

Improving hazel tree growing techniques through efficient use of irrigation water and mechanical pruning

Summary

Two actions were carried out in hazelnut orchards in Camp de Tarragona. The first one was a trial of irrigation strategies, to fully ascertain the water needs of the hazel tree and the ideal time to apply it to ensure efficient use of water. The second action involved carrying out mechanical pruning both in adult orchards, to rejuvenate the trees and facilitate the entry of light, and young trees, to guide them towards a specific shape.

Objectives

The main objective of the project was **to improve cultivation techniques in hazelnut orchards in the Tarragona area**, in order to increase production, cut costs and save on water. All of this was intended to make the orchards more competitive.

More specifically, the irrigation water needed for hazel trees was determined and mechanical pruning will be applied to both adult and young trees.

Finally, the results obtained were transferred to the sector through a number of dissemination and transfer actions (explanatory articles, talks, field trips, etc.).

Description of the actions carried out in the project

The project "Improvement of hazel tree cultivation techniques through efficient use of irrigation water and mechanical pruning" aims to improve different strategic points in the current hazel tree cultivation method. This project consists of two distinct parts:

- **Efficient use of irrigation water:** Water management is a key factor for managing any crop and it is even more relevant today, as we are in an area with long periods of drought that affect watercourses.

- **Mechanical pruning:** One of the costliest tasks in hazelnut cultivation is pruning by hand. While pruning shoots is a difficult task to mechanise, it is greatly reduced by using low-sprouting rootstock such as the "Dundee", which is already present in many orchards. Pruning the aerial part of the tree is a relatively simple mechanised task, but it has not been applied on many occasions in this crop. It should be borne in mind that in the traditional cultivation of hazel trees in the Camp de Tarragona area, farmers are reluctant to prune the aerial part, but over time it has been shown to significantly increase production in the area.

1. Testing irrigation strategies

This trial considers different strategies and irrigation doses with the self-rooted hazel variety "Negret - IRTA® -N-9" and grafted onto "Dundee" rootstock.

Four situations are considered:

- Drip and surface irrigation, based on crop evapotranspiration requirements (ETc), from June to September (reference thesis, R0).

- Drip and surface irrigation, based on crop evapotranspiration requirements (ETc), from April to September (alternative thesis, R1).
- Drip and surface irrigation, based on crop evapotranspiration requirements (ETc) and soil moisture probes, from April to September (alternative thesis, R2).
- Subsurface irrigation, based on crop evapotranspiration requirements (ETc) and soil moisture probes, from April to September (Alternative thesis, R3).

Six trees will be assessed for each thesis (three self-rooted trees and three grafted trees) where the effect of irrigation on the production, fruit quality and growth of hazel trees will be studied: vigour (trunk diameter at 20 cm from the ground), and crown volume.

2. Mechanical pruning test

Two moments for implementing mechanical pruning will be considered for this test:

2.1. Trees in full production

Action will be taken in already established orchards, where the alleys lack light, causing lower production. This trial will be carried out on three farms with trees in full production, but with different characteristics. For each of these theses, a comparison will be made with trees on which normal tasks have been carried out so far. There is already a production history for these orchards, and this new type of pruning can be assessed for variations in average production.

Each thesis will cover an area of no more than 1 ha, where each year one alley will be pruned and the following two left unpruned; the following year, the pruned alley will be the first left unpruned the previous year, and so on. Thus, over a 3-year cycle, the entire farm will have been pruned and without causing a major drop in production in the pruning year due to a reduction in much of the farm's productive volume. As the hazel tree bears fruit on old branches in its second and third year, it is expected that the pruned alley will recover production, and by doing this alternately, in the third year there will be a sufficient increase to compensate for the years of pruning.

This will be assessed by comparison with control alleys on the same estate. For each of the farms, the production in each trial alley will be assessed separately.

2.2. For trees in the process of shaping

This trial will be carried out on a tree farm with 1-year-old trees and pruning will be carried out to shape them from the first pruning using mechanical methods appropriate for the type of branches to be cut, depending on their year of growth. In this case, we will compare the theses using mechanical shaping pruning with manual shaping pruning, assessing growth and possible differences in how soon trees enter into production.

