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НА РЕПУБЛИКА МАКЕДОНИЈА
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CASE STUDIES ON ORGANIC FARMING OF OUTDOOR AND GREENHOUSE HORTICULTURAL CROPS AND VINEYARDS IN CRETE, GREECE

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ABSTRACT

The land area currently under organic management in Greece amounts to approximately 1% of the total area devoted to agriculture, of which a mere 436ha (or 2% of area cultivated organically) is given over to the production of vegetable crops. The case studies presented here were carried out within the module "Organic Farming" of the Postgraduate Specialization Programme of the Department of Sustainable Agriculture of the Mediterranean Agronomic Institute of Chania, Crete, Greece, in which first year students are introduced to the principles and methods of organic framing. The case studies on organic farming of outdoor horticulture crops and grape production were carried out in the prefecture of Chania, and that of greenhouse horticultural crops in the prefecture of Rethymnou, Crete. The case studies were written on the basis of observations and questions posed within the field. They cover the general management of the organic farms, cultivation practices and the methods of protection from pests and diseases within the various outdoor and greenhouse cropping systems. The survey showed that the farmers visited had been implementing organic farming practices for at least four years and all of them are successful in their production.

СТУДИИ НА СЛУЧАЈ ОД ОРГАНСКО ЗЕМЈОДЕЛСТВО ЗА ГРАД. КУЛТ. НА ОТВОРЕНО И ВО ОРАНЖ. И ЛОЗЈА НА КРИТ, ГРЦИЈА

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АПСТРАКТ

Во моментот, површината на земја што се обработува органски во Грција изнесува отприлика 1% од вкупната земјоделска површина, од која еден дел од 436ha (или 2% од површината култивирана органски) се однесува на производство на зеленчукови култури. Презентираните специјални случаи беа изведени во рамките на модулот вОрганско фармерствог од Последипломската слецијалистичка програма во Одделението за одржливо земјоделие во Медитеранскиот агрономски институт на Ханија, Крит, Грција, во кој студентите од прва година беа воведени во принципите и методите на органско земјоделие. Специјалните случаи на органско земјоделие на градинарски култури на отворено и производство на грозје беа направени во префектурата на Ханија, додека специјалниот случај на оранжериски градинарски култури во префектурата на Ретимно, Крит. Специјалите случаи беа напишани врз основа на набљудувањата и прашањата поставувани на терен. Специјалните случаи покрија општ менаџмент на органските фарми, култивациони практики и методите на заштита од штетници и болести на различни

градинарски култури на отворено и во оранжерии. Истражувањето покажа дека посетените фармери ги имплементираат техниките на органското фармерство за најмалку четири години и сите се успешни во нивното производство.

INTRODUCTION

Organic farming can be defined as an approach to agriculture where the aim is to create integrated, humane, environmentally sustainable agricultural production systems. Maximum reliance is placed on self-regulating agro-ecosystems, locally or farm-derived renewable resources and the management of ecological and biological processes and interactions. Dependence on external inputs, whether chemical or organic, is reduced as far as possible.

In order to understand the problems of agriculture in Greece, one has to bear in mind several facts. In 1995, there were 774,000 farms in Greece with a total agricultural area of 5,148,000ha. The average farm size is about 6.6ha (http://www.organic-europe.net/country_reports/greece/default.asp).

Organic agriculture in Greece has its roots in the ecological movement at the beginning of the 1980s. The first organic farmers were mostly amateurs who experimented with different organic cultivation methods. Commercial organic agriculture started in 1982 with the demand for organic sultanas from a Dutch firm. 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 200ha. EU-Regulation 2092/91 brought about a major change. A number of farmers officially converted their farms to organic agriculture and this was encouraged further by the introduction of hectare subsidies in 1996 through the adoption of the EU-Regulation 2078/92. Despite this incentive, the development of organic agriculture within Greece has remained relatively slow, with the share of organically utilised area and the number of organic farmers reaching 0.6% of the overall country total by 2003 (SOEL-Survey, February, 2003) and still less than 1% of the total area by 2005. According to DIO (in personal communication), currently, just over 21500ha are cultivated organically of which 6700ha are given over to cereals, legumes (for animal feed) and medicinal plants (31% of the total organic area), 436ha to vegetables (2% of the total) and about 14500ha (67% of the total) are utilized principally for olives and to a lesser extent citrus and vine crops. In the year 2004, a total of 4668 enterprises were operating in the field of organic agriculture in Greece, representing an increase of 15% in comparison with the previous year. Of these, 3804 were active in crop production, 327 in animal husbandry and 537 in product processing.

