

# Spanish trufficulture



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Trufficulture is one of the few agro-forestry profitable activities that grows in the Mediterranean area.

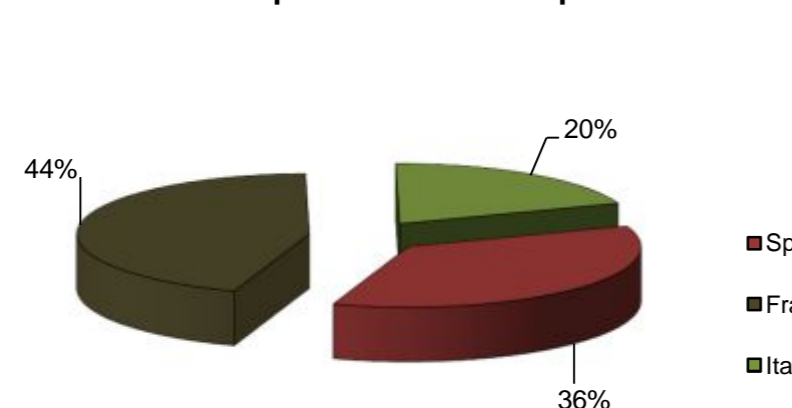
The history of the Spanish trufficulture began with the wild-truffle hunting, that starts strongly in the 50 decade of the past century and persist nowadays; and the development of the black truffle plantations, which started in the 1970s and between them stands out Arotz's plantation in Soria with its 600 ha and producing more than 2,500 kg per year.

Currently, production in the forest is going down and the majority of the plantations begin its production being it more than the one in the wild. In the Mora de Rubielos market (Teruel), more than the 40% of black truffles come now from plantations, increasing in years with low rain. Many times, plantations have the economic support of the public administration, so every year more than 500 ha are installed. At the same time, there is a group of more than 15 nurseries that produce annually more than 200,000 mycorrhized seedlings.

