in the field without any stalks chopping and soil disturbance. For that purpose, they use conventional wheat drilling machines. They remove the tubes guiding the seed from the feeding mechanism to the soil surface so that seed is left to fall down freely and to be distributed evenly from outlets spaced around 17 cm. The furrow openers (usually tines or single discs) of the drilling machine cause a first incorporation of the seed in the soil. The seed coverage is achieved by one pass of a disc harrow or a light cultivator.

Farmers using this method of wheat establishment claim that wheat yields are at least equal and in most cases greater than those of fields with conventional cultivation (Gemtos et all 1998). According to the authors the method appears to offer great advantages to the farmers as it:

-speeds up the work at a time when the weather is getting wet;

-reduces the need to work in wet conditions causing soil compaction:

-even in wet conditions working with light equipment with one or two passes minimises compaction; and

-reduces costs and energy consumption.

There are four possible explanations, assuming that the farmer's claim is true:

1. The seed distribution over the tield may be more uniform, giving a benefit to the crop (narrow spacing).

2. The uncut stalks produce a micro-climate that is beneficial to the wheat.

3. Wheat plants are supported by the cotton stalks and avoid lodging, which gives an additional advantage.

4. Provided weed infestation is low tillage is not necessa ry.

A method of establishing wheat after cotton by broadcasting the seed without any previous stalk chopping and/or tillage and seed incorporation by a light cultivator was studied under Greek conditions in comparison with conventional (ploughed) tillage (Gemtos et all 1998). Drilling was done by a conventional drilling machine by removing the tubes conveying the seed from the feeding mechanism to the soil surface. Thus, a homogeneous distribution of the seed was achieved. Stalk chopping and linear drilling were also studied as separate treatments. The results showed that plant emergence and development were not significantly affected by tillage treatment. Yields were higher in plots with unchopped stalks and linearly drilled in comparison to chopped stalks and broadcasted but did not differ significantly from ploughed plots. The no tillage methods present a lot of advantages in terms of timeliness, low economic cost and energy consumption and appear to be a good alternative practice allowing farmers to increase their margins.

e) *Effect of tillage systems on plant growth and yield*

Field experiments were conducted in Greece to determine the effects of tillage (ploughing followed by one rotary hoeing (CT), rotary hoeing (MT) and no-tillage (NT)) and fertilizer application (154:75 kg N:P/ha or 30 t digested farmyard manure) on growth (biomass and roots), N-accumulation and nodulation of Vetch (Sidiras et all, 1999). The highest dry matter yield and root weight and nodulation were obtained under NT. Just before harvesting, N-accumulation in the shoots and roots was also under NT. Plant growth and nodulation were much better with farmyard manure plots than with NP.

Organic farming in Greece

Organic farming is based on the view that agriculture is a form of agro-ecosystem management, designed to promote sustainable supply of food and other products to the home market. Thus, the farm is considered as a balanced unit, where production, environment and human activities are integrated. Chemical fertilizers and pesticides are replaced by organic forms of fertilizer and non-chemical crop protection strategies minimizing pollution from the farm. Within the EU, the differentiation between organically and conventionally produced commodities was institutionalized in the early 1990s when the European Commission introduced a specific regulation framework (EU Regulation 2092/91) that allows the certification, via inspecting organizations, of such commodities as “biological” or “organic”. Since then, organic practices in the cultivation of various crops have attracted interest across EU member-states. However, despite the widespread interest in organic agriculture, in most European countries it continues to occupy only a small portion of the utilized agricultural area.

This is not surprising considering the significantly lower yields and thus household income of organic farming systems.

Tzouvelekas et al, (2001) noted that if the expansion of organic farming systems throughout Europe as an alternative to conventional farming practices is desirable, then the long-run financial viability of the farmers must be secured. In order to cope with the problem of lower yields and thus reduced farmers' income, European countries have introduced financial support schemes (OECD) that requires complete conversion of at least a portion of a farm's land and continued organic production. Direct financial support schemes, however, although ameliorating the problem of lower farm income in the early stages of conversion, cannot ensure the economic viability of organic farm operations in the long run. In addition, they are in sharp contrast with the recently initiated processes of agricultural market liberalization. In the coming years, the most important policy issue for the EU will be to make its agriculture (both conventional and organic) more competitive and market oriented. Improving farm efficiency then becomes the critical issue It is clear therefore that the success of any policy effort aiming to transform conventional agricultural practices into organic ones depends, among other things, on the efficiency levels achieved by the individual farms

Organic agriculture in Greece has its roots in the ecological movement at the beginning of the 1980s (Van der Smissen 2000). The first organic farmers were mostly amateurs who experimented with different organic cultivation methods, e.g. Their products rarely reached the commercial market. Mostly they aimed to satisfy their own consumption needs. But soon more systematic programmes of biological agriculture followed, organised on an entrepreneurial basis.

