

# Truffles

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**Scientific Name and Introduction:** Truffles is the common name for several hypogeous fungi. The most highly prized white truffle (*Tuber magnatum* Pico:Fr.), the black truffle (*Tuber melanosporum* Pico), and the least prized Summer truffle (*Tuber aestivum* Vitt.). The market is concentrated in France, Italy and Spain, but recently truffles are being produced over the world, with China as one of the biggest producers.

**Quality Characteristics and Criteria:** A high quality truffle is characterized by a strong methane-like smell. No commercial standards exist, and only the kind of truffle and its geographical origin influences market price. The size (large is more appreciated), soundness, regular shape, and uniform distribution of color are important quality characteristics.

**Horticultural Maturity Indices:** Maturity indices do not exist for truffles, but truffles harvested for immediate sale should be collected during the normal season because they are bigger and develop stronger smell. Truffles harvested at the beginning of the season store better because they have lower water content and are less prone to superficial mold development.

**Grades, Sizes and Packaging:** No standards exist for grading, sizing or packaging.

**Pre-cooling conditions:** Only Summer truffles, or truffles grown in hot areas need pre-cooling because of their higher metabolic rates. Hydro-cooling at 0 °C (32 °F) is best, and must be done by immersion, which can be part of the washing procedure. After washing, excess water should be removed in a well-ventilated room at 4 to 5 °C (39 to 41 °F). Lowering the temperature helps maintain the characteristic aroma.

**Optimum Storage Conditions:** Truffles can be kept in good condition for 20 to 30 days at 0 °C (32 °F) with 90 to 95% RH. Storage-life is slightly reduced at 5 °C (41 °F) (Mencarelli et al., 1997). Attention must be paid to fluctuation of the refrigeration temperature around 0 °C (32 °F) that could freeze truffles and completely destroy their texture.

**Controlled Atmosphere (CA) Considerations:** Textural characteristics were maintained similar to fresh when stored in 60% CO<sub>2</sub> for 35 days at 5 °C (41 °F) (Massini and Landucci, 1988). High CO<sub>2</sub> maintains aroma better than low O<sub>2</sub> and controls development of superficial molds. Quality characteristics and aroma can be maintained in low permeability plastic film packages (Bruno et al, 1999). High CO<sub>2</sub> should be combined with low O<sub>2</sub> to avoid anoxic conditions.

**Retail Outlet Display Considerations:** The aroma compounds produced by truffles can contaminate other produce. Only those truffles that can be sold that day should be displayed unwrapped; the others should be kept sealed in impermeable plastic trays in the cold section.

**Chilling Sensitivity:** They are not chilling sensitive; should be stored as cold as possible without freezing.

**Ethylene Production and Sensitivity:** Truffles produce only very low amounts of ethylene and are not sensitive to ethylene exposure (Mencarelli et al., 1997). Production of ethylene in storage can therefore be a good indicator of internal decay.

**Respiration Rates:**

Temperature	mg CO <sub>2</sub> kg <sup>-1</sup> h <sup>-1</sup>
0 °C	20 to 36
5 °C	24 to 45
10 °C	30 to 60

To get mL kg<sup>-1</sup> h<sup>-1</sup>, divide the mg kg<sup>-1</sup> h<sup>-1</sup> rate by 2.0 at 0 °C (32 °F), 1.9 at 10 °C (50 °F), and 1.8 at 20 °C (68 °F). To calculate heat production, multiply mg kg<sup>-1</sup> h<sup>-1</sup> by 220 to get BTU per ton per day or by 61 to get kcal per metric ton per day.

**Physiological Disorders:** Drying of the epicarp can be a problem due to low RH. Internal browning of white flesh truffles can be caused by over-maturity, while worms and growing conditions can cause sponginess.

**Postharvest Pathology:** Bacteria are present inside and on the surface, but they usually do not cause decay. The frequent presence of worms inside truffles is often undetectable from the outside.

**Quarantine Issues:** None.

**Suitability as Fresh-cut Product:** No current potential.

**Special Considerations:** Truffles need brushing during washing. Excess water must be removed before storage to avoid growth of superficial mold. Special care must be used with mixed loads because truffles can significantly affect aroma of other commodities.

**References:**

- Massini, R. and A. Landucci. 1988. Trattamento e commercializzazione dei tartufi freschi e in conserva. Problemi normativi e sviluppo tecnologico. Proc. 2<sup>nd</sup> Int. Symp. on Truffle, Spoleto, Italy, pp. 645-651
- Mencarelli, F., R. Massantini and R. Botondi. 1997. Physiological and textural response of truffles during low-temperature storage. J. Hort. Sci. 72(3):407-414.