Experimental site for the measurement of meteorological parameters in protected cultivation and variability of a tomato cultivar

EXPERIMENTAL SITE FOR THE MEASUREMENT OF METEOROLOGICAL PARAMETERS IN PROTECTED CULTIVATION FOR TOMATO CULTIVAR

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Introduction

Light is a limiting factor of paramount importance for plants since, in addition to providing the radiant energy for photosynthesis, it modulates the growth and development in response to environmental conditions. When operating in protected cultivation the amount and the spectral distribution of solar radiation inside the greenhouse undergo a modification that depends on the type of cover used (Krizek, 2004). UV radiation is considered as a stress factor, which is able to affect the characteristics of plant growth and to trigger a variety of physiological responses that lead to an accumulation of secondary metabolites that increase the plant resistance (Fedina *et al.*, 2009). However, low doses of radiation in plants induce a metabolic response to stress resistance which leads to an increase of molecules with high antioxidant capacity (Schreiner *et al.*, 2006).

Currently, accurate measurements of meteorological parameters in protected cultivation are unavailable (Sanna *et al.*, 2013), and neither are known the measurement uncertainties of environmental parameters that can be resolved in percentage uncertainties on the variability of the product.

A new experimental site was settled in the research area of Turin, in order to assess the quality of the Saint Pierre tomato cultivar growth in protected cultivation. Different aspects are currently under evaluation: (i) internal microclimate and solar radiation measurement of the spectral distribution, using calibrated and traceable instrumentation, within the different cultivation environments; (ii) monitoring of the optical and radiometric properties of the films used as covering material; (iii) identification of the physiological processes of crops in response to the type of plastic film adopted and microclimate by phenological and physiological analysis, and morphological observations.

		UV-B Inside-A	UV-B Inside-B	UV-B Out	PAR Inside-A	PAR Inside-B	Global Radiation	Air T	Air RH
		[mW/cm²]	[mW/cm²]	[mW/cm²]	[W/m²]	[W/m²]	[W/m²]	[°C]	[%]
		Day	Day	Day	Day	Day	Day	Day	Day
05/06/16	0:00	0	0.1	0.1	0	161	479.3	16.3	77
06/06/16	0:00	0	0.1	0	152	223	1191.3	14.5	78
07/06/16	0:00	0.1	0	0.1	113	235	1221.6	16.6	69
08/06/16	0:00	0.2	0.2	0.1	0	189	1171	14.4	71
		15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min
08/06/16	12:15	200	0	100	170	109	454	16.4	59
08/06/16	12:30	200	100	200	171	118	450	16.3	60
08/06/16	12:45	200	200	200	253	220	503.6	16.2	55

Meteorological parameters evaluated during the both monitoring and tomato harvest periods

Detection of the morphological characters:
Weight, diameter, pulp hardness, color, LAI (in collaboration with University of Milan).

Phytochemical analysis:
titratable acidity (in terms of citric acid) and pH, quantification of total flavonoids and polyphenols (Folin-Ciocalteu method).

Experimental work

The microclimate conditions are monitored by sensors for:

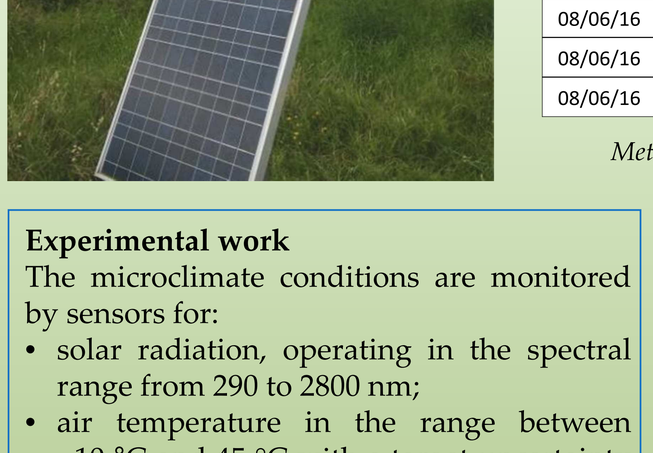
- solar radiation, operating in the spectral range from 290 to 2800 nm;
- air temperature in the range between -10 °C and 45 °C with a target uncertainty of 0.3 °C;
- air relative humidity between 10% and 98% with a target uncertainty of 1.5%;
- soil moisture, measuring the volumetric water content between 1% and 100%.

inside and outside the tunnel with different covering materials.
The instruments used follow calibration procedures defined *ad hoc*.

Tomatoes cultivated in tunnels with different covering materials

Aspects evaluated:

- microclimate and UV radiation measurement, using calibrated and traceable instrumentations;
- monitoring the optical and radiometric properties of the films used;
- physiological processes of culture in response to the type of film adopted.



Conclusions and expected results

In general, UV radiation can be considered as a stress factor which is able to significantly affecting the characteristics of plant growth and to trigger a variety of physiological responses that lead to an accumulation of secondary metabolites, but also important for human health given their antioxidant properties.
On the other hand, instruments that measure solar radiation need constant maintenance and calibration, to obtain UV-B measurements of required quality.
The expected results are: to assess the productivity of the agricultural product as a function of the meteorological parameters measurement uncertainty within the protected cultivation; assessment of the different degradations of the covering materials with reliable instruments; to assess quality through the chemical characterization of the crop with *health promoting compounds*.

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