Commercial organic agriculture started in 1982 with the demand for organic currants (sultanas) from a Dutch firm. 9 members of the Union of Agricultural Cooperatives of Egialia, started in 1982 the biological cultivation of Corinthian raisin, covering 13 ha of land. Their annual production was 30 tons, all of which was exported to the Netherlands.

From 1986 onward, a German firm supported the production of organic olives and olive oil for export. Individual farmers converted their farms in the following years, supervised by foreign certification and inspection bodies (Skal, Soil Association, Naturland). Their main products were olive oil, citrus fruits, wine, cereals, kiwis and cotton (Van der Smissen 2000).

In 1988 the first organised biological cultivation of olive trees started in Messinian Mani, in theSouth east of peloponissos, by a group of 8 producers on an area of 10 ha (Louloudis, 2001). Again, the annual production of olive oil and olive fruits was exported to the market of biological products of Central Europe.

In the next five years different agencies appear throughout Greece, such as the Action Network for Pesticides, the Laboratory of Ecological Practice, as well as local initiatives for the first successful exports.

In Northern and Central Greece, the first steps towards a systematic agricultural production were recorded in 1985 where a variety of aromatic herbs were cultivated. Further up in Westrn Macedonia a farmholding family established a vineyard in 1989. In 1990 annual arable cultivations started at the Yiannitsa prefecture while the following year at the prefecture of Imathia, a group of 15 farmers produced cereals, tomatoes,legumes, almonds, apricots, cherries, plums etc., on a 30 ha area. At about the same period equally important efforts (i.e. citrus and olive trees) began in skala Lakonias , in Argolida (Citrus trees) and in the Island of

Crete (vegetables, olive trees, vine and bananas) as well as in the prefecture of Central Macedonia (wheat and vegetables) (Vlontakis et al. 2000).

In 1990-1992 the Ministry of Agriculture, at its headquarters, appoints the responsibility for the implementation of EU Regulation 2092/91 to the newly established Office for Biological Products.

The year 1993 marks the starting point for the systematic inventory of cultivations, the control of productive procedure, and the certification and labelling of the products under the aforementioned Regulation "on the biological mode of producing agricultural products and the relevant indications on agricultural products and types of food". In the same year, the inspection and certifying organisation DIO, is founded. "SOGE" and "Physiologiki" are, so far, the other two inspection and certifying agencies recognised by the Ministry of Agriculture. By1 993 the Union of Professional Biocultivators of Greece is founded, and the (state-sponsored) Panhellenic Confederation of the Agricultural Co-operatives. A major development of Greek organic agriculture proves to be its inclusion among the schemes subsidised under the institutional framework of the agri-environmental EU Regulation 2078/92.

Organic agriculture or biological agriculture, as it is called in Greece seems very small-scale in comparison with many other European countries. Organic agriculture does not account to more than 0.6 % of the national agricultural output. The same can be said when comparing the number of biological farmers with the total number of farms in each E.C. country. As the relative numbers of farms vary from less than 0.5% in several countries to nearly 10% in Sweden and Austria, Greece finds itself to the lower position (0,48%).

The main features of Greek organic farming according to Pantzios and Tzouvelekas (1999) are: The increasing trend for organic farms, The geographical imbalances of organic farms, and The limited range of the cultivated crops.

However, the progress made in the last years is impressive. The growth of organic farming is influenced by many factors like Subsidies, Payments for training and advice on good organic farming practices, Governmental efforts to develop market demand for organic products, Support for the collection and processing of products, Alliance between farmers and supermarkets national labels trade and processing consumer and farmer information, research nation-wide policy and funding. These factors which stimulated organic agriculture in other European countries are just coming up in Greece.

Traditional practises of cultivation can still be found. Older people still know about crop rotation, green manure and traditional crops (pulses, rain-fed fodder crops). Models of traditional cultivation which could be referred to as organic have, however, vanished. Many people believe that it should be easier to convert extensive cultivation to organic farming than intensive cultivation systems. This is not the case. The main problem is that farmers consider extensive agriculture to be organic already. Due to the lack of information and training, there is no understanding of the demands of organic agriculture. One should bear in mind that only 5.7 percent of Greek farmers have attended an agricultural training programme of one year or more.

In general the main constraints for the development of the Greek organic farming are:

- ✓ Agricultural policy network (policy makers, politicians, organised professional interests, co-operatives, individual farmers) in Greece lacks a cohesive and consistent vision of post-1992 rural development. In the case of agri-environmental policy, the delays in submission and approval of schemes led to their limited implementation and, as a result, to limited absorption of the allocated resources.

