

THE PROCESS OF OBTAINING TRUFFLES THROUGH DIFFERENT METHODS OF MYCORRHIZATION IN THE ORGANIC SYSTEM

Marcela ȘTEFAN ¹

¹ Associate Professor PhD, Bucharest Academy of Economic Studies,
email: stefanmarcela57@yahoo.com

Abstract

Ecological or organic agriculture is aimed to obtain food and agricultural products fresh and genuine in accordance with the rules of natural factors. Organic farming is seen as a necessity for establishing the level of environmental quality of life; its perspective is to take into account the population eating with more natural products. The aim of this paper is to present different processes for obtaining truffles and their benefits. As well as, a reflection on the future research intended on increasing the production of truffles due to the fact that truffles are considered to be natural products, good for a healthy eating and therapeutic purposes.

Keywords:

Black truffles, mycorrhization methods, organic system

Introduction

Truffles are named by the searchers “the earth diamonds” and due to their high prices that are sold in the market, truffles have been gaining more ground worldwide. Even if there are hard to find, there are many seekers of black truffles in the world. For some of them, the extraordinary mushrooms have become grate business in the true sense. This research paper aims to analyse the different methods of micorrhization which are used in the truffle culture and their advantages for encouraging the cultivation of truffles. A deeply documented analysis of the literature and the analysis of statistical data from FAOSTAT are the base of this research paper.

For the first time, truffles were discovered by a sow that finding them in the ground they ate with great placer. Later, residents in several areas found these truffles or mushrooms as are referred to in the woods around the areas concerned and which too many people had not heard and did not understand why it took dogs with special senses to discover and will then be harvested.

Truffles are perennial crops, which are part of Agaricacea family, family that includes several species of edible mushrooms. Compared to other species, mushrooms truffles are outstanding, who have no foot and no hat, and their fruit resembles potato tubers, with a shape more or less round or slightly oval, variable size between 3- 10 cm in diameter.

Truffles are horticultural products obtained through the process of mycorrhization in symbiosis with the roots of hazelnut truffle mycelium.

Symbiosis – cohabitation is mutually beneficial form between two different species of organisms, such as the mycorrhiza, lichens and nodule.

Mycorrhiza – are symbiotic association between a fungus and the roots of higher plant assets.

Truffles are a species of edible mushrooms that grow in the soil from 4 cm to 40 cm deep, the roots of tree species such as oak, hazel, pine, beech etc. Nowadays they are found in both wild flora and in protected crops by planting trees inoculated with truffle spores, or mycorrhiza. The first uses of truffles date back 6,000 years ago when the ancients believed that truffles had magical powers aphrodisiacs. Francis I of France was the first to bring truffles to rank culinary delicacy, demanding that at its sumptuous banquets he mandatory seasoned with truffles to be the most important preparations. Also in France, Louis XIV

commissioned the first scientific research dedicated to cultivating truffles. Thus, the culture of truffles in France began to develop succeeding the late nineteenth century truffle production reached about 2000 tons of black truffles in a single year.

Many species of truffle are found in Italy, France, Spain, Australia and Romania. Due to the high quality that we have, under the two varieties of white and black truffles in the world occupy the first places among edible mushrooms. Diversity truffles are totalling about 110 species, many of them having only scientific value.

Currently, the number of truffles found in nature has a downtrend due to pollution and massive deforestation. Worldwide demand for truffles is quite high and amounts are variable, because the harvest is influenced by weather spontaneous 80%. Truffles are used in the food industry in the development of luxury gastronomic culture, pharmaceutical and cosmetic industry.

Due to their importance, the production and methods of growing truffles are analysed. The objectives of the research are to increase the truffle cultivation through different methods of mycorrhization in the organic system.

1. Materials and methods

Truffles are grown worldwide, so a relevant study, conducted in Europe 2000 shows that due to lack of significant rainfall, truffles harvested recorded a huge decline, a phenomenon that has influenced their price. Decreased truffles found in their natural habitat is influenced by the fact that there are many gatherers inexperienced that bring truffles from the earth with rudimentary tools, disregarding that can destroy root mushroom precious and that behind them there will be truffles except maybe in 4-5 years or even a decade.

Table 1 Truffle acreage worldwide (hectares)

	2010	2011	2012	2013	2014
Asia	18.918	19.478	20.005	22.781	26.314
Europe	459	679	698	697	786
Oceania	195	170	196	163	187
Australia	195	170	196	163	187
Worldwide	19.572	20.327	20.899	23.641	27.469

Source: FAOSTAT (2015)

Worldwide, mushrooms and truffles occupies an area of 27.469 ha, an increase of approximately 15% from 2010 to 2014. The largest areas are found in Asia.