In both cases (**2.1 and 2.2**), pruning wood will be chipped with a mechanical chipper and left on the surface for decomposition and incorporation into the soil.

Five trees will be assessed for each pruning thesis, where the following controls will be carried out: pruning time, weight of cut wood, production and characteristics of the hazelnut.

Final results and practical recommendations

The mechanical pruning trials show that, in general, there is rapid and very positive recovery of the trees after pruning, with the growth of new and vigorous shoots and the presence of female flowers in the year after pruning. This is a very positive aspect for the recovery of orchard production. In most of the actions, orchard production has increased significantly.

No significant differences in production between the theses were observed in the irrigation strategy test, although there were significant differences between the grafted and self-rooted trees. Significant differences were also observed in aspects such as the trunk volume or section. Each case needs to be studied further to obtain results, but this operational group is a good line of study with very encouraging results in this field.

Conclusions

1. Testing irrigation strategies

The highest yields are observed in the “irrigation with probes” thesis, as early as the second year of control. The “irrigation depending on potential evapotranspiration (ETp)” thesis produced the least. There were no significant differences in production between grafted and self-rooted trees. The trunk section of the trees in the “conventional” and “irrigation with probes” theses was larger than in the other theses. The trunk section of the grafted trees was significantly larger than that of the self-rooted trees. In terms of fruit characterisation, all parameters were fairly homogeneous among the four theses. Between grafted and self-rooted trees, a smaller fruit size was observed in the grafted trees.

In summary, it is recommendable to plant grafted trees for higher yields and greater resistance to chlorosis, and to use methods such as probes to use irrigation water as efficiently as possible. Underground irrigation is not recommended.

2. Mechanical pruning test

A rapid recovery of trees in terms of production and volume was observed in all theses. Mechanical pruning is recommended in all older orchards to improve shaping and increase productivity, following the scheme implemented in this trial. It was also shown that there were no disease problems associated with mechanical pruning if proper phytosanitary management is carried out. The trial is planned to continue beyond the operational group in order to strengthen the improvements detected and look for new forms of pruning that may be beneficial.

Leader of the Operational Group

ORGANISATION: Coselva, SCCL

Coordinator of the Operational Group

ORGANISATION:

Other members of the Operational Group (not recipients of the grant)

ORGANISATION: IRTA - Institute of Agrifood Research and Technology

Geographical area(s) of application

PROVINCE(S)	REGION(S)
Tarragona	Baix Camp

Dissemination of the project (publications, conferences, multimedia, etc.)

1,000 copies of a DIN-A4 multi-page brochure were produced. These brochures have been distributed at hazelnut fairs and international nut conventions, among other places. An explanatory talk on the project

was also held on 22 June 2021 as part of the National Hazelnut Day, with the participation of IRTA and Coselva technicians. On 1 December, a meeting was also held to present the results to all members of the Co-operative.

Throughout the project, guided visits to the farm were given for producers and technicians from commercial companies and nurseries. In particular, a thorough visit was given to the cooperative members in the province of Girona and another for Agromejora technicians.

In addition, a website (www.masdelvictor.cat) has been developed with an interactive explanation of the project, which also includes three explanatory videos. One is general video on the project and the other two are specific to each of the parts of the project (mechanical pruning and irrigation). The videos explain the current situation of hazel trees in our area, the project at a technical level and the impact the project will have on hazelnut orchards in Camp de Tarragona.

At the farm, a sign has been placed at the entrance showing the area where the project is being carried out, and explanatory signs have been placed next to the plots, where there is a QR code linked to the interactive website. The dissemination instructions issued by the DACC have been strictly followed in all dissemination actions.

Project website

<https://masdelvictor.cat/ca/context/>

More information on the project

PROJECT DATES	TOTAL BUDGET
Start date (month-year): July 2020	Total budget: €140,000.00
Completion date (month-year): September 2022	DACC funding: €74,200.00
Current status: Completed	EU funding: €65,800.00
	Own funding: €60,000.00

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