

A project to develop truffle-growing in Sicily

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Abstract. A project investigating natural truffle-beds in Sicily is presented here, with preliminary data on recorded species and ecological features.

Key words: agricultural and forestry administration, Sicily, truffles

Introduction

From the second half of the 1980s, throughout Italy, truffle growing has attracted interests and resources of private operators and institutional corporations. In the same period several different techniques were proposed for the planting of artificial truffle-grounds using expensive mycorrhiza plants.

Sicily, along with other regions, was an object of this interest and as a consequence several truffle-grounds were established which, in most cases, were unproductive, having been planted without any consideration for the ecological requirements of each truffle-species and without the support of suitable and exhaustive research experience and on-site experimentation.

In spite of this discouraging experience, it should be emphasized that at both national and a regional levels there is the expertise to face and overcome such difficulties.

In the last two decades, in particular, valuable experience has been gained through some of the national projects carried out by the C.N.R. (Progetti strategici C.N.R. – *Tuber: biotecnologia della micorizzazione*) and by the MiPAF (Progetto Finalizzato – *Incremento della produzione tartuficola*).

Sicily was excluded from those projects for almost their entire duration because, for a long time, truffle-cultivation was considered irrelevant there. A turning point came through the MiPAF project “Incremento della produzione tartuficola”, when as a result of stimulus from officials of the “Ministero Agricoltura e Foreste”, the project co-ordinator Dr Augusto Tocci and some officials of the “Servizi allo sviluppo della Regione siciliana”, a Sicilian “Unità Operative” was set up and financed under the supervision of Prof. Giuseppe Venturella from Palermo University.

This new “Unità Operative” has started intense mycological exploration integrated with ecological observations aiming at locating high quality potential sites for truffle production and naturally occurring truffle-grounds in Sicily. In particular, field trials have been started with the aim of:

- establishing the presence of truffle species in Sicilian forests;
- evaluating ecological requirements of the truffle species found there;
- defining geomorphological, pedological and ecological climatic areas potentially favourable for quality truffle-growing.

In June 2001 the “Dipartimento di Scienze Botaniche dell’Università di Palermo” organized, within this MiPAF project, some programmed excursions in Sicily to locate natural truffle-grounds. Researchers of other organizations involved in the project, officials of the “S.A.A. DELLA Regione Siciliana” and truffle hunters from Tuscany and Piemonte with trained dogs all took part in these surveys.

During the excursions, natural truffle-grounds were located in the provinces of Messina, Palermo, Agrigento, and Siracusa and the species found was the *Tuber aestivum* Vittad. The discovery of these truffle-grounds finally confirmed that Sicily too, as had been long suspected, is a land suitable for truffle-production.

The “Assessorato Agricoltura e Foreste della Regione Siciliana” considering the first promising results obtained from the project “Incremento della produzione tartuficola” of the MiPAF during the year 2002, planned a regional three-year research project *Progetto per lo Sviluppo della tartuficoltura siciliana* to be financed within the “Programmi interregionali (L 499/99)”.

The regional administration has become involved in this project because it believes production and marketing of truffles could become a significant resource for exploitation of some marginal areas. Another priority of the regional administration is to make the experimental results obtained available to those interested, thereby promoting rational decisions about which species to plant, which symbiont to use, which environments to select and what cultural techniques to adopt.

The increasing interest in truffle-growing is connected with the possibility of increasing production, both with intervention of recovery safe guard and expansion of natural truffle-grounds, and by establishing new plantings, using results acquired from recent research carried out on truffle biology and ecology.

There is also a growing interest for truffle and mushrooms as products to the region's portfolio of typical local products. For truffles, there is particular interest in high quality and high economic value species such as *Tuber magnatum* Pico, *T. melanosporum* Vittad., *T. aestivum*, and *T. borchii* Vittad. Some of these species occur naturally in Sicily. Their quantity varies each year according to the weather. Given a crisis in certain traditional agricultural sectors, Sicilian farmers, lured by advertising and the promise of easy money, have already planted several hundred thousands mycorrhiza-bearing plants.

These have not turned out to be productive because ecological requirements were not taken into account, and technical support based on experience from experimental studies was not available.

The *Progetto per lo Sviluppo della tartuficoltura siciliana* has therefore the purpose to identify hitherto unrecorded natural truffle-grounds in Sicily and to assess whether commercial use of truffle-grounds is possible.

Objective of the project

The project's objective is to achieve a general improvement in knowledge of *Tuber* species present in Sicily, particularly the most valuable ones. The aim is to give interested operators the possibility of making rational decisions and to encourage growth of interest in the subject, based on scientific results specifically relating to local production, typification, and marketing of truffles.

