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Health and Production of Greek Organic Pig Farming: Current situation and perspectives

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Υγεία και παραγωγικότητα των ελληνικών βιολογικών εκτροφών χοίρων: Παρούσα κατάσταση και προοπτικές

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ABSTRACT. For many years, outdoor pig farming has been one of the most important livestock production sectors in Greece. Since the 1960s, the introduction of high-yielding pig genotypes, under intensive production systems, has replaced almost to disappearance the traditional -based on the native pig breed- outdoor pig farms.

Organic pig production systems in Greece are growing in popularity over the last years due to the increasing interest of consumers for organic products. The National Greek projects for organic pig farming started in 2002 and since then it has increased, representing the 15% of total organic livestock production in 2007. According to the Directorate of Organic Agriculture in the Ministry of Rural Development and Food, the development of organic pig farming industry in West Greece, Thessaly and North Greece was impressive from 2002 to 2007. A significant but more gradual development of organic pig farming was seen in the island of Crete, while insignificant development was observed in the Central Greece. The development of organic pig farming especially in the Northern part of the country started from 2003-2004 onwards.

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In 2002, the total number of organic pigs was just 1.288, while in 2007 it had reached 175.000 organic pigs in the country. However, a significant reduction has been noticed since 2008, mainly due to the national funding cuts for organic pig farming, as well as the increase of feeding expenses. Moreover, training and specialization of organic pig farmers and their investments on modernization and equipment / housing facilities were insufficient, resulting in animal health problems, poor growth performance, poor carcass quality and high-cost production.

The most common health problems in Greek organic pig farming are respiratory problems, gastrointestinal problems, claw and skin problems, parasitic infections and high piglet mortality. Increasing health problems were attributed mainly to poor housing conditions (predispose to various infectious micro-organisms), and the contact of organic pigs with rodents that act as tank of several pathogens (*Trichinella* spp and *Toxoplasma gondii*).

The housing condition of organic farming may predispose animals to various infectious micro-organisms, normally no longer present indoors because of the strict hygienic measures that are taken. An important risk factor in organic pig production is the more frequent, compared with conventional swine industry, in contact with rodents. Rodents are actors - tank of several pathogens, some of which are hazardous to public health, such as *Trichinella* spp and *Toxoplasma gondii*.

This report aims to present updated information about the health status, production and development of organic pig farming in Greece during the last decade, as well as the potential of this particular productive activity for future development.

Keywords: organic farming, pig farming, pork meat, consumer, Greece

ΠΕΡΙΛΗΨΗ. Για χιλιάδες χρόνια, η υπαίθρια εκτροφή χοίρων υπήρξε ένας από τους πιο σημαντικούς τομείς της οικόσιτης ζωικής παραγωγής στην Ελλάδα. Από τη δεκαετία του '60, η εισαγωγή χοίρων υψηλού γενετικού δυναμικού για τις ανάγκες της βιομηχανικού τύπου χοιροτροφίας, οδήγησε στην εξάλειψη της παραδοσιακού τύπου υπαίθριας εκτροφής χοίρων, που στηριζόταν σε αυτόχθονες εγχώριες φυλές χοίρων.