MATERIALS AND METHODS

The case studies described were undertaken as part fulfilment of the Organic Farming module of the Postgraduate Specialization Programme in the Department of Sustainable Agriculture at the Mediterranean Agronomic Institute of Chania, Crete, Greece, where first year students were introduced to the principles and methods of organic framing. The organic farming case studies of outdoor horticultural crops and grape production were carried out in the prefecture of Chania, and that of greenhouse horticultural crops in the prefecture of Rethymnou, Crete. The organic farms which were visited and observed were selected on the recommendation of DIO, the organisation responsible for inspection and certification. The students and their accompanying tutors visited the horticultural and vineyard enterprises in early June 2005 so as to see the organic crops at an advanced stage of growth and to discuss the crops with the producers. The case studies are written on the basis of what was observed in the organic farming fields.

RESULTS AND DISCUSSION

The farm for the outdoor production of organic horticultural crops, the enterprise of Mr. Pagiavlas, was visited on 9th June 2005. The farm is located at Metochi-Kallyteraki in the prefecture of Chania at an altitude of 50m, with rainfall 400mm/year and a medium loam soil, which was mulched with plastic. It was turned over to organic farming in 1996 and has an isolation zone of approximately 50ha around as other organic farms have been developed. The farm was of a mixed type (vegetables and avocado trees) with an area of 1.5ha, of which only 0.5ha were planted with horticultural crops. The main crops grown on the farm all year round were: pepper, aubergine, tomato (cherry and table varieties), marrow, maize and blita (*Chenopodium album* L.), while during the winter season: lettuce, parsley, onion, garlic, radish

and vetch. In order to maintain soil fertility, the farmer added manure from chicken and rabbits to the crop rows as well as Patent K and N (25%), organic nitrogen (15.5N:40C), 6-5-13+2MgO (all Bioilsa organic certified fertilizers) and phosphorus derived from sugar beat , all delivered to the plants via drip irrigation. However, he did not compost.

Since weeds are a serious problem in outdoor horticultural crops, the farmer had implemented several strategies (mulching with black plastic, hand weeding, mowing and rotivation prior to sowing), although he had a tolerant attitude to weeds and some of them he considered as beneficial, like *Datura* to attract greenfly and blita, which is consumable. To protect plants from pest and diseases he had implemented several strategies. For control of pests, he used basil (*Ocimum basilicum* L.) against *Tetranychus urticae* Koch and *Datura sp.* against greenfly for pepper and aubergine, *Psytopseilus sp.* (natural enemy) and Vivere spray (basil extract + soap) against white fly and poison traps against mice, which are the biggest problem in certain years. For control of diseases, he used sulphur against powdery mildew, Ultradyne-C against *Botrytis*, copper-based compounds against fungi (3 sprays per season, 1g/l), whilst washing hands and tools with milk to counteract TMV. He also produced small amounts of organic seed from his own collection of varieties. The seed is for his personal use, as well as for a few colleagues.

Overall, the farm was working successfully since the farmer had never lost a crop and the enterprise was economically viable. He sells all produce locally and he is very well known in the cooperative and the local community. He is an ardent supporter of organic agriculture and has delivered many talks to local organisations and the media. The points where he showed failures are: virus infection of marrow, use of plastic for mulching, which is degraded in the field, failure to compost, which means he is dependent on imported high-cost fertilizers. In consequence the input:output ratio is not optimal. The points where he can make an improvement to the farming system are: decrease external inputs (fertilizer) by adopting a system of composting, arrange for better disposal of plastic from the mulch, or use a different mulch material, improve knowledge of soil fertility status to balance his inputs, improve seed production technologies (better isolation, improved extraction), possibly to increase the population of beneficial insects.

The second organic farm visited on 9th June was owned by Mr. K. Spandidakis and comprised 0.85ha of plastic covered greenhouse in the area of Plakia, Rethymnou. The farm was located at an altitude of 20m with rainfall 400mm/year which was shortly to be collected from the greenhouse roof and stored in a newly constructed 800m^3 reservoir. The farm turned organic in 1992/93 and consisted of mixed vegetables. At the time of the visit, 3 types of tomato (cherry, medium and large-fruiting), 2 types of cucumber (long and short), aubergine (black, oblong), pepper (flask-type) and melon (Galia-type) were being cultivated. All crops were grown from commercial hybrid seed of non-organic origin. Propagation was carried out under glass and plants, transplanted to the soil at the 3-4 leaf stage. Crops were grown from October to July. To assist soil fertility, the farmer added 200-250 tons per hectare of his own compost every two years. At the time of soil sterilization he added Biokalio and Ca fertilizers certified for organic crop production. He stated that weeds are not a major problem, since he carries out solar soil sterilization for 1 month in the summer. In addition, he owned weeding equipment and also practiced hand weeding. To monitor pest populations, blue and yellow sticky traps had been placed throughout the greenhouse. For pest management, a number of strategies were applied: successful control of whitefly with *Neocaris sp.* (natural population in the area), *Lyriomyza sp.* (leafminer) controlled by *Dacnusa sibirica* Telenga (added the parasite 3 times after transplantation). *Tetranychus urticae* Koch is a problem in summer, but is controlled by the addition of copper and sulphur, while there was no effective control for aphids. The diseases, *Fusarium – Verticillum* are controlled primarily by solar sterilization (possibly with addition of chitin, a process known as bio-fumigation), powdery mildew is controlled with soda and oil sprays or with sulphur, while downy mildew is controlled with sulphur or copper. The farm is managed by 5 persons. The farmer is apparently successful in that further investment is being made (reservoir, mist system). Overall he has good production and quality and sells at a high price to guaranteed markets. The production is sold directly to specific outlets in Athens. According to the farmer, one of his important successes was his compost, since this covered 60% of the total farm requirements. The compost, formed from sea algae, greenhouse debris and manure, is fermented for 3 months, turning every 15 days. The compost is exposed to the weather so that the rainfall will leach out the salt. Furthermore, the plastic is not degraded on the farm, but returned to the manufacturer.

