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OBSERVATIONS ON HAZELNUT ORGANIC FARMING

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Abstract

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In these last years the organic farming seems to be an innovative and interesting opportunity for the Italian and European hazelnut growers. After some historical introduction on the organic farming and on his origins, his basic concepts are delineated. The main pests and diseases of the hazelnut are listed and discussed and the methods of prevention and the allowed struggle for organic farming are mentioned. Specifically the proper practices of conducting with the organic system are listed and also the most recent European legislation, in this regard, is mentioned. The comparison between Italian and Turkish trials of organic and conventional hazelnut cultivation is reported. Unfortunately the first result is a loss of the yielding that could be recovered after 3–4 years of cultivation; this to allow the attainment of a biological equilibrium in the orchard. Another way to have the advantages of the organic farming without big drawbacks is to apply it in an intensive way just like it has been tried in Italy. Even if the hazelnut orchards organic management can penalize the production, the introduction of this method could be encouraged by: economical support from Regions and/or States, higher price of "biological" nuts, lower management costs and ideological reasons. As for the other crops also the hazelnut cultivation requires 3 years of conversion to enter into the organic system and also the rules to follow are quite heavy. Because this is not always so easy, the organic grower must be more and more professional than a conventional one.

Key words: biological nuts, hazelnut, nut quality, pest and disease, plant protection

Introduction

Since the release of the book "Silent Spring" (1962), Italian, European and international media (newspaper, magazine, radio and television), haven't lost opportunity to point out the "inconveniences" and the danger of using pesticides in agriculture. Good articles have been written by very able journalists, but often, completely ignorant about basic knowledge of agriculture, biology and chemistry. Conventional Agriculture is often showed as the worst polluter on the planet. This is probably due to the fact that its products are intended to human alimentation and perhaps also because its products are used to feed livestock which will be eaten by humans.

Some press campaigns have amplified the dangers of using pesticides in agriculture, often trespassing on psychological terrorism. As well known, the consumer is much more sensitive to what newspapers and television show, than to scientific evidence. This is because while the media make stir and inspire unjustified fears, the science publishes results on their own scientific journals that never reach the consumers.

One possible reaction to this state of affairs was the discovery, introduction and spread of "organic" agriculture, which has always found favour with a niche of consumers, but not yet the majority of them.

The introduction in agriculture of inorganic fertilizers and a lot of synthetic pesticides, even if with positive effects on the agriculture productions gave birth the first suspect of forecasted dangers of these "not-natural" substances introduced in agricultural production.

While the ecologist movement wasn't born yet, from 1940 the concept of organic agriculture and the first attempts of its application were introduced.

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The botanist Sir Albert Howard is considered the "father" of organic farming. In fact, working in Bengal in the first quarter of the twentieth century, he studied the traditional Indian farming practices (obviously without mineral fertilizers or pesticides) and described them deeming them superior to conventional agriculture.

Among the reasons able to explain the contrariness of Italian hazelnut growers to introduce organic management in their orchards, we could remember:

- the lower productivity (about 20–30%);
- the worse fruit quality;
- the manual de-suckering needing;
- the impossibility to control grass ground with herbicides.

On the other hand, the introduction of organic management in hazelnut orchard it could be encouraged by:

- economical support from Regions and/or States;
- higher price of "biological" nuts;
- lower management costs;
- ideological reasons.

In many countries, the Organic farming activity is regulated by apposite special laws. They're based on the IFOAM (International Federation of Organic Agriculture Movements) standards.

The organic management activity is regulated by specific protocols, which schedule what it's possible to do and what, on the contrary, is absolutely to avoid.

At this regard it must be mentioned that in Europe the organic agriculture control was regulated with the Reg. (CEE) n° 2092/91 concerning the organic productive method of agricultural yielding and foodstuffs production.

More recently a new regulation CE Reg. (CEE) n° 834/2007 abrogates all the previous regulation and indicates the standards for organic production and for organic products labelling.

In many countries, the production protocols indicates the agronomic practices absolutely forbidden and those permitted.

What's forbidden?

- Pesticides from chemical synthesis;
- chemical or synthetic fertilizers;
- OGM and their derivative products.

What's permitted?

Plant protection from pest and diseases:

A) with substances of origins :

- Animal (manure, kitchen manure etc.);
- Mineral (ash, rock powder) or
- Vegetal (algae, fats, husk compost, plants extract).

B) agronomic practices.

- Crop rotation;
- Green manure;
- Intercropping.

And we don't have to forget the practices like the physical elimination of twigs, branches, lateral trunks, when affected by parasites like Agrylus, aphids etc.

Pests and Diseases Control

The main hazelnut pest and diseases and their control admitted in organic farming are listed below with the products for its control admitted from organic farming protocols.

Bacteria: *Pseudomonas avellanae*, Xantomonas (Cupric salts).

Fungi: Armillaria, Rossellinia, Cytospora, Gleosporium, Alternaria (Cupric salts), Phyllactinia (Sulfur).