Η βιολογική εκτροφή χοίρων στην Ελλάδα, τα τελευταία χρόνια, παρουσιάζει σημαντική ανάπτυξη λόγω του αυξημένου ενδιαφέροντος των καταναλωτών για βιολογικά προϊόντα. Σε εθνικό επίπεδο η επιδότηση προγραμμάτων ενίσχυσης της ίδρυσης βιολογικών εκτροφών ξεκίνησε το 2002, παρουσιάζοντας σημαντική αύξηση, αντιπροσωπεύοντας το 15% της συνολικής βιολογικής κτηνοτροφικής παραγωγής το 2007. Αρχικά, το 2002, εντάχθηκαν στο πρόγραμμα της βιολογικής κτηνοτροφίας, χοιροτρόφοι από την Δυτική Ελλάδα, στη Θεσσαλία, στη Βόρεια Ελλάδα και στην Κρήτη. Σύμφωνα με τα στατιστικά στοιχεία της Διεύθυνσης Βιολογικής Γεωργίας του Υπουργείου Αγροτικής Ανάπτυξης και Τροφίμων, η ανάπτυξη της βιολογικής χοιροτροφίας στη Δυτική Ελλάδα, στη Θεσσαλία και στη Βόρεια Ελλάδα υπήρξε εντυπωσιακή για το χρονικό διάστημα 2002 - 2007. Σημαντική υπήρξε, επίσης, αλλά σε μικρότερο βαθμό και πιο σταδιακή, η ανάπτυξη της στην Κρήτη. Ωστόσο, από το 2003-2004 και μετά, άρχισε η ανάπτυξη της βιολογικής χοιροτροφίας και σε άλλες περιοχές, και ειδικά στη Βόρεια Ελλάδα. Το 2002, ο συνολικός αριθμός των βιολογικών χοίρων ήταν μόλις 1.288. Από τότε και μέχρι το 2005 παρατηρήθηκε μια σταθερή αύξηση, ενώ κατά την περίοδο 2006-2007 παρατηρήθηκε μια σημαντική αύξηση, φθάνοντας τον αριθμό των 175.000 βιολογικών χοίρων. Ωστόσο, από το 2008 παρατηρείται σημαντική μείωση, κυρίως λόγω των περικοπών στις κρατικές επιδοτήσεις για τη βιολογική χοιροτροφία, καθώς και της αύξησης των τιμών των βιολογικών ζωοτροφών και ειδικά των δημητριακών. Επιπλέον, σε πολλές περιπτώσεις, η ανεπαρκής κατάρτιση και εξειδίκευση των χοιροτρόφων καθώς και οι χαμηλές επενδύσεις τους σε εκσυγχρονισμό και εξοπλισμό των εκτροφών τους, είχε ως αποτέλεσμα προβλήματα υγείας των ζώων, μειωμένες αποδόσεις, υποβαθμισμένης ποιότητας σφάγια και υψηλό κόστος παραγωγής.

Στις βιολογικές εκτροφές χοίρων, οι απώλειες υγείας οφείλονται συνήθως σε αναπνευστικά και γαστρεντερικά προβλήματα, σε παρασιτώσεις και δερματολογικές παθήσεις. Κυρίαρχο πρόβλημα αποτελεί σε πολλές περιπτώσεις η υψηλή θνησιμότητα των γαλουχούμενων και απογαλακτισμένων χοιριδίων. Σφάλματα στη διαχείριση των εκτροφών όσον αφορά τις συνθήκες διαβίωσης, τις εγκαταστάσεις και τα μέτρα υγιεινής, αποτελούν σημαντικούς προδιαθέτοντες παράγοντες για την εκδήλωση ασθενειών. Ένας σημαντικός παράγοντας επικινδυνότητας στις βιολογικές εκτροφές χοίρων είναι η πιο συχνή, σε σύγκριση με τα συμβατικές εκτροφές, επαφή με τρωκτικά. Τα τρωκτικά αποτελούν "δεξαμενή" πολλών παθογόνων, ορισμένα από τα οποία είναι επικίνδυνα για τη δημόσια υγεία, όπως *Trichinella* spp. και *Toxoplasma gondii*.

Η παρούσα εργασία έχει ως στόχο να παρουσιάσει πρόσφατα στοιχεία σχετικά με το επίπεδο υγείας, την παραγωγικότητα και την ανάπτυξη και τις προοπτικές της βιολογικής εκτροφής χοίρων στην Ελλάδα.

Λέξεις ευρετηρίασης: βιολογική εκτροφή, χοιροτροφία, χοιρινό κρέας, καταναλωτής, Ελλάδα

Organic pig farming in Greece

INTRODUCTION – HISTORY

Organic animal farming is directly related to organic plant production because the nutritional needs of animals other than grazing are covered with organic feed. Greece has many comparative advantages in comparison to other countries in terms of organic farming, due to favorable pedo-climatic conditions, rich natural ecosystems in mountainous and semi-mountainous areas, as well as rich biodiversity of plant life (with a significant number of endemic plants in different geographical districts).

For thousands of years, outdoor pig farming has been one of the most important livestock production sectors in Greece. Since the 1960s, the introduction of high-yielding pig genotypes, under intensive production systems, has replaced almost to disappearance the traditional outdoor pig farming, that was based on the native pig breed. Organic pig production in Greece is growing in popularity over the last years due to the increasing interest of consumers for products considered as traditional or “naturally produced”. The National Greek funding projects of organic pig farming started in 2002. The contribution of organic pig farming in total Greek organic livestock farming was minimal until 2004, but since then, it has been increased, representing the 15% of the total organic livestock production as it is shown in Table 1.

