SMART HOP YARD - USE OF REAL-TIME WEATHER DATA IN PEST AND DISEASE PROGNOSIS

Ing. Pavel Donner, Ph.D., Ing. Josef Ježek, Ph.D.
Hop Research Institute Co., Ltd., Kadaňská 2525, Žatec, Czech Republic
e-mail: donner@chizatec.cz

Abstract

The network of automatic weather stations helps prognose pest and disease pressure during vegetation and thus helps farmers effectively use plant protection products in Czech hop growing regions.

Key words

Hop. Weather. Pest and disease prognosis. Hop protection.

Introduction

The Smart Hop Yard project is based on the already proven Smart Vineyard project and is based on the installation of a network of weather stations that cover all hop-growing areas of the Czech Republic. Prediction models for individual pathogens can be automatically calculated due to the obtained data. In 2021, the function of prediction model of downy mildew (Pseudoperonospora humuli) was verified. Prediction of hop aphid (Phorodon humuli) was added into the calculation in 2022. Up-to-date information on disease and pest pressure enables growers to apply plant protection products in a targeted and effective manner.

Material and methods

The service is operated by Breuss Technology, Ltd. The weather stations consist of a printed circuit board equipped with 1 or 2 AA batteries with an output voltage of 3.6 V, a data recording interval switch (15 or 30 minutes), a network (Sigfox) antenna and connectors for connecting optional sensors. In the basic state, the station records air temperature, relative humidity and precipitation. Optionally, it can be extended by other sensors, such as an anemometer, soil temperature and humidity sensor, etc. The data is sent for processing in the selected interval and is available in the dashboard on the website www.chytrachmelnice.cz within about 10 seconds after sending. Station overviews are divided according to hop-gro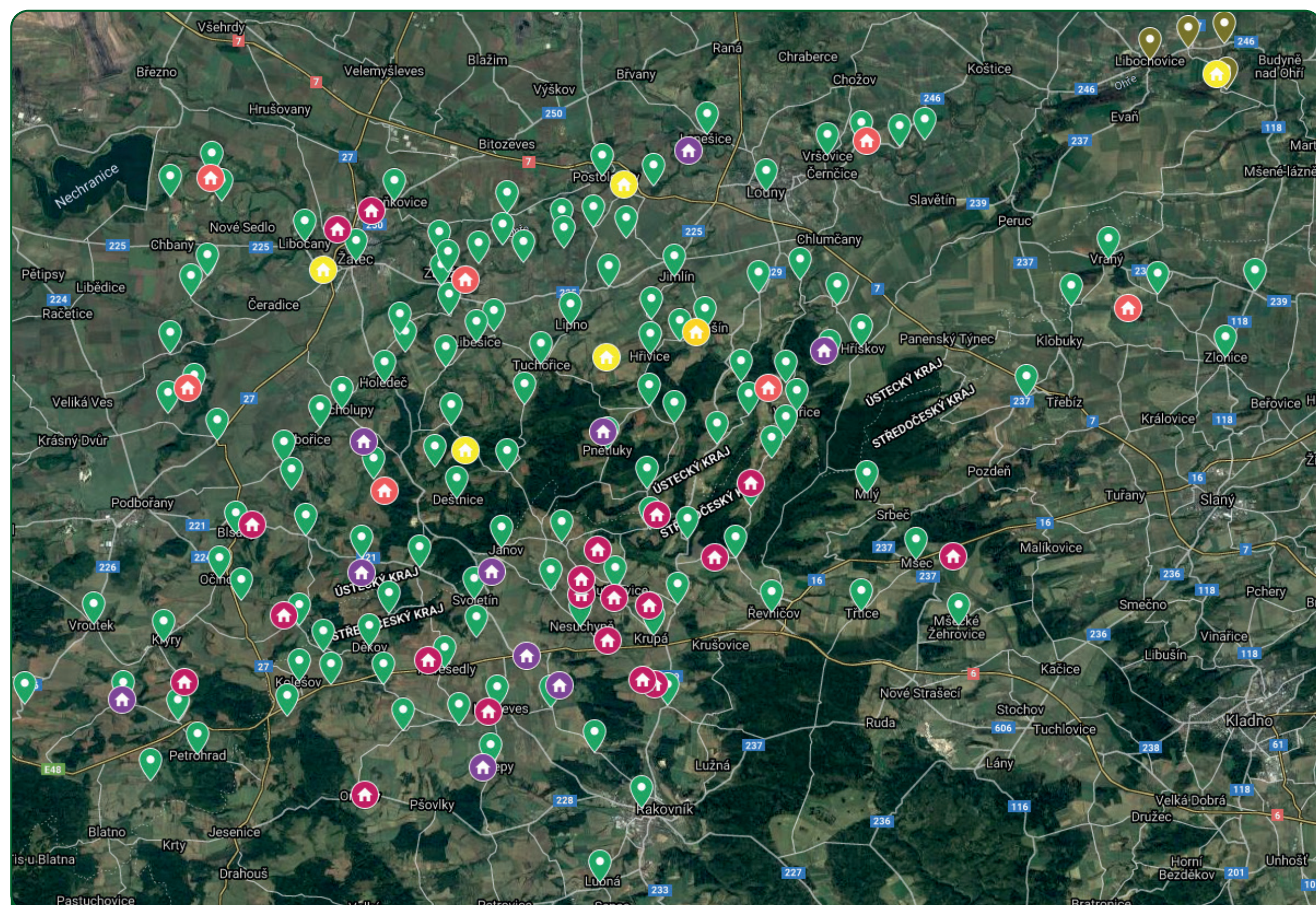wing areas, mainly for the sake of clarity and also specific environmental conditions in individual areas. Stations can be installed either directly on the hop garden construction at a height of about 6-7 meters (when installed below, the station loses signal after plants reach full growth) or on the perch near the hop garden or in the general area (up to 500 m, if there are no major obstacles between the hop garden and station to secure the relevance of the data). The accuracy of the temperature and relative humidity sensor is ± 0.2℃. resp. ± 2% (Bosch sensors used in the automotive industry), the rain gauges are calibrated to 0.31 mm per flip. The obtained data are collectively statistically evaluated after the growing season and presented to growers and public at seminars.