Insect

- Agrilus: its agronomic control requires the elimination of affected and damages branches.
- Aphids: an help could be from cocinellid predators (Aguilera-Puente, 2012); Eulecanium, Operoptera, Quadraspidiotus, could be controlled by Mineral and paraffin oils or Azidiractina, piretrine;
- Curculio: Following Sarraquigne et al. 2009, some results for the Curculio control, fungi treatments were less effective than nematodes. The control of insect pest of Curculionidae family, in Chile showed some potential and promising results with the use of entomopathogenic fungi (Sepulveda, 2012). In Slovenia, due to a large population of Curculio, the hazelnut organic management is absolutely not suitable (Personal communication from Anita Solar). A possible method to reduce the Curculio infestation could be the soil milling, at the end of winter, just to destroy Curculio pupae.
- *Cydia latiferreana*: in Oregon, the use of Feromone traps could be an alternative to pesticides used to control related lepidopterean pests like (Hedstrom, 2012).
- *Gonocerus acuteangulatus*, *Palomena prasina*: rotenone use; in an old work of my Institute (Roversi et al.,2007) it was clearly demonstrate the effect of summer pruning in reducing the attacks of these bedbugs. More recent investigations (Pansecchi et al., 2013) confirm the positive effect of both manual and mechanical pruning in controlling the percentage of kernels affected by bedbugs.
- Oberea, Xyleborus, Zeuzera: Their attacks could be controlled by Pheromones traps.
- *Phytoptus avellanae*: Sulfur.
- Scale insects: in Turkey, following Tuncer, their population could be controlled by *Verticilium lecanii*.

• Scolytidae: their contol could be made with the baited (Rebell® Rosso);

• denaturized ethanol with 1% toluol could be effective in mass trapping (Tuncer, 2009).

Unfortunately following Tuncer (2009), there's almost no studied on the effectiveness of pesticides approved in the organic production as kaolin, Spinosad, Neem and microbial formulations.

Of course the good vegetative plant status, the accurate soil management (to avoid asphyxia of the roots) destruction of affected plants, the disinfection of large pruning wounds or after a hailstorm, are all very important pre-requisite to have a very healthy hazelnut orchard.

Grass Control and Soil Management

The herbicides are absolutely forbidden and so it's possible to introduce grass covering between rows and milling on the rows.

Another alternative is grass cutting, 2–3 time/year, especially on pre-harvesting time.

Again, it's possible to mill the entire surface of the orchard, but not so deeply because hazelnut root system is quite superficial.

Orchard Fertilization

The most important goal is to increase the organic matter content of the soil. After plantation it's very difficult to incorporate organic matter in the soil, for this reason it will be important to enrich the soil by green manure or with fertilizers "certificated" as biological of animal origin (manure, poultry manure etc.).

Also some fertilizers of mineral origin (phosphorites, rock dust, ash etc…) are allowed because they aren't derived from chemical processes.

At this regard, we could present how the Turkish hazelnut growers fertilize their orchard: see Table 1

Table 1

How organic and conventional hazelnut orchards are fertilized in Turkey (Demiryurek and Ceyhan, 2009)

Input use	Organic	Conventional
Farm manure (kg/ha)	3000.0	2533.4
Organic fertilizer (kg/ha)	258.6	none
Lime (kg/ha)	1145.2	263.6
Nitrogen (kg/ha)	none	236.1
Phosphorus (kg/ha)	none	47.2

Suckers Control

For economic reasons, of course, manual de-suckering is not suggested.

The de-suckering in organic farming cannot be made through chemical or hormonal treatments. So, it must be handmade 2–3 time by years. Obviously it's a long, hard and expensive operation. In organic farming it's possible to do it mechanically or with flame or water steam.

While desuckering with flame begins to have some application in Langhe district (Italia), with very good results, water steam it's only at an experimental level.

The disbudding is still at an experimental level too, and the use of the no-suckering rootstocks is not yet widespread.

One of the main problems for hazelnut growers who desire to apply organic farming to their orchards, is the idea that it could bring a production lack.

Really this lack has been object of experimental trials and the results aren't always concordant.

From Demyurek and Ceyhan (2009) experimental data, the conventional management gives (Figure 1) a higher yield than the organic one. Anyway the net hazelnut income resulted higher in the organic, due to lower production costs.

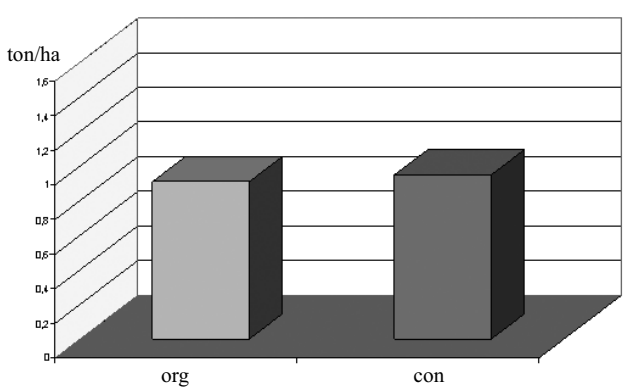

Fig. 1. Hazelnut production (ton/ha) in organic and conventional orchard management (from Demyurek and Ceyhan, 2009)

The average yield for 9 years (2003–2011) of observations, are reported in the following Figure 2.