Initially, producers from West, Central and North Greece, and the Island of Crete joined the first Gov-

ernmental projects in 2002. According to the statistic data of the Directorate of Organic Agriculture in the Ministry of Rural Development and Food (DOA 2012), the development of organic pig farming industry in West Greece, Thessaly and North Greece (Central Macedonia) was impressive from 2002 to 2007 (Table 2). Also, there was a significant gradual development of organic pig farming in Crete, and insignificant increase the rest – outside Thessaly- Central Greece. Since 2003-2004, the development of organic pig farming was remarkable in North Greece, especially in Central and West Macedonia, as well as in East Macedonia and Thrace (Table 2, Figure 2). Data referring to number of organic pigs in Greece are shown in Table 3, suggesting that the total the number of organic pigs increased significantly during the years 2006-2007. However, a significant reduction has been noticed since 2008 (Table 3, Figure 1), mainly due to the National funding cuts for organic pig farming, as well as the increase of feeding expenses. The prices of organic feedstuffs have increased remarkably during the last three years. Moreover, in many cases the training and specialization of organic pig farmers and their investments on modernization and equipment / housing facilities were insufficient, resulting in animal health problems, poor growth performance, poor carcass quality and high-cost production.

Genetic, diets, health problems

Swine breeds used in the Greek organic pig farm-

Table 1. Number of organic (free range) animals from 2002 to 2010 in Greece.

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Animals	Total number of organic animals								
Pigs	1.288	3.628	4.469	126.003	110.096	175.004	60.918	54.631	42.991
Cattle	7.760	13.834	14.671	22.900	22.292	25.102	20.254	28.618	23.109
Goats	66.472	174.657	215.291	288.815	305.222	388.508	296.967	309.060	226.556
Sheeps	56.374	95.824	133.619	216.897	259.275	408.576	316.243	357.499	288.923
Poultry	46.553	70.004	68.386	144.108	133.852	159.323	239.452	266.182	368.689

Source: Directorate of Organic, Agriculture. Hellenic Ministry of Rural Development and Food, www.minagric.gr

