

Technological improvements in the cultivation and post-harvest of the hanging tomato

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01. Rationale

The hanging tomato (*Solanum lycopersicum* L.) is a traditional variety with deep roots in Catalan horticulture and gastronomy. In recent years, this variety has experienced a very significant increase in demand, which has led to stepped-up cultivation. While in the past it was grown under low-input conditions and consumed during the winter (after a post-harvest period), it is now grown using modern tomato cultivation techniques (protected cultivation, use of high-yield hybrids, high water and fertiliser inputs, consumption of freshly harvested fruit). The growing demand of the Catalan market and the loss of seasonality in consumption (it is currently consumed all year round) has led to the emergence of new production areas which compete in the market with local production, offering produce outside the harvesting cycle in our area (July-October). In this context, extending the production period and optimising yield and quality under the current production systems should make it possible to improve the competitiveness of Catalan producers.

The main objective of the project was to provide Catalan hanging tomato producers with technological improvements in relation to the pre- and post-harvest technical itinerary, to extend the

production phase in our area, increase organoleptic quality and reduce the environmental impact of the cultivation systems. To this end, the following specific objectives were set:

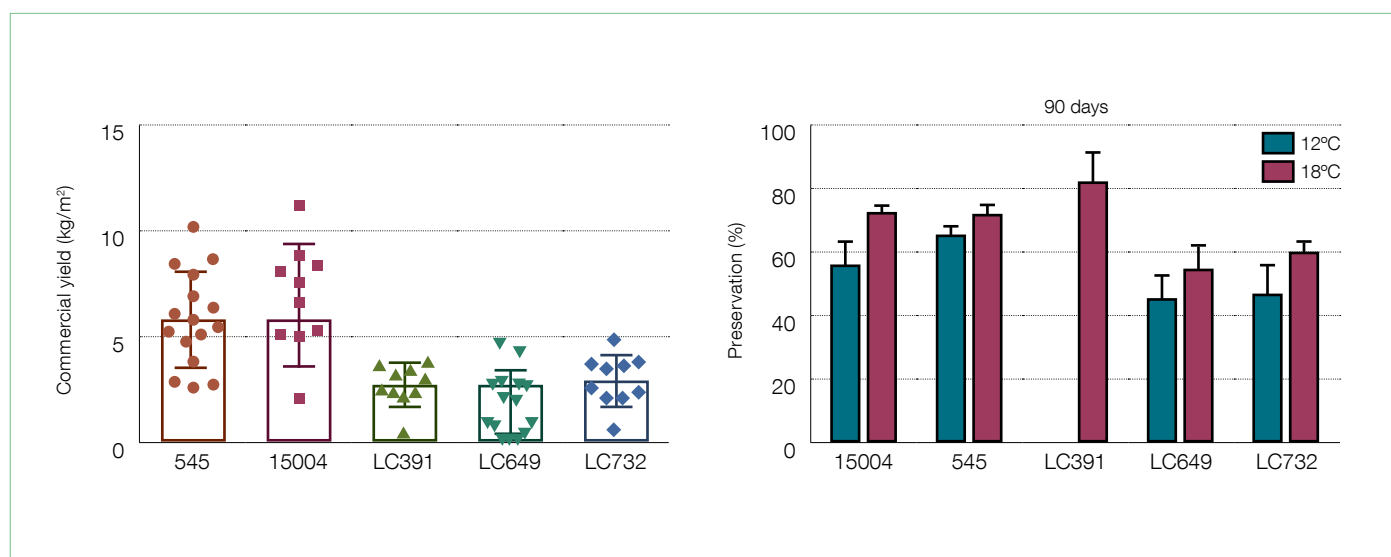
- Study different growing cycles (early, intermediate and late) under low-cost protection structures, with the aim of extending the marketing period of local products.
- Improve post-harvest storage conditions and identify the pathogens that cause rot, in order to guarantee maximum product quality and extend the storage and marketing period.
- Optimise the water consumption used in cultivation, in order to reduce the environmental impact.
- Evaluate the effectiveness of edges that act as reservoirs of useful fauna to reduce the use of phytosanitary products.
- Transfer knowledge and new technologies to the productive sector.