- ✓ The marketing network of organic products in Greece is still in its infancy. This is due to the lack of well organized distribution channels and the negative opinions of retailers regarding the promotion of organic products.
- ✓ Organic farming is an expensive venture for farmers in terms of training, production, certification, and marketing.
- ✓ There is lack of information for Greek producers throughout production, post-harvest and marketing processes. Lack of information and practical training, on the organic cultivation techniques with result the producers are not well informed and so they seem to be indifferent.
- ✓ The small number of organic producer associations, as well as the small size of the majority organic operations are serious drawbacks for the marketing of the products.
- ✓ The range of the crops cultivated in Greece is considered to be small. The main reason for that is the fact that most farmers are used to produce some particular products and that growers are oriented towards perennial crops rather than annual ones.
- ✓ Generally in Greece public awareness of organic agriculture and its relation to health and the condition of the environment is low and consumer education in these matters must be considered a priority.
- ✓ Greek consumers do not have the appropriate information background for organic products
- ✓ The mistrust of Greek consumer for the organic products as for their appearance and the most important for their price
- ✓ The prices of organic products in Greece are higher than those of conventional ones, since they are products of top quality and the cultivation/production cost is higher.
- ✓ The organic agricultural products are been provided by few shops, which are basic shops of healthy diet
- ✓ The small size of organic farms that is scattered and neighbouring with conventional in many Greek regions. This has as result the biological products to be influenced by the chemical substances that are used in the conventional agriculture. Thus is a problem of certification of biological products created, which often involves loss of identity of "biological". The growers in order to avoid the damaged, are forced to give the production in the conventional market leading to the degradation of very good quality and loss of income.
- ✓ There is high competition between organic and conventional products and there is competition between domestic biological products, with what is imported.

Despite its current marginal character, the Greek organic sector may be expected to grow in importance in at least two respects: (a) environment and health considerations are gradually inducing consumer preferences for natural, chemical-free products, and (b) oversupply of agricultural production and the liberalization of world markets result in declining producer prices and the need for developing quality-based, differentiated commodities (Fotopoulos and Pantzios 1998). In the light of overproduction and the loss of product identity due to the uniform intensification of the agricultural production system in some regions of the EU. Papageorgiou, (2002) suggested that organic farming, by safeguarding the quality of products, makes Greece more competitive while contributing to strengthening agricultural multifunctionality. At the same time, decisions and policies for the subsequent development of a sector can only be successful when based on regular monitoring and thorough analysis.

Although organic farming initially has appeared in regions or/and crops with relatively low input demands, in Greece has expended to areas where chemicals were intensively used recently due to the CAP adoption. Such a response may be also attributed to the environmental degradation and increasing both farmers and consumer awareness concerning organic farming practices. Following the CAP reform and the GATT agreements, organic farming in Greece appears as an alternative production method with the potential of an extra income and with positive effects on the environment (Papadopoulou et al., 1997). The socioeconomic parameters of organic farming in restructuring small to medium sized agricultural economies, like that of Greece, are of significant importance. In these cases organic farming seems to offer a promising alternative and profitable agricultural practice (Kaldis et al, 1996). This is in line with the current public concerns for the protection of the environment and of the natural resources, and health and nutritional considerations. Morever, it has to be noted that the argument advanced by free market optimists that liberalized agricultural policies will lead to conservation, through reductions in outputs and environmentally damaging inputs, leaves many more things to be decided. Critics have pointed out that lower prices may induce farmers either to abandon land with loss of biodiversity and rural landscape ecology as a result, to increase production and pollution in order to sustain current revenues, or to switch to more environmentally damaging crops. Lekakis et all, (1999) proposed that overall reductions in the total volume of agricultural output or the total amount of agro-chemicals used does not guarantee environmental enhancement. Environmental problems are usually location specific and crop specific. The cultivation of industrial crops is responsible for serious ecosystem offences in areas around the World. Thus, to actually have some measure of which way a lower price regime would be going in terms of conservation, we need to study the effects of either technology shifts or production shifts. The specific experience of Spain and Greece in the production of cotton, maize, and sugar beets, through the adopted modelling approach, indicated that price reductions will simply change the ‘inter- industry’ production mix in a way that will highlight either the soil erosive, or the chemical intensive character of production. While the proposed model did not offer any such tools directly, informing the farmer of the availability of viable and environmentally sustainable technology options and controlling the amount of inputs used, would be among the possible alternatives.