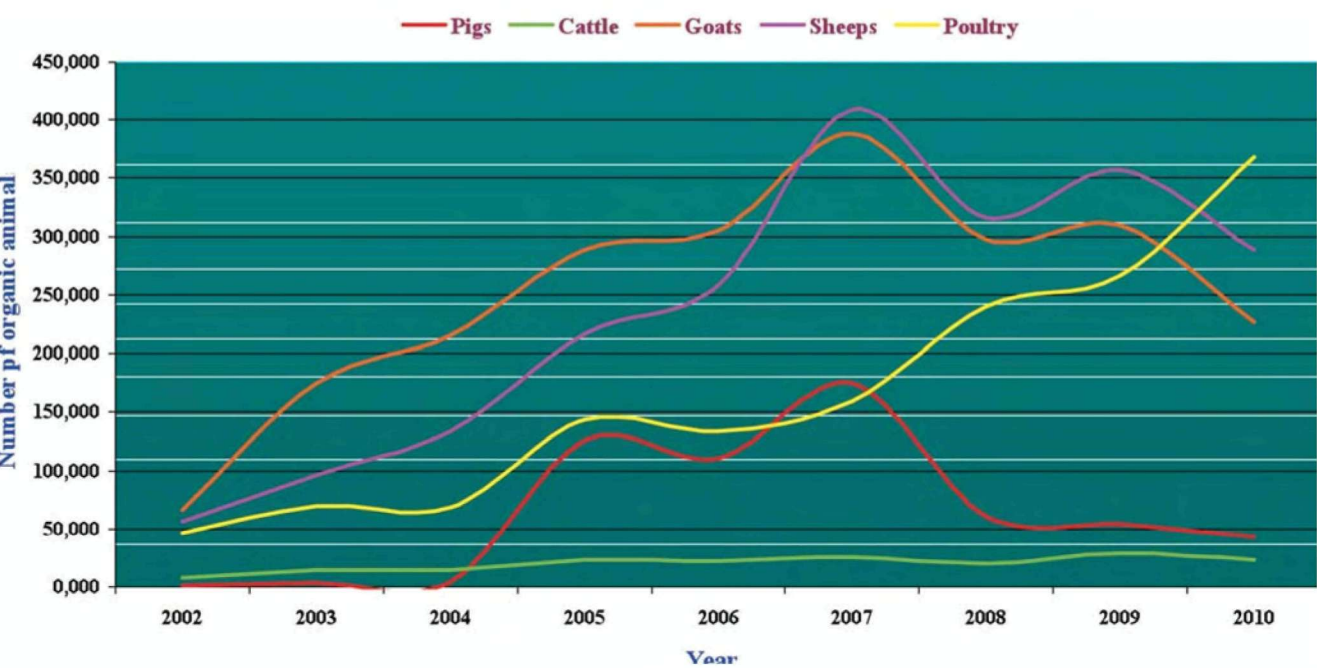


Figure 1. Organic livestock farming in Greece during 2002 - 2010.
Source: Directorate of Organic Agriculture, Hellenic Ministry of Rural Development and Food, www.minagric.gr

ing are types of Greek domestic swine and various domestic pigs derived from crossbreeding between male Greek domestic pigs and improved breeds, such as Large White and Landrace.

According to the legislation in force about organic pig farming, all animals should originate from organic farms, except the cases that are required to renew the herd, so it is allowed to entrance conventional pigs in a percentage of 20% or in a percentage of 40% in cases of increasing the capacity or of s changing of breeding stock. Therefore, the different Greek domestic swine breeds (which still exist up today in many mountainous areas) can be the initial breeding stock (sows and boars) of organic pig farms, that after a short period of just 4 months, could be a grandparent nucleus of sows which will be kept in the farm for producing its own organic gilts (Papatsiros 2011). In organic pig farming, organic feed have to be used, preferably from the same unit or another organic unit. However, it can be used to 30% transition feed, except where the feed from the same farm where the percentage is until 100%. Therefore, the function pig units, which produce their organic feed, could contribute significantly to securing the required quantities of feed and at the same time reducing production costs.

The most common health problems in Greek organic pig farming are respiratory problems, gastrointestinal problems, claw and skin problems, parasitic infections and high piglet mortality. The housing condition of organic farming may predispose animals to various infectious micro-organisms, which are rarely an issue for indoor intensive production systems where strict hygienic measures are taken (Papatsiros 2011).

High piglet mortality is observed in suckling and weaning piglets, mainly due to skin traumas or crushing of piglets by the sow, as well as diarrhoea syndromes. Moreover, respiratory diseases, arthritis and endoparasites are also frequent health problems in weaned pigs. Diarrhea syndromes in weaned pigs are caused by *Escherichia coli*, *Clostridium perfringens* infections and parasites, related hygiene of outdoor or indoor areas. In addition, respiratory problems in growing and finishing pigs, usually with pneumonia signs, are caused mainly by *Mycoplasma Hyopneumoniae*, *Actinobacillus pleuropneumoniae* and Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) infections (Papatsiros 2011).

Leg problems (lameness, hoof injuries and abscesses), reproductive disorders (variations in litter size and

abortions or returns-to-oestrus) and poor body condition are common health problems in sows. Genetic factors, diseases, ground condition in outdoor areas and mating management (increased social activity resulting in trauma) are the main risk factors for lameness in sows. Poor mating management regarding oestrus and pregnancy testing, synchronisation of oestrus in sow batches and poor body condition are regarded as important risk factors for reproductive problems in the herd. Similar findings are referred from other studies in organic pig farms in Europe (Feenstra 2000, Vaarst et al. 2000, Kampshof and Steverink 2001).

Parasite infections from *Sarcoptes scabiei*, *Trichuris suis* and *Ascaris suum* are very common in Greek organic pig farms. Studies have shown high prevalence of helminth infestations in organic outdoor pig production (Roepstorff et al. 1992, Carstensen et al. 2002). Another important risk factor in organic pig production is the frequent contact with rodents. Rodents are tank of several pathogens, some of which are hazardous to public health, such as *Trichinella* spp, *Toxoplasma gondii*, *Salmonella* spp, *Campylobacter* and *Leprosira*



Figure 2. Regions of Greece with most developed organic pig farming during 2004-2007.

Table 2. Development of organic pig farming in Greece during 2004-2007.