In particular the project aims to:

- locate new natural truffle-grounds in Sicily, in addition to the few already known;
- deepen floristic, ecological, and phytosanitary studies in existing natural truffle-grounds;
- define geological, morphological, and pedoclimate characteristics favourable for production of *Tuber magnatum*, *T. melanosporum*, and *T. aestivum* in Sicily;
- produce 1:250000 scale maps of areas favourable for truffle-growing;
- establish practices conducive to more rational use of natural truffle-grounds;

- stimulate natural production of truffles, inside the natural truffle-grounds, by planting trees with the correct mycorrhizal symbionts while maintaining a healthy ecosystem in the area, by monitoring and carrying out rational environmental management;
- identify ecotypes for local truffles that can constitute the bases for the production "in situ" of mycorrhizal seedlings;
- monitor the mycorrhizal process in vivo;
- synthesize in vitro mycorrhizas of truffle species and their natural hosts (pine, oak etc.);
- demonstrate successful adaptation by mycorrhizal plants, obtained in vitro, to open field conditions;
- prepare experimental truffle-grounds in environments identified as favourable on the bases of the floristic, pedological, and phytosanitary studies;
- teach local growers new procedures for truffle-growing based on best practice;
- activate linked economic activities through marketing of local truffles, restore and exploit marginal areas, stimulate breeding of truffle-dogs, and encourage farmers to remain in agriculture by creating new working opportunities.

Phases of the research

The project's first year activities were directed towards:

- identification and mapping of areas potentially favourable for truffle-growing using existing information and characteristics of soil, climate, and vegetation;
- identification and mapping of natural truffle-grounds with the aid of trained dogs;
- ecological characterization of the natural truffle-grounds;
- pedological characterization of the natural truffle-grounds through the description of mini-profiles and through physical and chemical laboratory analyses of soil samples (total and active CaCO₃, pH in H₂O and KCl, organic Carbon levels, assimilable Manganese, soil structure and stability, soil skeleton contents, weaving, and all other necessary parameters for complete and exhaustive site characterization);
- taxonomic classification of truffle specimens found during this work, with identification of possible clones;
- pedoclimate characterization of natural truffle-grounds.

In the two year period 2004/2005 the following further activity is planned:

- periodic reviews of truffle areas already identified and listed, to monitor the changes;
- identification of new possible truffle areas;
- integration of pedological information with analysis of soil samples to identify the characteristics of the new truffle-grounds, and periodic observation on the degree of soil dampness in summer months;
- updating maps;
- expansion of natural truffle-grounds;
- establishment of artificial experimental truffle-grounds.

Research institutions and cooperators involved

The complexity of the natural truffle-ground ecosystem imposes a strategy of research based on a multidisciplinary approach which is only possible through close cooperation between research institutions and the “Servizi allo Sviluppo” of the “Assessorato Regionale Agricoltura e Foreste”.

The “Assessorato” plans, coordinates and, in part, carries out the project while the Research Institutions provide supplementary contributions.

The “Unità Operativa di pedologia e cartografia tematica” of “Servizio IX” of the “Assessorato Agricoltura e Foreste” and the “Istituto sperimentale per lo studio e la difesa del suolo” (MiPAF section of Rieti) are working on geopedological characterization of natural truffle-grounds and on mapping (scale 1:250000) areas potentially favourable for truffle-growing.

The “Laboratorio di Micologia del Dipartimento di Scienze Botaniche dell’Università di Palermo” in co-operation with the “Dipartimenti della Facoltà di Agraria dell’Università di Palermo” and the “Facoltà di Scienze Matematiche, Fisiche e Naturali” (for entomology, bryology, and lichenology), the “Istituto Sperimentale per la Selvicoltura di Arezzo” and the “Dipartimento di Biologia Vegetale e Biotecnologie Agroambientali” of the University of Perugia is responsible for evaluation of the fungal vegetative and ecological characteristics.

The “Laboratorio di Micologia Applicata del Dipartimento S.EN.FI.MI.ZO.” of Palermo University is responsible for evaluating the phytosanitary state of truffle-grounds, for mycorrhizal syntheses and verification of the adaptation of plants produced in vitro to open field environmental conditions.

The “Servizi allo Sviluppo dell’Assessorato Agricoltura e Foreste” through its central and peripheral Operational Unities, are also actively involved in the project.

In particular, the “Unità Operativa n. 45 S.R.As.” is responsible for co-ordination of the project while the “Unità Operativa n. 49 di pedologia e cartografia tematica” and the “Unità Operativa n. 50 di Agrometeorologia” deal with pedological, climatic and cartographic aspects.

The peripheral “Unità Operative” n. 70 of Sant’Agata di Militello (Messina), n. 84 in Palazzolo Acreide (Siracusa), n. 116 in Paceco (Trapani), and n. 107 in St. Giovanni Gemini, besides supporting the Research Institutions and the other specialistic Operative Unities in this activity, also co-operate to locate productive sites using a trained dog, and to carry out experimental field surveys with researchers and technicians of the specialized Operational Unities involved in the project.

First year activity

In June 2003, the “Servizi allo sviluppo” acquired a trained dog which was entrusted to Dr Giuseppe Giarrizzo of the “Unità Operativa” 116 in Paceco.