Organic farming: statistical data

There is no official data on organic agriculture for the period from 1982 to 1992. According to estimates, there were about 150 producers cultivating a total area of 200 hectares. EU-Regulation 2092/91 brought about a major change. Many farmers officially converted their farms to organic agriculture. A second expansion took place after the introduction of hectare subsidies in 1996 with the adoption of the EU-Regulation 2078/92. Organic agriculture has rapidly expanded since its official establishment, with annual growth rates of between 50 percent and 120 percent; slowing down to 20-30% in 1999-2000. In 1999, both the share of organically utilised area as well as the number of organic farmers reached 0.6 percent of the overall country total.

The percentage of organic agriculture in Greece is one from the lowest among E.C. countries. However the medium size of Greek rural exploitations, what have been included in the organic agriculture is progressively increased the last years. This element leads to the likely conclusion that the organic agriculture includes mostly professional farmers.

Development of organic cultivated areas

Year	Cultivated Area (ha)	Increase %
1993	591	-
1994	1343	127%
1995	2354	75%
1996	3767	60%
1997	5928	57%
1998	8882	50%
1999	10379	18%
2000	12208	14%
2001	14964	23%
2002	15851	6%
2003	16672	5%

Source: Ministry of Agriculture

Rate of Change of organic cultivated area in the Greek regions during the 1999-2002

Region	Percentage increase 1999-2001 (%)	Percentage increase 2000-2001 (%)
EASTERN MACEDONIA - ΘΡΑΚΗ	18	16
CENTRAL MACEDONIA	116	22
WESTERN MACEDONIA	546	230
THESSALY	118	98
IPIROUS	-26	7
IONIAN ISLANDS	-25	-5
ATTIKI	43	6
STEREA HELLAS	85	25
WESTERN GREECE	13	3
PELOPONNESE	35	22
NORTHERN AEGEAN	49	36
SOUTHERN AEGEAN	53	41
CRETE	48	26
Average	42	23

Source : Ministry of Agriculture

From following table it becomes obvious that the organic agriculture presents a high percentage in few prefectures of country, in each region. No one substantially change was marked in the 10 first prefectures of country and there will not be important changes in the near future

10 first prefectures in the organic agriculture

Prefecture	Area (Ha)	Percentage related to total area (%)
LAKONIA	2408	16.1
AHAÚAS	1398	9.3
LESVOS	1262	8.4
VIOTIA	997	6.7
MESSINIA	940	6.3
HERAKLION	937	6.3
ARKADIA	692	4.6
PIRAEUS	591	3.9
ARGOLIDA	528	3.5
EVIA	326	2.1
SUM	10083	67.4
TOTAL	14964	100

Source: *Dio*, Major Certifying and inspection body for organic products in Greece

The following tables were provided by DIO, major certifying and inspection body for organic products in Greece (www.dionet.gr)

Development of the area under organic inspection

Year	Cultivations (0.1 Ha, 1000 m2)	% Increase	PASTURE LANDS (0.1 Ha =1000 m^2)	Indigenous plants (0.1 Ha= 1000 m^2)
1993	5905	-	-	-
1994	13430	127%	-	-
1995	23540	75%	-	-
1996	37670	60%	-	-
1997	59278	57%	-	-
1998	88823	50%	-	-
1999	103791	18%	11926	-
2000	122089	14%	30000	-
2001	149643	23%	563994	-
2002	158511	6%	1049581	-
2003	166725	5%	1265179	27095
2004	215997	30%	1230563	27393

(source: DIO, statistical data 2004)

Organic land per geographical region

Region	Land (0.1 ha/stage)			Total area (0.1 ha/stage)	% of the total
	Biological product	Conversion stage	Under control stage		
EASTERN MACEDONIA AND THRACE	1707	311	3.577	5.596	3%
ATTICA	6109	1059	1662	8831	4%
NORTHERN AEGEAN	13217	2343	5730	21290	10%
WESTERN GREECE	15419	2624	5690	23733	11%
WESTERN MACEDONIA	2104	949	3080	6133	3%
CONTINENT	3262	176	549	3987	2%
THESSALY	6229	2093	15118	23440	11%
IONIAN ISLANDS	3275	599	305	4180	2%
CENTRAL MACEDONIA	6574	4245	7878	18697	9%
CRETE	15643	5436	5117	26196	12%
SOUTHERN AEGEAN	1064	394	253	1711	1%
ΠΕΛΟΠΟΝΝΗΣΟΥ	31134	6670	14241	52045	23%
STEREA HELLAS	11929	3595	4636	20159	9%
GENERAL SUM	117665	30495	67836	215997	100%

(source: DIO, statistical data 2004)