Region / Prefectures		2004	2005	2006	2007
Number of organic (free range) pigs					
West Greece	Aitolokarnania	1.367	7.624	8.338	9.437
	Achaia - Ileia	178	157	157	160
Thessaly	Larissa	1.093	4.437	5.812	4.676
	Trikala	93	927	882	1.168
	Karditsa	-	803	863	234
North Greece	Thessaloniki	345	2.152	2.870	3.583
	Chalkidiki	98	2.527	2.083	1.691
	Serres	72	1.127	2.173	3.443
	Kilkis	-	-	339	900
	Pieria	-	186	1.080	1.273
Central Macedonia	Imathia	220	459	299	438
	Grevena	57	712	3.972	6.120
	Kozani	60	302	332	422
	Florina	-	155	317	464
	Kavala	-	402	697	927
East Macedonia and Thrace	Drama	11	1.118	1.615	2.183
	Evros	-	541	1.185	2.101
Crete	Rethymnon	427	564	829	938
	Heraklion	-	170	113	48

Source: Directorate of Organic Agriculture, Hellenic Ministry of Rural Development and Food, www.minagric.gr

Table 3. Number of organic (free range) pigs from 2002 to 2010 in Greece.

YEAR	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total number of organic pigs									
Total number	1.288	3.628	4.469	126.003	110.096	175.004	60.918	54.631	42.991
Fattening pigs	1.238	1.648	1.856	**	87.669	69.180	18.835	14.791	11.435
Sows	18	752	2.557	**	20.345	18.200	17.066	16.315	13.630
Other pigs *	32	1.228	6	**	2.082	87.624	25.017	23.525	17.926

(* Including estimated young animals, (**) no published data

Source: Directorate of Organic Agriculture, Hellenic Ministry of Rural Development and Food, www.minagric.gr

spp. During 2009, a total of 826.618 pigs were tested for *Trichinella* spp. at slaughterhouses, including 2.892 samples from free range organic pigs. According to the National Reference Laboratory results, two positive samples were detected [one for *Trichinella britovi* and one for *Trichinella* spp. (unspecified)] in free range pigs' samples. It is alarming that one of these cases was connected with clinical signs of Trichinellosis in five persons of a family in northeastern Greece, who consumed undercooked wild boar meat from an organic pig farm (Boutsini and Kontos 2011).

Trends and Perspectives

Factors in pork meat market

The supply and demand for organic pork in the Greek market are one of the most significant factors affecting the survival and development of the Greek organic pig farming. In recent years, the sufficiency of Greece in pork meat is approximately 50%, which suggests that there are considerable opportunities in Greek swine industry development.

“Market competition” of organic and conventional pork meat can influence further development of the Greek organic pig farming. This competition is based on the lower prices of conventional pork and purchasing power of Greek consumers. An important advantage of organic pork meat is its high quality and the similar-to-conventional taste. Investigations in the Greek organic market have shown that consumers are willing to pay a 20-30% price increase for organic products, if they are sure that these products are of high

quality and safety.

The ‘new “kind” of consumer’, the “green” consumer is the main target group of organic pork meat market. “Green” consumer is environmental-sensitive and prefers environmentally-friendly or eco-friendly products. According to Koniari 2008, Greek women seem to be more sensitive than men on environmental aspects of meat production. Also families with dependent children, as well as Greek consumers in the age groups of 29-39 and 51-60 years and people with 30,001 – 40,000 € income/year show high environmental – sensitivity according to the same study.

There is no much available data for the prices of organic meat and meat products as prices diverge depending on the country and on the product. For instance, farmer price for organic pork in 2002 was about 2.46 €/kg on EU-15 average, but some countries had significantly higher prices like Greece (5.00 €/kg), Ireland (3.49 €/kg) and the United Kingdom (3.22 €/kg) (Napolitano et al. 2009). The average price premiums in EU for organic pork meat are about 62 %. Consumer price premium for organic pork cutlet (81 %) is higher than average farm gate price premium and ranged extremely from 0 % in Portugal to 165 % in Greece. The high divergence in consumer prices and price premiums reflect often the different sales chains used, i.e. consumer prices are usually much higher in organic food shops than in supermarket chains (Napolitano et al. 2009).