Another Italian experimental work (Franco and Pancino, 2009), shows that in Monti Cimini (VT, in the Centre of Italy), the hazelnut grower apply (see Figure 3) the organic management of their orchards, in 2 different methods.

For organic management less specialized orchards in less suited areas with a yield of no more than 1.5 ton/ Ha were considered "*extensive*", whilst orchards with the land

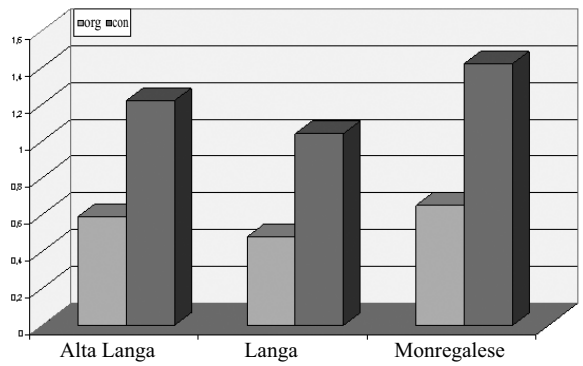

Fig. 2. Average of nine years of hazelnut production, as related to location and orchard management

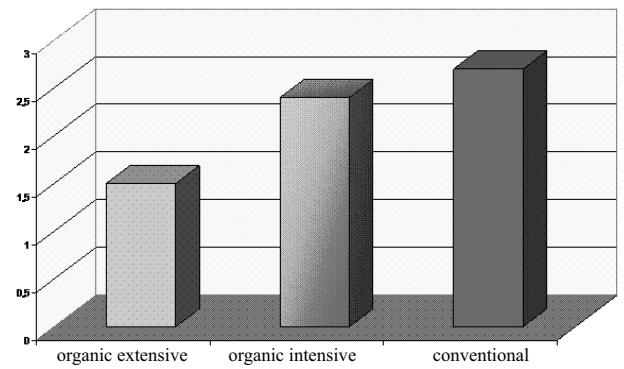

Fig. 3. Average yield (ton/ha) in orchard with organic or conventional management

dimension suitable to a greater mechanization, with a yield of more than 2.5 ton/ha, were considered "*intensive*".

Annual pruning, de-suckering and mineral fertilization were applied only in intensive orchards!

Some others information about the difference between extensive and intensive organic management, could be obtained from the following Table 2.

Table 2

Comparation of time (h/ha) required for some operations in extensive vs. intensive techniques for organic hazelnut orchards (Modified from: Franco and Pancino, 2009)

Operations	Organic extensive technique, h/ha	Organic intensive technique, h/ha
Pruning	15	18
Fertilization	2.5	4.5
Treatements	1.5	3.0
Harvesting	38.5	22.0

The comparative results among hazelnut orchard conventional managed and those organic managed in extensive or intensive way, are here summarized – see Table 3.

Table 3

Comparison of economic results of different productive techniques time (Modified from: Franco and Pancino, 2009)

Parameters	Organic management		Conventional
	Extensive	Intensive	
Yield, t/ha	1.5	2.4	2.7
Price, €/kg	2.45	2.45	2. 5
Variable costs, €	10 335	1100	1055
Gross margin, €	3.430	5.550	5.260

The results clearly show that orchards conducted with Organic management, considered as intensive, a production not so lower than conventional managed orchards.

On the contrary, a big difference is observed for the orchard in which the extensive organic management is applied.

Anyway the "gross margin" obtained in the orchard with intensive organic management, is higher than the one obtained with conventional management.

In international bibliography it is possible to find experimental works which compare qualitative differences between fruits obtained from organic agriculture or in a conventional way, but none of them related to hazelnut.

Anyway, some experimental works of my Institute showed differences about kernel defects. In particular, the percentage of kernel affected by bud bug damages is very high in nuts obtained from organic managed orchards. This was expected because in organic farming the use of synthetic pesticide is not allowed.

Despite to the mentioned important production lack, growers choose organic management in view of some elements which are: time saving for cultural techniques, the market answer for this kind of nuts, the higher price paid by the consumers and the financial supports from Piedmont Region.

The data, reported in Table 3 and Figure 3, suggest that, to apply effectively the hazelnut organic farming cultivation, the professional capacity of the organic grower must be at least the same or greater than the conventional one.

Of course the orchard must be established in a very appropriate soil, with correct plant spacing in orchards. Again, the cultural practice as soil management, ground grass control, plant pruning, mineral nutrition, irrigation (when needed) and diseases control with products permitted by protocols, must be applied at the highest level, to assure the best plants grow and healthy.

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