Distribution of organic land per cultivation and stage

Cultivation	area (0.1 ha/stage)			Total (0.1 ha)	%
	Biological product	Conversion stage	Under control stage		
Arable	26709	8715	31565	66989	31%
Vine	12998	3905	4100	21003	10%
Olive	63042	15403	28833	107278	49%
Citrus fruits	6321	934	669	7924	4%
Horticultural	3280	424	655	4359	2%
Fruit trees	5314	1.114	2013	8441	4%
SUM	*117665*	*30495*	*67836*	*215997*	*100%*

(source: DIO, statistical data 2004)

Organic agriculture in Greece is still at an embryonic stage, compared to many other European countries (M.A.I.CH., 20001). However, there was made a great progress in the last years. According to the Ministry of Agriculture officials, although Greece started late with organic production, (compared to the other EU member states) it has the largest potential for organic agriculture. This can be justified by the fact that Greek regions favor organic farming due to their soil and climate conditions (Van der Smissen, 2000). This can be justified by the fact that Greek regions favour organic farming due to its geographical and topographical structure which allows for crops to be grown in isolation and away from conventional "high chemical input" fields. This includes islands and isolated land pockets at varying altitudes, from sea level up to almost 5,000 ft.

Larger operations have started appearing mainly in organic olive growing and organic viticulture. The main organic products of Greece are olive oil and olives, followed by vine, other tree crops (especially citrus) and arable crops. Organic olive production is not very different from extensive, rain-fed, conventional olive production. The difference is in fertilising practice (green and animal manure) and Dacus fly protection (traps instead of spraying) (Van der Smissen 2000). There is enough know-how for this crop, the costs for organic cultivation practices are not much higher than the conventional costs, and the hectare subsidy is high. Wine, the second major product after the olive, is a typical Mediterranean crop, too. Organic know-how with respect to vine cultivation has reached quite a high level. The increase in organic viticulture is also a consequence of the high hectare subsidy and restrictions on conventional wine production. The demand for fresh fruit and vegetables, especially for the external market, has caused the area under organic cultivation to increase. Other organic arable crops (e.g. sunflowers, sugar beets, industrial tomatoes, pulses, sesame, herbs) are mainly hindered by the lack of processing possibilities, the low level of know-how and low prices for these products on the conventional market. The situation is improving as more and more processing firms decide to get certified organically.

Organic farming: Impact on environmental protection and product quality.

The need for environmental protection and consumer demand for high quality agricultural products have led to greatly increased interest in the application of organic farming methods in Europe in recent years. A multiobjective programming model was developed by Psychoudakis et all, (2002) to assess the cost of reducing the use of agrochemicals by changing the pattern of cropping alone. The Mygdonia Valley, a less favoured area with environmental restrictions, including lakes Koronia and Volvi, north-east of Thessaloniki in northern Greece, is an example. The data shown that a substantial reduction of the use of agrochemicals fungicides and insecticides wich are the most noxious agrochemicals, can be achieved by changing the pattern of cropping alone, apart from other practices (organic farming or integrated farming), which are not considered. The approach is applicable to Mediterranean conditions which allow a wide choice of cropping patterns. It would be possible to incorporate in the model new activities can be considered in particular, alternative farming practices.

Farmers may be more cautious with input use in organic cultivations. Tzouvelekas et al, (2002) suggested that the organic wheat farms examined were relatively more efficient than conventional wheat farms. Reasons may include lower profit margins and restrictions on inputs permitted, which may force organic farmers to be more cautious with input use. From an earlier study (zouvelekas et al, (2001) suggested that the organic olive-growing farms exhibited a higher degree of technical efficiency (relative to their production frontier) than did conventional olive-growing farms. The data were collected from a survey of 84 organic and 87 conventional, olive-growing farms in 4 different counties, during the 1995-96 period. Reasons may include lower profit margins and restrictions on inputs permitted, thus forcing organic farmers to be more cautious with input use. However, both input- and output-oriented technical efficiency scores were still relatively low for both types of olive-farming. Thus there was considerable scope for cost reducing and farm income improvement in both farming modes.