Furthermore, the higher production cost of organic pork meat, affects the development and market expansion possibilities significantly. Production costs can be

reduced by reducing maintenance costs and increase productivity of organic pig farming. The cost of maintenance can be reduced by using various coppices or woodland (mainly oak). The labor cost (less time spent on animal feeding) can be reduced also since organic - outdoor pigs are able to excavate the ground for roots, bulbs, etc. In addition, productivity growth in organic farms can be increased by improving the rearing conditions (eg construction of simple and well-designed facilities, use of infrared lamps for newborns in farrowing buildings) and the implementation of preventive measures (e.g., vaccination programs, treatments with phytotherapeutics) that reduce morbidity and mortality rates (especially during winter). Such interventions that reduce production cost and increase performance parameters were critical for organic pork farms' development in mountainous regions of North and Central Greece.

Factors of major significance in organic pork meat production

Good animal health and welfare is an important goal for organic husbandry, since animals are not just parts of the farming system: they are also sentient creatures and as such they should be given special moral considerations. The goals and principles of high animal health and welfare as well as the production of healthy and safe animal products of high quality present a challenge for organic livestock farming. Farmers have to develop a farming system, where animals are allowed to live in harmony with the surroundings and to experience a good quality of life, e.g. to allow the herd to perform natural behavior, emphasizing in the harmony of the group and the freedom of animals to make as many choices as possible. Farmers in such systems have to intervene when necessary and at first signs of disharmony in any aspect of the herd. Another major challenge is to avoid biosecurity risks when producing food from animals, because of the outdoor access and the group rearing which could lead to greater exposure to environmental contaminants. A potential conflict is the presence of zoonotic organisms, such as *Trichinella* spp., *Salmonella* spp., *Toxoplasma gondii*, *Campylobacter* spp., *Escherichia coli*, etc because organic herds have outdoor soil access and therefore there is greater risk of contamination by such bacteria than conventional herds.

The organic pig farming is facing the problem of the absence of many organic slaughterhouses. There are regions like Crete where the absence of organic slaughterhouses consist the major problem of organic pig farming.

Most Greek consumers do not seem to be aware of the meaning of balanced nutrition, but food borne hazards is the greatest worry (Zervas 2007). Their basic concern, apart from other personal selection criteria, is food safety that affects their preferences for specific types of animal products, according to value and trust criteria.

Disease prevention is a key point in organic (and conventional) livestock production. Health management by identifying and controlling the level of risk factors is therefore significant for organic farmers (Arsenos et al. 2004). Health and welfare problems in organic pig production may differ from problems in conventional pig herds as a result of differences in management. Control of animal health problems in organic herds includes restrictions in medicine use and prophylactic medication as well as the high risk of wildlife contact and difficulties in cleaning and disinfection due to animals' free access to outdoor areas.

The implementation of a health management and disease prevention program based on Hazard Analysis Critical Control Point (the HACCP concept) can be the basis for ensuring food safety and high quality of organic pork meat, through regular monitoring of disease-risk factors. The development of a HACCP system in organic farms requires the quantification of risk factors by means of epidemiological studies or alternatively by an expert panel (Bonde and Sorensen 2004). HACCP systems are characterized by continuous monitoring of the risk factor level in the operational health management on-farm. Instead of such monitoring the routine control of risk factors like hoof trimming at regular intervals to prevent hoof disorders causing lameness may be an alternative. Other options could be breed selection based on disease resistance or in general choosing more robust breeds in the production system. The general health status in the herd might also be improved by implementing Good Farming Practice codes such as sanitary measures, quarantine facilities for recently purchased animals as well as good rodent management measures (Meerburg et al. 2004). Disease monitoring by means of abattoir recordings or regular

blood or faeces sampling, followed by standard corrective actions in case of problems should be included in farms' health management programme.

The advantage of HACCP in herd health management is the preventive approach focusing on risk factors. The application of integrated veterinary management in organic pig farms will ensure the quality and safety of the produced organic pork, contributing beneficially to the competitiveness of this particular meat market. Furthermore other certification and quality assurance schemes (e.g. Agro 3 quality standard published by Agrocet 2008) based on the standards of "transparency" and "traceability" of the produced organic pork from "stable to the table" can be used in addition to an on farm HACCP system.