Example of HRI-managed weather station. Locality Velká Bystřice (Tirschitz - Tršicko).

Results

Based on the weather data and data of the prognostic models, we anually statistically evaluate correlations among weather parameters, yield, alpha-acids content, altitude, etc. General statistical data show the difference in quality and quantity of hops among Czech hop growing regions, as well as the yield and alpha-acids content decrease with age. Significant correlation confirming long-term observation also shows the negative effect of increasing temperature on alpha-acids content, therefore higher alpha contents were reached in localities in higher altitudes, where the temperature is lower.

Acknowledgement

Difference in yield (t/ha) in Czech hop growing regions in 2021.

Dependence of alpha-acids content (% DW) on average seasonal temperature (June - August 20th 2021).

Dependence of alpha-acids content (% DW) on altitude (2021).

Example from an overview map. Green markers indicate cadastre with growing hops, colored icons with houses icons indicate the location of individual stations according to companies and years of installation.
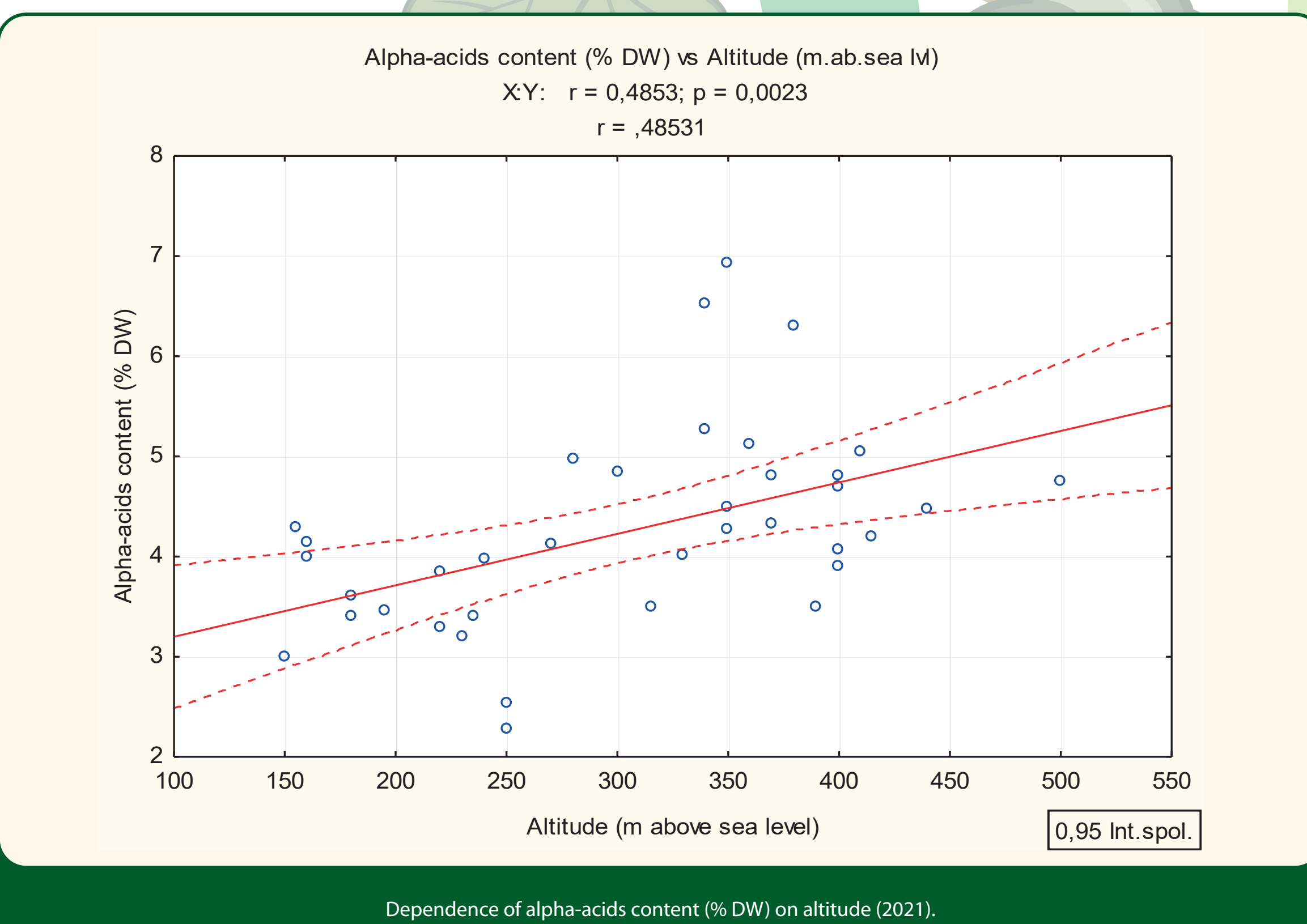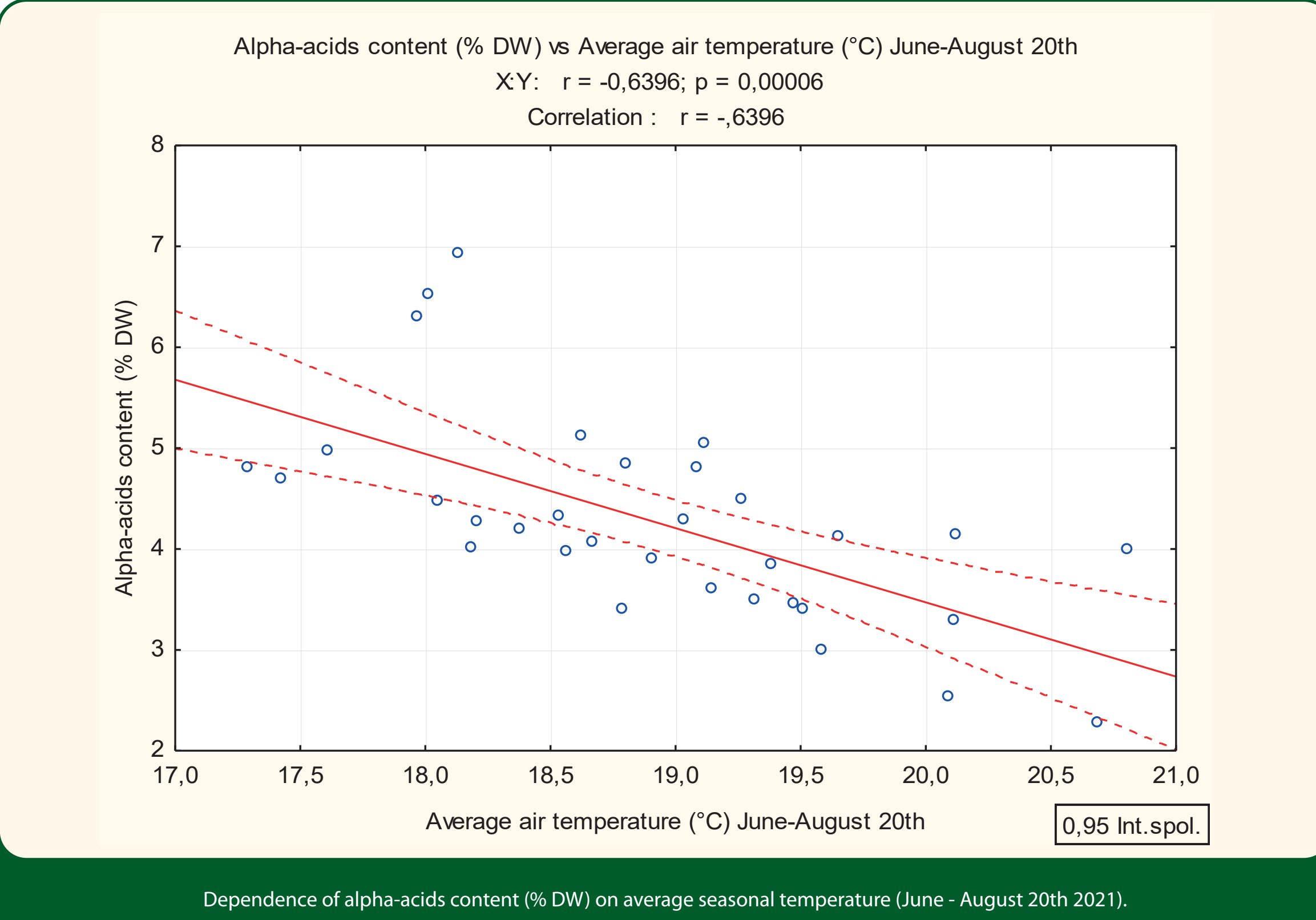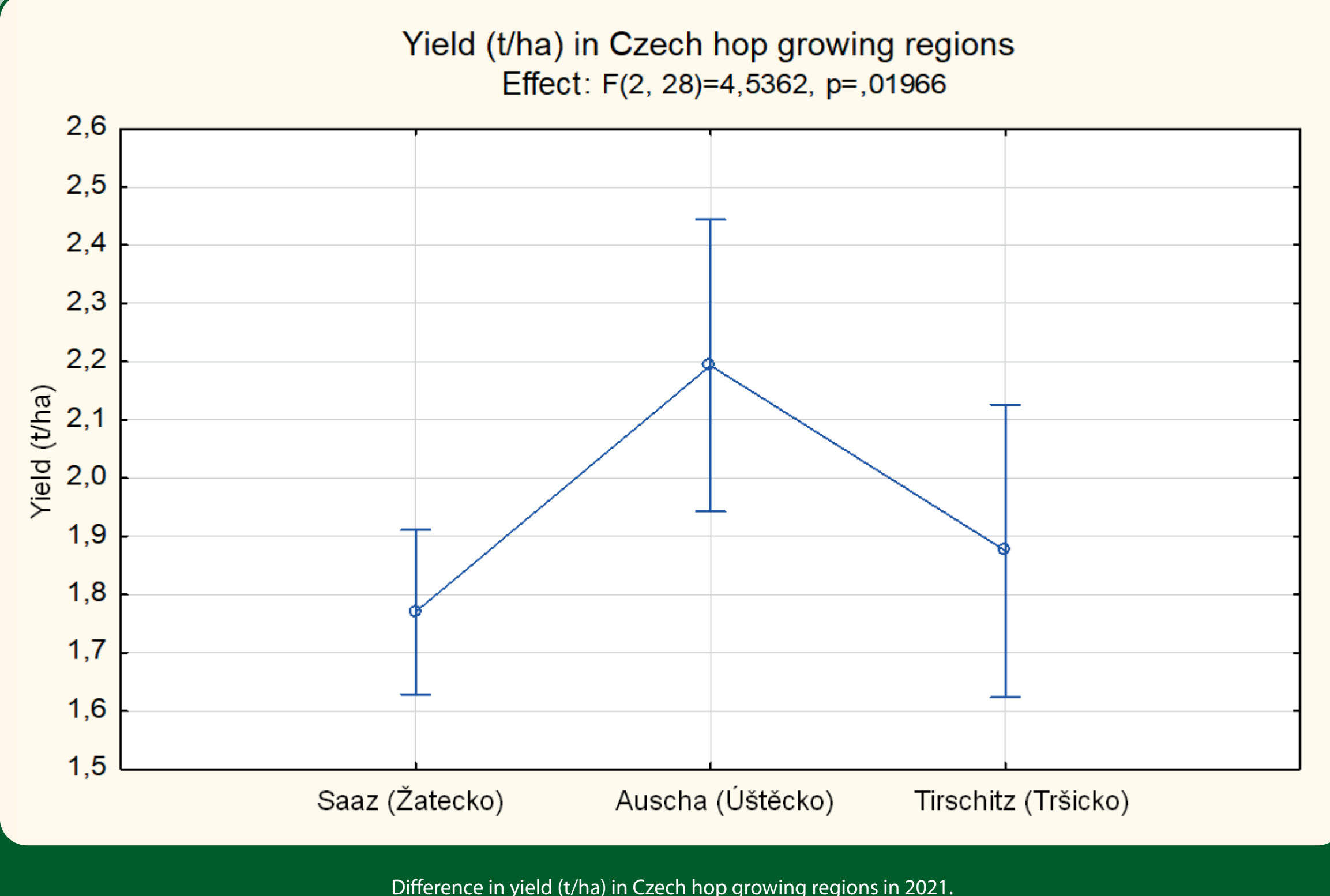
Lipno✔	19.2 C	19.2 C	14.8 C	0 mm	27 / 59.5 mm	10 / 15
Pnětluky✔	17.2 C	17.6 C	14.5 C	0 mm	29.5 / 59.5 mm	7 / 15
Zbrašín✔	18 C	18.3 C	14.1 C	0 mm	20.1 / 59.5 mm	3 / 15
Divice✔	18.3 C	20.2 C	14.8 C	0 mm	30.4 / 59.5 mm	14 / 15
Nová Ves✔	19 C	19.6 C	14.7 C	0.31 mm	30.1 / 59.5 mm	8 / 15
Oploty✔	17.7 C	18.1 C	15.4 C	6.2 mm	27.6 / 59.5 mm	10 / 15
Čínov✔	17.3 C	19.4 C	15.9 C	8.99 mm	32.5 / 59.5 mm	8 / 15
Žatec CHI✔	20.3 C	20.8 C	15.8 C	1.24 mm	27 / 59.5 mm	12 / 15
Staňkovice✔	20.1 C	20.1 C	15.7 C	1.24 mm	18 / 59.5 mm	4 / 15

Example from the stations dashboard in Saaz region (Žatecko). The columns from the left show the current measured temperature, maximal daily temperature, minimal daily temperature, precipitation from 00:00 to 23:59 of the day, comparison of monthly precipitation sum with the long-term normal of the area and the last column shows the number of days in which the limit value of downy mildew index was exceeded (11/15). For easier orientation, values up to 9/15 are not highlighted, the value 10/15 is highlighted in yellow and values higher than 11/15 are highlighted in red.