The biggest failures of the farmer are insufficient control of *Fusarium* - *Verticillium* and nematodes. Effective aphid control is required since the crop was being terminated due to this problem. The biggest single disease problem is downy mildew in the winter. So far there was no effective control measure for it. Further development of the farm will include the use of rainwater from October, improved packing facilities and the introduction of more natural enemies of pests.

Our further suggestions to the farmer were to improve humidity levels in order to control downy mildew in the winter, to strike a balance between the use of traps and/or beneficial insects for pest control (plus perhaps net incorporation in the windows), to carry out regular soil checks and assess the salt content of the compost. The commercial seeds should be selected hybrids with greater resistance to soil-borne pests-diseases or alternatively he should consider grafting.

The third organic farm was visited on 19th June. Mr. Papadantonakis was the owner of 0.22ha of a four year old vineyard in the village Zounaki, prefecture of Chania, Crete. The field was located at an altitude of 105m, with rainfall 600mm/year only in the winter. The slope of the field was 25% and the soil type was clay. The field was protected from soil erosion by two channels dug above and below the field in order to prevent the downward movement of the soil. In addition, in the winter the vineyard soil is covered with a weed (*Oxalis pes-carpae* L.), which acts as cover crop to protect the soil from erosion. The vineyard was planted with 650 plants of which 85% was variety Romeico (red), 8% Mosckato Spinas (white), and the rest different varieties. All of them were grafted on to 41B rootstock. The vineyard has been cultivated organically since planting in 2001. There is no severe problem with weeds. However, the farmer rotivated the soil two times per year, once late in March and the second time in mid June, in order to remove the weeds. There was a drip irrigation system. The capacity of the drippers was 4 l/hour, the irrigation time 5 to 8 hours. This year, the vineyard has been irrigated once per month. Soil fertility is maintained by the addition mixture of 8kg compost, 1kg chicken manure, 100g patent Kali granules (0% N, 0% P, 30% K, 10% Mg) and 10g of boron per plant. The farmer tried to use vetch as green manure but without success because the weed (*Oxalis pes-caprae* L.) outgrew the vetch.

According to the owner, the most important measure that protects the vineyard from fungal diseases is the position of the rows (north-south), so that they are open to the sea, and the construction of a vineyard support system which provides good aeration of the field. Furthermore, correctly timed and good pruning is very important for disease protection. The farmer practiced green pruning twice in the spring, when the leaves infertile branches were removed. He also used sulphur and copper for fungal disease protection. The vineyard was treated with copper from the beginning of April and since then approximately every 15 days. The first application of copper (Kocide 101 WP, 2g/l) was when the shoots were 15cm long (1st April) in order to protect against *Perenospora sp.* At the second time of copper application, the farmer started to add sulphur (wettable and powder) at a concentration of 4g/l until flowering, after which the dosage was changed to 2g/l. The copper and sulphur were used to control *Oidum sp.*, while sulphur also controlled mites. The most serious pest was *Lobesia botrana* Schiff. which is controlled by Bt and good green pruning, since the pest likes humidity.

Overall, the farmer has excellent vineyard management and no serious problems.

CONCLUSIONS

Overall all three farmers are successful in their farming systems because they have not had serious failures or crop losses. However, there are certain improvements that they should make to their farms.

First, the most important consideration for the farmer of outdoor horticultural crops is to adopt a system of composting, which will decrease his dependence on high cost fertilizers and the input:output ratio will improve. Also, the farmer should find a solution for the better disposal of plastic from the mulch, or he should use a different mulch material. Since he uses seeds from local varieties that he produces on his own, he should work on improvement of seed production techniques.

With respect to the farmer producing greenhouse horticultural crops, the main point where he should consider is better regulation of humidity levels in order to control downy mildew in the winter. He should also attempt to find a better solution for soil born pests-diseases (Fusarium, Verticillium, nematodes) and since he uses commercial seeds he should select hybrids with greater resistance to soil borne pathogens, or alternatively consider grafting. Finally, he would be well advised to check the salt content of his compost prior to incorporation in the soil, since the algae are collected from nearby beaches and may have a significant salt content, which if leaching is insufficient could adversely affect the soil in the long run.With respect to the organic vineyard, the principal suggestion is to try alternative plants as green manure, i.e. species that are more competitive than vetch against Oxalis.

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