The financial and scientific support of Greek farmers could improve the current conditions in organic pig

farming. National - Governmental financial assistance and educational training programs (especially in young farmers) along with the creation of farmers' groups could lead to an increase of organic pig farming in Greece. According to Greek Marketing Academy the problems of Greek organic farming does not seem to be related with the product as such and how it is perceived by the consumer, but rather to the holistic functioning of the market (Photopoulos and Cristallis 2002). For this reason authors believe that to achieve a better development for the organic sector a spirit of cooperation among all interested groups and a high degree of confidence is required especially because there are several economic, social and psychological obstacles to overcome. ■

REFERENCES

- Agrocet – Hellenic Ministry of Rural Development and Food (2008). Agro Standards 3.1-3.5 – 2nd edition: Management System for pig meat quality assurance. Available at www.agrocet.gr Hellenic Ministry of Rural Development and Food publication
- Arsenos G, Banos G, Valergakis GE, Fortomaris P, Zygoiannis D, Proposed husbandry practices to ensure animal health and product quality in organic sheep and goat production systems. In: M. Hovi, A. Sundrum & S. Padel (Eds), *Organic Livestock Farming: Potential and Limitations of Husbandry Practice to Secure Animal Health and Welfare and Food Safety*. In Proceedings of 2nd SAFO workshop, 25–27 March 2004, Witzenhausen. University of Reading, Reading: pp. 101–113.
- Bonde M and Sørensen JT (2004) Herd health management in organic pig production using a quality assurance system based on Hazard Analysis and Critical Control Points, *NJAS-Wag J Life Sci* 52 (2): 133-143.
- Boutsini S and Kontos V (2011) Epidemiology –Diagnosis of Trichinellosis. In: Book of Abstracts, 2nd Greek Veterinary Congress for Farm Animal medicine, Food Safety and hygiene and Consumer Protection, Thessaloniki 18-20 March 2011: p. 174.
- Carstensen L, Vaarst M, Roepstorff A (2002) Helminth infections in Danish organic swine herds. *Vet Parasitol* 106: 253-264.
- DOA (Directorate of Organic Agriculture), Hellenic Ministry of Rural Development 2012. <http://www.minagric.gr/greek/3.6.4.html>.
- Feenstra AA (2000) Health Monitoring Study in Organic Pig Herds. Darcof Report 2/2000, pp. 107II2, 2000. www.darcof.dk/publication/rapport/daL2.pdf.
- Fotopoulos Ch and Krystallis A (2002) Purchasing Motives and Profile of the Greek Organic Consumer: A Countrywide Survey. *Br Food J* 104 (3/5): 232-260.
- Kampshof A and Steverink M (2001) Year Results Biovar Study Group 2001. <www.platformbiologica.nl/varkens/> Accessed 6 December 2004 (in Dutch)
- Koniari Ch (2008) The profile of green Greek consumer Department of Home Economics and Ecology. Harokopeion University, Athens, 2008.
- Meerburg BG, Bonde M, Brom F WA, Endepols S, Jensen AN, Leirs H, Lodal J, Singleton GR, Pelz H-J, Rodenburg TB, Kijlstra A (2004) Towards sustainable management of rodents in organic animal husbandry. *NJAS-Wag J. Life Sci* 52: 195–205.
- Napolitano F, Girolami A and Braghieri A (2009) Organic meat: market development and consumer willingness to pay. In: *Organic Farming: Methods, Economics and Structure*. Nova Science Publishers, Inc: pp. 1-14.
- Papatsiros VG (2011) Impact of animal health management on organic pig farming in Greece. *Biotechnol Anim Husb* 27(1): 115-125.
- Roepstorff A, Jørgensen RJ, Nansen P, Henriksen SA, Skovgaard J, Pedersen J, Andreasen M (1992) Parasites in organic pigs. Rapport over Projekt finansieret af Jordbrugsdirektoratet under Landbrugsministeriet. National Committee for Pig Production, Danish Bacon and Meat Council, Copenhagen: p. 36.
- Vaarst M, Roepstorff A, Feenstra A, Hogedal P, Larsen VA, Lauritsen HB, Hermansen E (2000), Animal Health and Welfare Aspects of Organic Pig Production. Darcof Report No 2/2000, 2000; pp. 77-78. <http://www.darcof.dk/publication/rapport/daL2.pdf>.
- Zervas D (2007) Consumers' nutritional habits and shopping preferences: a survey in Greek consumers. Department of Dietetics and Nutritional Science, Harokopeion University, Athens.