Table 2 Total production of truffles worldwide (tonnes)

	2010	2011	2012	2013	2014
Africa	16.495	17.439	18.114	20.135	21.185
America	437.394	432.399	469.832	495.844	487.986
Asia	4.975.489	5.167.230	5.996.432	6.871.078	7.209.100
Europe	1.726.004	1.725.402	1.883.264	2.149.775	1.948.625
Oceania	52.051	49.508	59.580	56.377	60.070
Australia	52.051	49.508	59.580	56.377	60.070
Worldwide	7.207.433	7.391.978	8.427.222	9.593.209	9.926.966

Source: FAOSTAT (2015)

The production of mushrooms and truffles worldwide for 2014 according to data from the table above was 9.926.966 tons, an increase of 15% from 2010 to 2014. The largest production areas are found in Asia.

Table 3 – The area cultivated with truffles in Europe (hectares)

	2010	2011	2012	2013	2014
East	0	0	0	0	0
North	57	55	56	60	41
South	325	550	574	571	600
Romania	0	0	0	0	0
Europe	459	679	698	697	711

Source: FAOSTAT (2015)

Across Europe, in 2014 the cultivated area with mushrooms and truffles was 711 hectares, registering a growth trend as shown in the last 5 years. The largest areas have been cultivated in southern Europe.

In Romania, truffles have spawned a niche in the tourism industry in rural areas. The truffle tourism – how Romanian truffles named it, the Romanian branch of tourism can have a future because culture is a culture of truffles ecological land use on long validity, providing jobs for rural and bringing revenue to the local budget.

In Romania, crops truffles are found on large area surfaces flora spontaneous and quite small in protected crops so they could not be highlighted in the statistics, the only outstanding productions.

Table 4 – Total production of truffles in Europe (tonnes)

	2010	2011	2012	2013	2014
East	256.188	283.714	273.040	280.955	283.642
North	155.981	146.533	154.337	159.821	167.509
South	866.508	798.311	922.506	1.180.868	958.287
West	447.327	496.844	533.381	528.091	539.187
Romania	7.317	9.973	7.661	9.311	8.785
Europe	1.726.004	1.725.402	1.883.264	2.149.775	1.948.625

Source: FAOSTAT (2015)

The truffle, a fungus extremely rare and highly perfumed, which grows on the roots of certain trees from forests, is perceived as being extremely difficult to fumbling only by initiates gatherers, using dogs or gilts trained to do this work. The culture of truffles in Romania does not have a tradition and establishing a culture of truffles requires large investments with long-term recovery. The minimum cost of establishing a hectare is around 18,600 euros (15,000 euros excluding VAT). This is what adds cost containment field with irrigation system implementation. Purchase of small machinery or equipment maintenance culture (disking, mowing, and spraying possibly) is also taken into account for those farmers who do not already hold.

2. Results and discussions

When setting up an orchard of hazel truffle as dust extraction using amendments and fertilizers are used as synthetic nitrogen and phosphorus, which is spring and only intervenes where necessary. The distance between rows is 3.5 meters and 4 meters between trees and density is 700 trees per hectare. Seedlings a year are protected polycarbonate

tubes, which provides a microclimate warm in winter and cool-preserver moisture in summer. For a culture with truffles is recommended the same range of general works like any plantation of fruit growing. It will make cleaning plant saplings around the diameter of one meter for the plant to develop in the best conditions. Important is that the weeds and the grass not to consume the organic material found in the ground.

Milling in the first year after planting is done two to three times. It is also recommended annual soil analysis, which cost the client around 200 euros per year, to ascertain whether there are changes in the pH of calcium and other nutrients, because truffles are very sensitive to imbalances. In terms summers more drought, should be watered every day, as root, the most important part of the plant cultures pride, not in want of water, but cannot use water on the network because it contains chlorine and destroy mycorrhiza. Treatments are not. They are only in specific cases, and even special and are made only with organic substances, not to negatively influence the development of mycorrhiza.

The first yield of truffles, at the earliest, can be harvested in the third year. Because in the process of micellization lab developing root is cut, all the sap goes into the system and peripheral implicitly roots develop over the years not down, but the soil surface, often in harvest truffles are just above and in the early years on the surface, just off the stalk. Typically, the depth of which truffles grow is 15-20 cm below the ground level. When truffles grow, the substance which exudes maturity when they destroy vegetation around them and actually looks like a halo, like a circle without vegetation around the plant. Then, it can be sure that there, at the root of that tree truffles are growing. In addition, we use a dog and you pinpoint the location of truffle. When he tries to dig the dog's back and gave his driver, owner, go and seek truffle. Search truffle will not involve illness never root. During contact with the root of man's minimal. Often there is no direct contact with the roots.