During the conversion period from conventional to organic, there is a need both for control and assessment of the benefits in terms of soil and crop quality. One aspect of soil quality is the potential for the accumulation or depletion of trace elements in soil and their availability to plants. Many farmers in Greece have started to apply organic practices in the past few years especially in the production of olives and grapes for wine making, the country's main crops. However, organic fertilisers are not widely used, partly because of the difficult access in mountainous areas where olives and vines are often cultivated, and partly because of their cost and lack of availability in areas where there is no animal husbandry. Vavoulidou, et all, (2004) determined concentrations of Fe, Cu, Mn and Zn and other physical and chemical soil parameters in organic, conventional and uncultivated soils in vineyards, olive groves, and citrus groves of varying ages in several areas of Greece. They found that concentrations of the trace elements were in the range expected for the predominant studied soil types, indicating a long-term balance between input, mainly from agricultural chemicals, and output by slow leaching from the generally neutral or alkaline and frequently lime-rich soils. No differences were observed in the total concentrations of Fe, Cu, Mn, and Zn in organic practice soils compared to conventional and fallow soils, but significant differences were found for Cu, Zn, and Mn between soils cultivated with different crops. The relatively high values found for Cu in a few samples are likely to be due to the long-term use of copper-based fungicides, which are the only products allowed for the control of fungal diseases in organic cultivation. Given the current debate over the desirability of their continued use in organic agriculture and the differences observed in Cu concentrations between crops, they conluded that further studies have to curried out on the Cu content of soils for a wider variety of land uses and growing conditions.

One of the primary reasons for purchasing organic food is the perception that it is more nutritious than conventional food. Although there is little evidence that organic and conventional foods differ in respect to the concentrations of the various micronutrients) there seems to be a slight trend towards higher ascorbic acid content in organically grown leafy vegetables and potatoes (Magkos, et all, 2003). There is also a trend towards lower protein concentration but of higher quality in some organic vegetables and cereal crops. With respect to the rest of the nutrients and the other food groups, existing evidence is inadequate to allow for valid conclusions. A well balanced diet can equally improve health regardless of its organic or conventional origin.

Water is the main determining factor with respect to crops and yields. In addition fruit quality can be substantially affected by the water regime (Ismail-AS et all, 1999). Two isolated orchards, irrigated and non-irrigated and subjected for 4 years to standard organic farming techniques were selected in the Gavolochori region of Western Crete, on a relatively isolated hill top. A total amount of 400 m^3 of water was applied to the irrigated grove 3 times during the spring and summer period. Olive oil quality was evaluated in fruit samples of the irrigated and non-irrigated orchards. Olive fruits from the irrigated plot had increased fruit weight, moisture and oil content while the extracted olive oil had higher titratable acidity, peroxide value, oxidative stability, total phenols as caffeic acid and lower specific absorbance coefficients K232 and K270, compared with the fruits and the extracted oil from the non-irrigated plot.

A market survey was conducted in Athens in order to record customer satisfaction with the main elements of marketing mix and image perception of Greek quality and organic wine (Tsintarakis 2001). MUlti-criteria Satisfaction Anallysis (MUSA), which is a methodology that estimates the satisfaction level of a specific group of people (customers, workers, etc) based on personal values and preferences of that group, has been utilized in this research to process the collected data and to provide us with the resulting strengths and weaknesses of the products. Based on the survey results, it was shown that organic wine is an invesment for Greek agribusiness.

Organic farming: Soil amendments, agronomic evaluation

The continuous decomposition of organic matter in cultivated soils of arid and semiarid regions may lead to soil degradation with a consequence of inability to ensure a sustainable production. The application of organic wastes, and particularly composted municipal refuse and sewage sludge, could be a way of solving two problems, the waste disposal and the correction of the low organic matter content of many agricultural soils (Kapetanios et all, 1993). Using wastes in agriculture is an economical disposal of these materials, and it is interesting from an ecological point of view as it reduces negative effects on the environment. However, it could lead to phytotoxic levels of heavy metals in soils.

Agricultural income in Greece has declined significantly (National Statistical Service of Greece, 2002). For example in the Island of Crete the availability of water resources restricts agricultural production, and desertification is gradually expanding (Chartzoulakis et al., 2001). Additionally, despite a chronic deficiency of soil organic matter, recycling of biodegradable organic wastes on land is only poorly developed and is not standard agricultural practice, as is the case elsewhere in other Mediterranean countries (Manios et al., 2001). The effort to increase agricultural income may come from the expansion organic farming. This approach will provide certified agricultural products, which on one hand will be beneficial to consumer's health, and at the same time attract higher financial premiums. However, this will require gradual replacement of chemical fertilisers that are currently extensively used in agriculture production, with organic soil amendments. Additionally, organic soil amendments increase the soil organic matter content and water reserve and reduce runoff and soil erosion from the typical hilly, terrain characteristic of the Mediterranean region. Aggelides and Londra (2000) investigated the potential of organic fertilizer for soil improvement. The fertilizer produced by composting 62% town wastes, 21% sewage sludge and 17% sawdust by volume, was applied at the rates of 0 (control), 75, 150 and 300 m^3/ ha to loamy and clay soils, in order The experiments were conducted in areas characterised by a semi-arid climate. The chemical properties of the soils were afected directly by the amendment compost. The physical properties of the amended soils were improved in all cases as far as the saturated and unsaturated hydraulic conductivity, water retention capacity, bulk density, total porosity, pore size distribution, soil resistance to penetration, aggregation and aggregate stability, were concerned. In most of the cases the improvements were proportional to the application rates of the compost and they were greater in the loamy soil than in the clay soil.