From mid-June to mid-July, despite climatic conditions unfavourable for formation of fertile bodies, numerous sites were tested with the aid of the trained dog, and 8 new truffle grounds were located in the provinces of Palermo, Messina, and Siracusa (Tab. 1). The truffles were of the species *Tuber aestivum* and were found in oak woodland or in mixed woodland containing oak, at altitudes varying from 400 to 950 m.

Table 1. Truffle-grounds located in the first year of activity (June 2003 - May 2004)

Date	Province	Altitude (m)	Species
14 Jun 2003	Palermo	630	<i>T. aestivum</i>
14 Jun 2003	Palermo	1000	<i>T. aestivum</i>
15 Jun 2003	Trapani	450	<i>Genea</i> sp.
16 Jun 2003	Siracusa	600	<i>T. aestivum</i>
16 Jun 2003	Siracusa	540	<i>T. aestivum</i>
17 Jun 2003	Messina	630	<i>T. aestivum</i>
24 Jun 2003	Palermo	630	<i>T. aestivum</i>
8 Jul 2003	Messina	950	<i>T. aestivum</i>
9 Jul 2003	Messina	1000	<i>T. aestivum</i>
26 Feb 2004	Trapani	650	<i>T. borchii</i> , <i>T. puberulum</i> , <i>T. excavatum</i>
7 Apr 2004	Trapani	650	<i>T. borchii</i>
14 Apr 2004	Agrigento	950	<i>T. puberulum</i>
14 Apr 2004	Agrigento	100	<i>T. puberulum</i>
8 May 2004	Trapani	650	<i>T. borchii</i>
10 May 2004	Agrigento	900	<i>T. puberulum</i>
10 May 2004	Agrigento	1000	<i>T. puberulum</i>

In 2004 from mid-February to mid-April, 4 more truffle grounds were located in the provinces of Trapani and Agrigento. In this case the species *Tuber borchii*, *T. puberulum* Berk. & Broome, and *T. excavatum* Vittad., were found in native pine woodland mixed with other conifers and oak at altitudes from 650 to 1000 m.

All natural truffle-grounds were found on soils that, at the first control, was found to have evolved on rich substrata in limestone and were in every case characterized by the presence of oak trees.

The new sites have been characterized for their ecology and are the first components for new maps of Sicilian natural truffle-grounds and of areas favourable for truffle-growing.

In some sites considered more interesting, instruments will be installed to define the pedoclimate.

Besides identifying soil and environmental characteristics necessary for producing truffles, another important objective of the project is scale 1:250000 maps of areas potentially favourable for truffle-growing, using existing information and soil, climatic, and vegetative characteristics. Where a suitable soil database based on direct field observations is unavailable, the first draft of the map will use data about rocks and climate, and results of the first findings of carpophores in the field. For this, the geological map of Sicily (scale 1:100000, drafted within the "Piano Cave" by the "Assessorato Regionale all'Industria") and climatic data (from the "Unità Operativa di Agrometeorologia del Servizio IXdell Assessorato Agricoltura e Foreste della Regione Siciliana") are being used with appropriate re-scaling. The first approximation was made using the geological map of Sicily, excluding outcrops clearly not producing soils favourable for truffle-growing (e.g. vulcanite, metamorphic rocks, coastal sand dunes etc.). More data from field comparisons, pedological, and climatic information will be inserted as it becomes available. Climatic information, for places where carpophores have been found, has also been established.

Autumn exploration of the sites was fruitless probably because of extraordinarily high summer temperatures and absence of rain in July and August. This may have affected the fungal mycelium.

Unfortunately, therefore, the unusual weather this year did not permit planning of regular and systematic searches for carpophores or pedological study of the site.

Information about caves is now being reviewed and the number of sites to be surveyed will probably increase in the near future. Co-operation with regional producer associations could enhance the results of the project. In consideration of this co-operation, a survey file about artificial truffle-grounds established so far in Sicily, has been prepared. From this investigation will emerge both the distribution of the those truffle-grounds on each regional territory and the location of those already in production.

For the latter, where land-owners permit, the project will carry out field surveys to record productivity and pedological and climatic characteristics.

General considerations

The research carried out during the first year of activity of the project for the development of truffle-growing in Sicily, has shown that different species of truffle (*Tuber aestivum*, *T. puberulum*, *T. maculatum* Vittad., *T. borchii*, *T. panniferum* Tul., *T. excavatum*) can be found in Sicilian provinces. Natural truffle-grounds require soils evolved on substrata rich in limestone and characterized by the presence of oak trees. It is important however, to add that some truffles have been found in coniferous woodland recently planted and without any oak trees (Camarata in the province of Agrigento).

These first results suggest this fungus may have in Sicily an economic importance worth further analysis and study for a full understanding of its qualitative, productive, and economic potential. Such an undertaking by the public administration is justified, above all by the fact that truffle-growing is totally compatible with the safeguard of the environment, of natural resources, of the soil and of forest gene pool resources, so that cultivation is totally in line with national policies.

MiPAF, having assessed the experience of the previous and finished project, has fixed a meeting with the Regions and the autonomous Provinces with the purpose of defining guide-lines for research for a possible future project that will be started in the near future.