The nose is connected by a filament thinner than a hair, which connects the truffle and root, but it is clear that the nose can sometimes be in the root. In addition, any seeker with common sense and respectful towards nature nose clean over the hole in the ground which is then soaked enhance and he falls back into the pit and plugged that hole immediately. If the soil should be transparent, truffles should imagine them like fruit stalks related to root through some thinner than a hair.

The species of trees that can be inseminated with truffle mycelium are varied. In Romania, most customers opted for hazelnut plantation mycorrhiza, but most species are oak and hornbeam recommended, because the productions give better yield. Generally, the growers prefer hazelnut, because while a plantation of oak gives exclusive truffles and truffle gives one hazel and peanuts. However Oak productivity period is longer, reaching up to 50 years, unlike hazel, where the period is only 30-35 years. It also occurs the output gap between hazelnut and oak mycorrhiza mycorrhizae. Oak Plantation for a mature production is around 250-300 kg / hectare, while in hazelnut production is 15% lower than oak.

Conclusions

Cultivation of black truffle has become an important agricultural alternative in rural regions due to its success in relatively harsh conditions, its high market value and diminishing production in natural areas. Truffle business seems to be a winning bet in advance, but in reality there are certain risks that must have in mind. First, to get a good profit from plantation trees as mycorrhizae it requires an investment up to 20,000 euros per hectare. In Romania it is recommended to be hazel plant in order to benefit from early harvest or oak for a long life production of up to 50 years. In the first case, the investor can be able to harvest truffles after 3-4 years. In this case, the advantage is that farmers can harvest and sell including peanuts, priced at 5 euros per kilogram. If oaks, production will occur only in the eighth year after planting, when you can harvest an average of 150 kilograms per hectare truffle.

For one hectare, about 700 saplings are required and should take into account also the costs for soil analysis, milling, cleaning herbs, watering (in dry periods). In Romania, the soil which is the best suitable for truffles cultivation it can be found in the Transylvania region. In general, the truffles are sold at prices above 100 euros per kilogram, but white truffles which are the most common can be priced above 3,000 euros per kilogram, the average price is around 1000-1500 euros per kilogram. Truffles' consumers can buy a jar in certain stores or they can order from the restaurant, so the price of serving pasta with truffles exceeds 30 euros in Bucharest.

Then there is the final part of oak wood, which can lead to a hectare, say at least one every cubic meter of oak. If per hectare are 700 trees and currently one cubic meter of oak is 400 euros then, the revenues from timber means 280,000 euros. In terms of forest, interspersed if two species are put together, it creates competition and the plant grows much better.

The advantages which encourage the cultivation of truffles through different methods of mycorrhization are:

- Long term land use;
- An ally against soil erosion;
- Tourism truffles, a branch of rural tourism;
- Green space, environmental enrichment;
- Create jobs in rural areas;
- Revenues for local budgets;
- High economic value crops.

Even if there are a lot of benefits, there also remain major issues regarding the management practices to ensure successful black truffle production. However, globally, the demand of growing truffles and amounts collected are increasingly smaller, so no need to worry about demand, provided you export oriented.

References

1. Andrés-Alpuente, A., Sánchez, S., Martín, M., Aguirre, J., Barriuso, J. (2014), Comparative analysis of different methods for evaluating evergreen oaks mycorrhized with black truffle, *Mycorrhiza* 24 (1), 29-37.
2. AGROINTEL *Magazine*, (2016), <http://agrointel.ro/>.
3. BENCUIVENGA, M., DI MASSIMO, G., DONNINNI, D., BACIARELLI FALINI, L. (2009), The cultivation of truffles in Italy, *Acta Bot Yunmanica* 16, 21-28.
4. BOUTAHIR, S., IOTTI, M., PIATTONI, F., ZAMBONELLI, A. (2013), Morphological and molecular characterization of Tuber oligospermum mycorrhizas, *Afr J Agric Res* 8 (29), 4081-4087.
5. COCIU, V. (2006), Nut corps, *Cares*, Bucharest.
6. DUELL, G. (2012), The President's Report [online], *The National Conference of Australian Truffle Growers Association*, available in <http://www.trufflegrowers.com.au/wp-content/uploads/2012/09/2012-Presidents-Report.pdf>.
7. STEFAN, M. & MANESCU, B. (2002), Compared horticultural systems, ASE, Bucharest.
8. FAOSTAT (2015), <http://faostat.fao.org/>.
9. HALL, I., BROWN, G. & BYARS, J. (1994), The black truffle, 2nd Ed. *New Zealand Institute for Crop and Food Research*, Christchurch, New Zealand.
10. HALL, I.R., BROWN, G.T. & ZAMBONELLI, A. (2007), Taming the truffle, Timber Press, Portland.