The agronomic utilization of fly ash might also be beneficial, and several studies have shown that it can improve soil structure and water-holding capacity physicochemical characteristics enhance soil fertility and increase the pH of acid soils. On the other hand, it may also result in adverse edvects on micronutrient plant uptake Matsi and Keramidas, (1999) investigated the effects of soil application of aged alkaline fly ash, derived from two different electric power plants in northern Greece, on: (1) the pH, salinity, available B and P levels of two Red Mediterranean acid soils and (2) the growth and total uptake of B and P by ryegrass (Lolium perenne L.) grown in pots containing fly ash±soil mixtures. Fly ash of low B and salt content can be used as a liming agent in acid soils, at amounts that depend on the acid-neutralizing capacity of the fly ash and the buffering capacity of the soils. For fly ashes and soils similar to those used in this study, a rate of no more than 20 g/ kg soil, equivalent to 40 Mg /ha, is considered acceptable. The results of this study also show that the beneficial efects of fly ash addition are rejected in increased nutrient uptake and biomass yield. Boron in fly ash needs special consideration because of its potential toxicity to plants. The final decision for the agronomic use of fly ash must also take into account other factors, such as possible deterioration of soil physical properties for certain soils and potential environmental impacts.

Moreover, increasing the organic matter content of soil has the additional benefit of reducing the problems associated with the use of brackish water for crop irrigation, which is frequently the case in some areas of Greece, e.g. Crete (Tsikalas and Manios, 1986). In cases when animal husbandry in stables is limited, conventional farmyard manure is not available, necessitating the production of composts from other local organic residues (Willers et al., 1999; Manousakis, 2001). The raw materials that can be used to produce high quality composts are mainly the residues of cultivations and agricultural industries. A secondary source, both in amount and quality, is the organic fraction of municipal solid waste (OFMSW) (when source separated) and sewage sludge, when mixed with green waste or other bulky organic materials (Manios and Siminis, 1988; Manios and Dialynas, 1995, Manios et al., 2003; Vrilakis et al., 1999). Recycling of organic residues by composting and land application would contribute to the sustainable development of the island of Crete.

Olive farming is concentrated in the central and southern regions of the country (namely, the areas of Sterea Ellada, Peloponnese, the Aegean and Ionian Islands and\ Crete) where climatic and soil conditions favor olive-tree cultivation. Olive production is perhaps the most wide-spread farming activity in Greek agriculture. Olive-oil is one of the fundamental exportable Greek commodities as the country ranks third in world olive-oil production — behind Spain and Italy (Tzouvelekas et al, 2001). The recent EU policy measures encouraging organic farming provide a realistic alternative to olive growers for at least two reasons. First, organically produced olive-oil, marketed as a quality-based, differentiated type of oil, may still find a 'niche' in the nearly saturated oils-and-fats market. Second, in contrast to other crops a technology for organically cultivating olive trees is already available and readily applicable though at an infant stage since olive trees are considerably less vulnerable to pests than other crops; thus it is much easier for olive farmers to convert their plantations to organic. In addition Baourakis and Stamataki (1997) stated that the potential organic farmer is most likely the one motivated by financial factors. As a result, organic olive growing has recently become the dominant type of organic farming in Greece.

One of the major environmental problems in olive oil producing countries, as Greece, Italy, Spain, Tunisia and Morocco, remains the treatment and disposal of the olive-mill wastewater, that is the main waste product from the extraction of olive oil, with toxic effects on plants and several hydrobial organisms, mainly because of its phenol and organic matter contents (Manios et al., 2004). Physico-chemical treatment processes tested could not be implemented on a large scale because of their high investment and maintenance cost (Kalogerakis et al., 2000). Alternatively, great interest has been focused on biological treatment using aerobic bacteria and fungi (Balis et al., 1996; Chatjipavlidis et al., 1996) for bioremediation of olive-mill wastewater by composting. Other wastes of olive-mills are the extracted press cake and the leaves