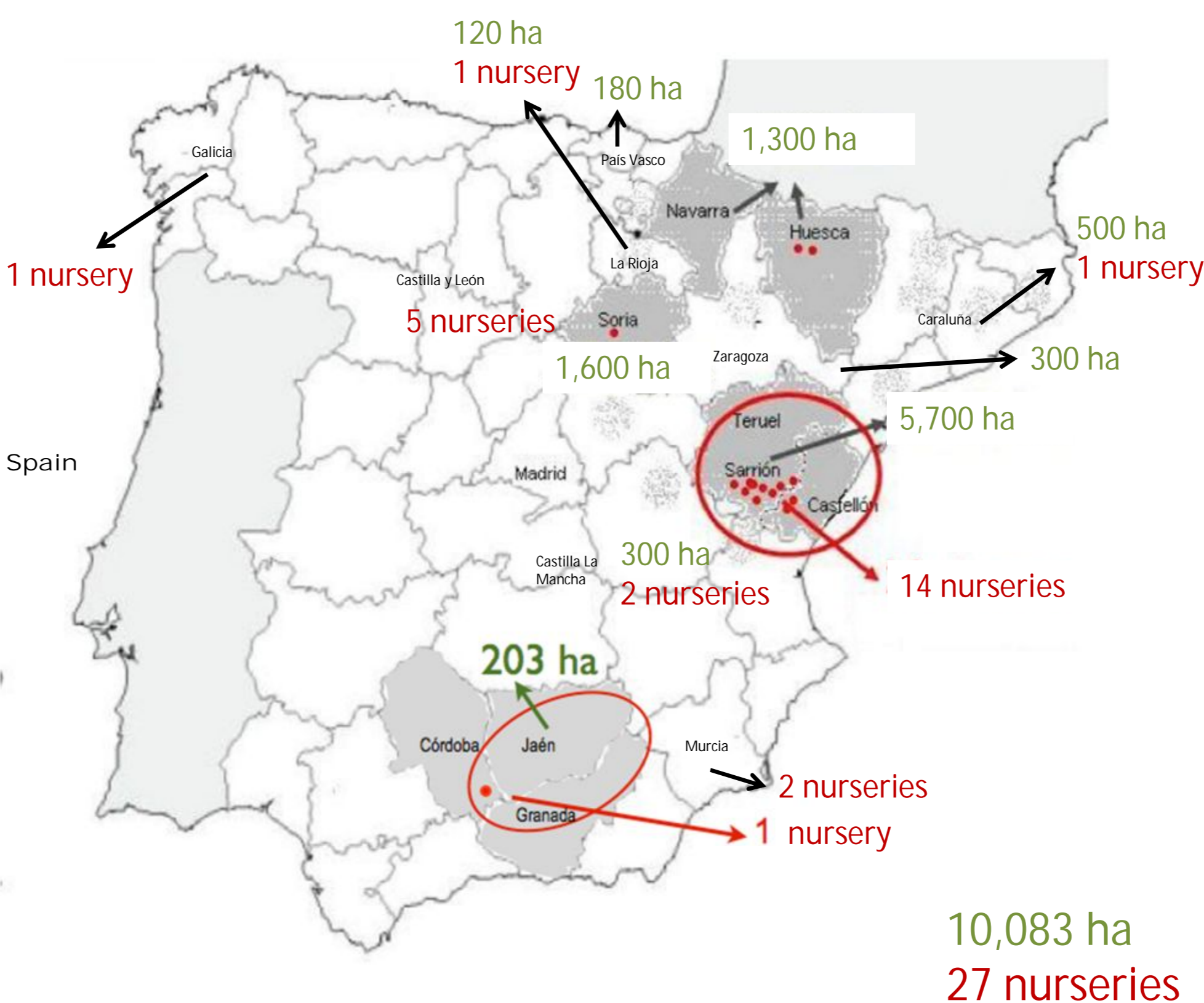
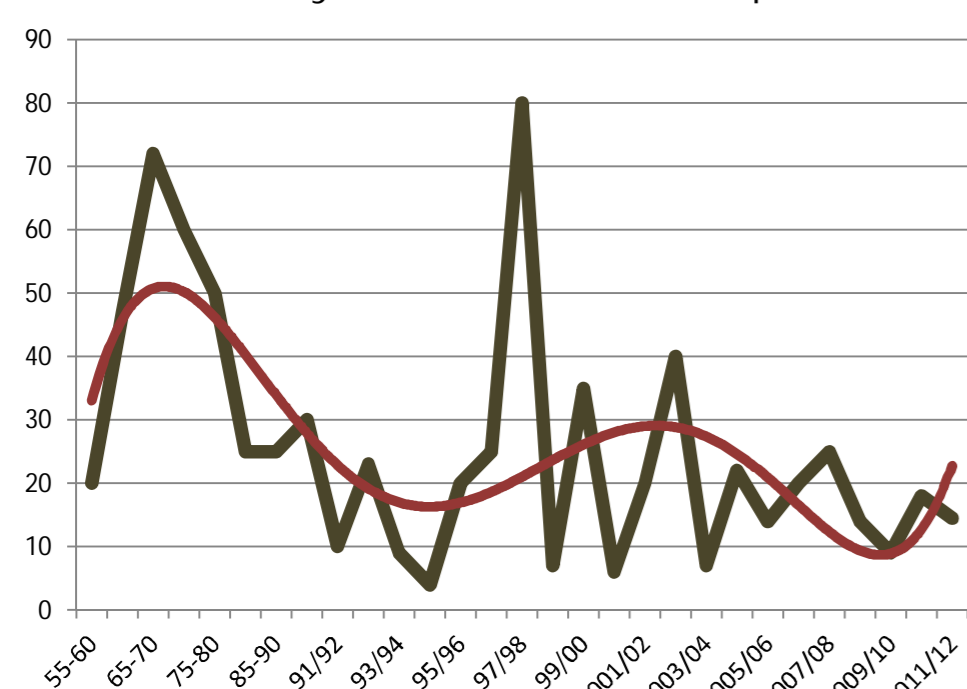
There is also a very wide scientific and technique activity, with many research projects and experimental areas developed by Spanish Research Institutes and Universities. Between them, it highlight the research project for the integral development of the trufficulture in Teruel, promoted by the INIA (Spanish Government) and that had seven subprojects. From the scientific-technique area, in collaboration with the truffle-farmers associations, there is supported the consultancy and broadcasting activities. Nursery and cultivation techniques are also being exported to Chile and Argentina.

