FRUIT FORECAST

Summary

The meteorological variability generated by climate change causes uncertainty in the development of crops, increasing the difficulty in crop planning, particularly in fruit farming. Greater variability in the volume and quality of peach and cherry production requires higher investment in resources and work from technical teams in planning the harvests, without providing greater precision.
Technical teams use different techniques (sampling, ripening controls, measurements, etc.) to determine the aforementioned variables of volume and optimum harvesting time in advance, but the reliability of the results provided by these systems has much room for improvement.
The large number of variables affecting both quality and quantity of production (such as weather conditions, field characteristics, production areas, etc.) mean that obtaining reliable predictions using traditional approaches is a very complex task.
The FRUITFORECAST operational group made up of the FRUITS DE PONENT cooperative group and CERIMA CHERRIES, a fruit and vegetable company specialising solely in the production, packaging and export of cherries worldwide, in collaboration with the IRTA Research Centre and the company RAW DATA, which specialises in big data technologies, has developed a tool based on predictive models that anticipate information on changes in quality parameters and harvest volumes for the peach and cherry sector in order to improve reliability in planning harvests.

Objectives

Establish reliable harvest planning to gain a strategic position in making strategic business decisions, negotiating sales contracts (prices, delivery dates and volumes) with customers, reducing production costs through more efficient resource management (such as hiring staff and machinery at the right time) and optimising the cold storage and logistics capacity of the plants. As a consequence, reduce the current uncertainty in crop planning and improve the reliability of these predictions with big data technology.

In previous projects, Raw Data attempted to make crop forecasts using historical data from previous years, meteorology and satellite imagery. The results showed that field information was needed to provide more accurate forecasts. IRTA has experience in field sampling and can thus suggest the data that could contribute to forecasting.

Description of the actions carried out in the project

This pilot project was implemented between March 2020 and September 2022, based on big-data-related technology that enabled the integration of multiple sources of information to develop predictive models to reduce uncertainty in crop planning.

The data sources used in this project were divided into four main blocks:

1) Agro-meteorological databanks (sources: Meteocat, AEMET, MeteoBlue)
2) Satellite imagery with different indices
3) Historical data from the producing companies
    a) Ripening controls, using fruit quality parameters such as chlorophyll degradation in peaches (measured with the DA-meter) and sugar content in cherries (measured with a refractometer)
    b) Historical production volumes per field (source: ERP head office)
    c) Measurements (source: company records)

4) Characterisation of the land by:
   a) Maps/soil types
   b) Planting details (area, age of trees, variety, rootstock, training system, etc.)

Over the two and a half years of the project, the following actions were carried out in different phases:

Phase A: Data recovery. Creation, retrieval, processing and standardisation of project members' data. Work was carried out on the characterisation of the orchards, the historical records of peach and cherry entries into warehouses, measurement and ripening controls throughout the project, hyperlocalised meteorological data obtained from the METEOCAT network, AEMET or Meteoblue, and maps of the orchard locations.
Phase B: Selecting the orchards for sampling using prediction models to identify the most representative orchards for each variety. The database created in phase A was used to do this, calculating which orchards correlate best with the overall volumes of each variety from the history of the participating agricultural companies. More thorough volume measurements were obtained more from these orchards.
Phase C: Field data collection. Each year 12 peach varieties (2 orchards per variety) and 5-6 cherry varieties (2 orchards per variety) were assessed.
Phase D: Creation and training of prediction models, test results and interaction with beneficiary companies in order to ensure the models are as reliable as possible. Data collected in Phase A, Phase C (samples) and from additional sources such as indicators extracted from satellite imagery were used. In this phase, the first static forecasting system was created, after which the first model was progressively validated, in conjunction with the members of the operational group
Phase E: Creation of a tool to display the results provided by the models.

Final results and practical recommendations

- Definition and validation of the set of variables needed to create each prediction model.
- Creation of the different prediction models, aimed at obtaining volume and ripening date forecasts per productive orchard.
- Validation of the results of the prediction models with a level of reliability superior to current methods and approved by the companies benefiting from the project.
- Technological development with image recognition to speed up measurement in the field and perform it using smartphone images.

Conclusions

Tests of the model in the growing seasons covered by the project showed promising results, but were insufficient to fully validate the model. Feeding new data into the model as they are generated is needed, in order to provide a sufficiently complete history to feed the predictive model.

Leader of the Operational Group

ORGANISATION: Producció Cirera Ribera d'Ebre, SL (CERIMA CHERRIES)

Coordinator of the Operational Group

ORGANISATION: FEMAC

Other members of the Operational Group (grant recipients)

ORGANISATION: FRUITS DE PONENT, SL

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

ORGANISATION: IRTA - Institute of Agrifood Research and Technology

ORGANISATION: RAW DATA

Geographical area(s) of application

PROVINCE(S)	REGION(S)
TARRAGONA LLEIDA	RIBERA D'EBRE SEGRIÀ

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

Dissemination conferences

- 27/05/2021 Online technical conference in the PATT. Presentation of the project
- 16/06/2022 Online technical seminar in the PATT. Project results

Publications

- "Resultados del GO Fruit Forecast: el valor de los datos en agricultura" (Results of the GO Fruit Forecast: the value of data in agriculture) - 22/06/22. Interempresas.
- "El GO Fruit Forecast demuestra el valor de los datos en agricultura" (GO Fruit Forecast demonstrates the value of data in agriculture) - July/August 22 No. 1063. Agriculture agri-livestock journal.
- "Fruit Forecast: modelos predictives de producción y calidad de la fruta de hueso" (Fruit Forecast: predictive models for stone fruit production and quality) - July/August 22. *Fruticultura* journal no. 88.

Project website

https://www.femac.org/fruitforecast/

More information on the project

PROJECT DATES	TOTAL BUDGET
Start date (month-year): July 2020	Total budget: €106,552.00
Completion date (month-year): September 2022	DACC funding: €56,472.56
Current status: Completed	EU funding: €50,079.44
	Own funding: €42,060.00

With funding from:

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Order ARP/133/2017 of 21 June, approving the regulatory bases for grants for cooperation for innovation by promoting the creation of European Association for Innovation operational groups in the areas of agricultural productivity and sustainability and the execution of innovative pilot projects by those groups, and Resolution ARP/1531/2019, of 28 May, announcing the call for the grant.

Generalitat de Catalunya
Departament d'Acció Climàtica, Alimentació i Agenda Rural

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