To carry out these studies, three traditional varieties (LC391 (from Catalonia), LC649 (Castellón) and LC732 (Majorca)) and two commercial hybrid varieties (545 and 15004, from Semillas Fitó) were used, which were grown at different irrigation doses (22-142% water requirements based on crop evapotranspiration (cET)), cycles (transplanting: 15 April, 1 May, 15 June) and cultivation systems (open air, protected cultivation in low-cost tunnels). Post-harvest studies were carried out at different storage temperatures (12°C and 18°C). The trials were carried out in the Alt Maresme area.

02. Results and conclusions

The pilot project has made it possible to optimise the technical itinerary of the hanging tomato crop, in order to lengthen the harvest and post-harvest period and improve the organoleptic and environmental quality of local production. The implementation of these measures should allow for an improvement in the competitiveness of producers, which, through the transfer actions implemented, is expected to result in an increase in the economic and environmental profitability of the crop.

In relation to pre-harvest factors, the results show that the choice of variety is the key point that determines yield, with the improved varieties studied being far superior to the traditional ones. However, the technical route used determines the final yield, which in the case of the improved varieties can range between 2.0 and 11.4 kg/m², determining the economic viability of the crop. The highest yields were obtained in early-cycle tunnel cultivation, mainly because protected cultivation reduces the incidence of cracking (the main factor that reduces the commercial value of the fruit) and the early cycle makes it possible to extend the harvesting cycle.



Left: marketable yield (kg/m²) of the varieties evaluated (the error bars indicate the standard error of the mean; The dots represent the mean for each growing environment). Right: Effect of storage temperature on preservation at 90 days. Source: Operational Group.



Photos: Operational Group.

Unfortunately, the late growing cycle is not adapted to the growing area, so extending the harvesting period beyond November is not feasible. The highest yields were obtained at irrigation rates close to 100% cET, so it is very important to adjust water inputs to the real demands of the crop, and this has been shown to be a good method for calculating irrigation rates. Regarding the efficient use of irrigation water, consumption values between 123 and 658 l/plant were recorded, which have been translated into efficiency values between 2.4 and 36.4 kg fruit/m³ irrigation water, indicating that significant progress can be achieved in the environmental impact of cultivation. Among the variables that determine the incidence of cracking, a positive correlation has been identified between the appearance of this physiopathology and the daily oscillation of environmental relative humidity. Finally, as previously demonstrated, the use of flower edges as a reservoir of useful fauna has made it possible to significantly reduce the damage caused by *Heliothis armigera*, *Tuta absoluta* and whitefly.

In relation to postharvest behaviour, it has been observed that low temperatures (12°C) and high humidity (95%) cause higher postharvest losses. It is recommended to use temperatures of around 16-18°C and relative humidity of around 75% for the

storage of hanging tomatoes. Studies on the fungi appearing during postharvest have identified the presence of *Penicillium* sp., yeast, *Alternaria* sp., *Stemphylium* sp., *Fusarium* sp., *Rhizopus nigricans* and *Geotrichum candidum* in the analysed samples, and no main fungus has been identified as the cause of rots. As for pre-harvest factors determining preservation, few significant effects have been observed, with irrigation dose being an unimportant factor, as previously described in other studies. The data collected have made it possible to draw up a Post-harvest Management Manual, which gives recommendations for the different phases (pre-harvest, harvest, transport and entry into storage, post-harvest and marketing) that should make it possible to improve the preservation of the fruit.

In conclusion, the pilot project has made it possible to gain an exhaustive insight into the pre- and post-harvest factors that determine the economic and environmental profitability of the hanging tomato crop. These results have been passed on to the sector through knowledge transfer workshops and management manuals, as well as customised technical advice for producers. The project has made it possible to gather a wealth of information on the crop, opening the door to future measures to improve the situation of a key crop for Catalan horticulture.