Black truffle plantations and nurseries that produces mycorrhized seedlings in Spain

Black truffle production in Europe



Evolution and tendency of the black truffle production in Spain



## Spanish publications about truffles in the SCI between 2007 and 2013

- Parladé J, De la Varga H, De Miguel AM, Sáez R, Pera J (2013) Quantification of extraradical mycelium of *Tuber melanosporum* in soils from truffle orchards in northern Spain. *Mycorrhiza* 23: 99-106
- Alvarado P, Moreno G, Manjón JL (2012). Comparison between *Tuber gennadii* and *T. oligospermum* lineages reveals the existence of the new species *T. cistophilum* (Tuberaceae, Pezizales). *Mycologia* 104: 894-910
- de Aragón JM, Fischer C, Bonet JA, Olivera A, Oliach D, Colinas C. (2012) Economically profitable post fire restoration with black truffle (*Tuber melanosporum*) producing plantations. *New Forests* 43: 615-630
- García-Barreda S, Reyna S (2012) Below-ground ectomycorrhizal community in natural *Tuber melanosporum* truffle grounds and dynamics after canopy opening. *Mycorrhiza* 22: 361-369
- González-Armada B, De Miguel AM, Cervero RY (2012). Ectomycorrhizae and vascular plants growing in brA >> I,s as indicators of below and above ground microecology of black truffle production areas in Navarra (Northern Spain). *Biodiversity and Conservation* 19: 3861-3891
- Moreno G, Alvarado P, Manjón JL (2012) Phylogenetic affiliation of *Choiromyces magnusii* and *C. venosus* (Tuberaceae Ascomycota) from Spain. *Mycol Progress* 11: 463-471
- Navarro-Rodenas A, Pérez-Gilbert M, Torrente P, Morte A (2012) The role of phosphorus in the ectomycorrhiza continuum of desert truffle mycorrhizal plants. *Mycorrhiza* 22: 565-575
- Navarro-Rodenas A, Ruiz-Lozano JM, Kaldenhoff R, Morte A (2012) The Aquaporin TcAQP1 of the Desert Truffle *Terfezia clavervii* Is a Membrane Pore for Water and CO2 Transport. *Molecular Plant-Microbe Interactions* 25: 259-266
- Navarro-Rodenas A, Lozano-Carrillo MC, Pérez-Gilbert M, Morte A (2011) Effect of water stress on in vitro mycelium cultures of two mycorrhizal desert truffles 21: 247-253
- Olivera A, Fischer CR, Bonet JA, Martínez de Aragón J, Oliach D, Colinas C (2011) Weed management and irrigation are key treatments in emerging black truffle (*Tuber melanosporum*) cultivation. *New For* 42: 227-239
- Venturini ME, Reyes JE, Rivera CS, Oria R, Blanco D (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Microbiology* 28: 1492-1498
- Águeda B, Fernández-Toirán LM, De Miguel AM, Martínez-Peña F (2010) Ectomycorrhizal status of a mature productive black truffle plantation. *Forest Syst* 19: 89-97
- Alonso Ponce R, Águeda B, Ágreda T, Modrego MP, Aldea J, Martínez-Peña F (2010) Un modelo de potencialidad climática para la trufa negra (*Tuber melanosporum*) en Teruel (España). *Forest Syst* 19: 208-220
- García-Montero LG, Díaz P, di Massimo G, García-Abril A (2010) A review of research on Chinese *Tuber* species. *Mycol Prog* 9: 315-335.
- Morte A, Navarro-Rodenas A, Nicolás E (2010) Physiological parameters of desert truffle mycorrhizal *Helianthemum almeriense* plants cultivated in orchards under water deficit conditions. *Symbiosis* 52: 133-139