Manios (2004) evaluated olive press cake, olive tree leaves (OTL) and branches, vine branches (VB), pressed grape skins (PGS), pig manure (PM), sewage sludge and the organic fraction of municipal solid waste (OFMSW) for their behaviour during composting, their compatibility in mixtures and the quality of the end product The quality evaluation included both a detailed physiochemical (pH, electrical conductivity (EC), nutrients concentration, heavy metal concentration, etc.) and biological analyses (pathogenic microorganisms). It also included an agronomic evaluation, in which composts were used either as a soil amendment or as a component for substrates in open air or covered (greenhouse) cultivation mainly of local vegetables (tomatoes, cucumbers, etc.). It was shown that all materials were composted successfully, especially when mixed. The end products contained large amounts of organic matter, usually combined with an increased EC value. Pressed grape skins should be considered as the ideal raw material, producing high quality compost, with the lowest EC value (1.57 mS/cm) and the largest organic matter concentration (84.50%), compared to all other materials. When any of the produced compost was used in a ratio of 30% by volume (v/v), it increased plant growth, whereas in larger volumes, it presented phytotoxic behaviour, inhibiting both root and shoot development.

In olive oil producing areas usually ornamental horticulture is also developed because of the climate type. Pot ornamentals are mostly grown in soilless growing media that contain the rather expensive peat mixed with an inorganic material. Composted olive-mill wastes could be considered as an appreciable low priced organic ingredient for pot ornamentals growing media, and simultaneously disposal of these wastes in a friendly to the environment way could be obtained In Greece, the yearly extracted press cake is about 275,000 t, the olive-mill wastewater 785,000 t and the olive leaves 45,000m^3. Supposing that the whole quantities of the extracted press cake and olive leaves will be used as starting material about 200,000 t of OWC could be produced yearly. This is a quite big amount and could be considered for use in professional horticulture, on the condition that experimentation will take place on the OWC amounts that can participate in the growing medium of various crops. Papafotiou et al. (2004) investigated the possibility of using olive-mill wastes compost (OWC) in the production of ornamentals replacing part of the peat in the growing medium. Rooted cuttings of *Euphorbia pulcherrima* cv. Peterstar white were grown in media containing OWC, peat and perlite in various ratios, and their vegetative growth, root growth and flowering was determined. A medium of 1 peat:1 perlite (by volume) was used as control. The results suggested that OWC can replace up to 25% of the peat in a medium with perlite in the production practice of poinsettia. The quality of the plants produced in this medium was as good as that of the control. The decrease of plant height with no simultaneous effects on bract number and flowering could be particularly interesting, as could contribute to the reduction of the amounts of plant growth retardants that are routinely employed for height control in commercial cultures of poinsettia, and to the decrease of production cost. Higher concentrations of OWC are not recommended for poinsettia production, as they induced late flowering expressed as decreased bract number at the time that control plants and plants grown in 12.5% OWC were ready for the market

Weed control in organic farming

There is a strong interest in developing alternative methods of physical weed control in organically grown crops because weeds remain one of the most significant agronomic problems associated with the production of organic crops (Economou et al. 2002).

The crop system implemented in Greece following the wheat harvest involves treating the ground to incorporate crop residues into the soil. Under semi-arid Mediterranean climatic condition, soils typically have low organic matter content and weak structure, resulting in low infiltration rates. The rotation followed is winter cereals–legumes (for green manure)–cotton. For dry conditions such as those in the Mediterranean, this leads to a reduction in soil moisture while creating favourable conditions for the emergence of weeds. Thus, before wheat is sown in October, it is necessary to control weeds using mechanical or chemical means (Skorda et al. 1997, Bilalis et al. 2001b, Kalburtji and Mamolos 2001). The problem is greater on organic farms because weed control can only be carried out mechanically. This weed control system is more time consuming and has a higher cost. The soil tillage system affects weed flora. Changes in tillage can have a significant effect on weed control and the weed population (Bilalis et al. 2001a). The correct use of crop residues helps conserve soil moisture and deal with weeds, while also improving soil structure. Mulching is a weed control method used in agriculture and forestry throughout the world. The use of crop residues to cover soil can suppress weeds, while at the same time reducing soil tillage for weed control, under any tillage system implemented. Bilalis et al, (2003) analyzed the effects of four levels of surface cover, consisting of wheat straw from the preceding crop, on weed dry mass, density of weed species and species diversity of the weed population in an organically grown Vicia faba crop. The crop system implemented on organic farms requires that crop residues are incorporated into the soil following the end of wheat cultivation. This system leads to a reduction in soil moisture and the creation of favourable conditions for the emergence of weeds. In contrast, covering the soil with 60 % crop residues was found to maintain soil moisture and lead to a reduction in dry weed mass, population density and population frequency as well as a reduction in population diversity, regardless of the initial weed flora before the implementation of different soil tillage systems. Finally, an increase in the prevalence of broad-leafed weeds was observed as the level of soil cover increased.

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