- Manjón JL, García-Montero LG, Alvarado P, Moreno G, di Massimo G (2009) *Tuber pseudoexcavatum* versus *T. pseudohimalayense* - new data on the molecular taxonomy and mycorrhizae of Chinese truffles. *Mycotaxon* 110: 399-412
- Navarro-Rodenas A, Morte A, Pérez-Gilbert M (2009) Partial purification, characterisation and histochemical localisation of alkaline phosphatase from ascocarps of the edible desert truffle *Terfezia clavervii* Chatin. *Plant Biology* 11: 678-685
- Valverde-Asenjo I, García-Montero LG, Quintana A, Velázquez J (2009) Calcareous amendments to soils to eradicate *Tuber brumale* from *T. melanosporum* cultivations: a multivariate statistical approach. *Mycorrhiza* 19: 159-165
- García-Montero LG, di Massimo G, Manjón JL, García-Cañete J (2008) Effect of *Sphaerospora brunnea* mycorrhizas on mycorrhization of *Quercus ilex* × *Tuber melanosporum*. *N Z J Crop Hortil Sci* 36: 153-158
- García-Montero LG, di Massimo G, Manjón JL, Velázquez J (2008) Description of *Tuber malenconii* mycorrhizae and a comparison with mycorrhizae of *T. aestivum* and *T. mesentericum*. *Mycotaxon* 105: 407-414
- Palazón C, Delgado I, Barriuso J, Sánchez S, Asensio C (2008) Black truffle (*Tuber melanosporum* Vitt.) obtention in a mycorrhized oak orchard of a traditional irrigated land. *ITEA-Información Técnica Económica Agraria* 104: 472-481
- Samils N, Olivera A, Danell E, Alexander SJ, Fischer CR, Colinas C (2008) The Socioeconomic Impact of Truffle Cultivation in Rural Spain. *Econ Bot* 62: 331-340
- García-Montero LG, Casermeiro MA, Manjón JL, Hernando I (2007) Impact of active soil carbonate and burn size on the capacity of the rockrose *Cistus laurifolius* to produce *Tuber melanosporum* carpophores in truffle culture. *Mycol Res* 111: 734-739
- García-Montero LG, di Massimo G, Manjón JL, García-Abril A (2008) New data on ectomycorrhizae and soils of the Chinese truffles *Tuber pseudoexcavatum* and *Tuber indicum*, and their impact on truffle cultivation. *Mycorrhiza* 19: 7-14
- García-Montero LG, Pascual C, García-Abril A, García-Cañete J (2007) Problems of using rockroses in *Tuber melanosporum* culture: soil and truffle harvest associated with *Cistus laurifolius*. *Agroforestry Systems* 70: 251-258
- García-Montero LG, Manjón JL, Martín-Fernández S, Di Massimo G (2007) Problems of using pines in *Tuber melanosporum* culture: soils and truffle harvest associated with *Pinus nigra* and *P. sylvestris*. *Agroforestry Systems* 70: 243-249
- García-Montero LG, Di Massimo G, García-Abril A, Grande MA (2007) Suitability of lime trees for *Tuber melanosporum* culture: mycorrhizae, soil studies, and truffle harvest associated with *Tilia platyphyllos* and *T.-x vulgaris*. *Sydowia* 59: 46-56
- García-Montero LG, Manjón JL, Pascual C, García-Abril A (2007) Ecological patterns of *Tuber melanosporum* and different *Quercus* Mediterranean forests: Quantitative production of truffles, burn sizes and soil studies. *Forest Ecol Manag* 242: 288-296
- Suz LM, Martín MP, Oliach D, Fischer CR, Colinas C (2008) Mycelial abundance and other factors related to truffle productivity in *Tuber melanosporum-Quercus ilex* orchards. *FEMS Microbiology Letters* 285: 72-78



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