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REDUCING *Botrytis cinerea* INCIDENCE IN UNHEATED TOMATO GREENHOUSES IN REAL TIME USING A WIRELESS SENSORS NETWORK

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Abstract: The objective was to investigate the influence of ventilation on the humidity conditions in unheated tomato greenhouses and the consequences for *Botrytis cinerea* control and generate the necessary knowledge to build a warning system for this problem. Two different natural ventilation treatments were randomly assigned to the greenhouses. One treatment was permanent ventilation (PV), with the vents open during the day and night, while the other was classical ventilation (CV), in which the vents were open during the day and closed during the night. On a second stage and supported by a wireless network of air relative humidity and temperature sensors a rules based engine with defined setpoints will be developed to make available a early warning system via SMS, e-mail and Web. This will allow the growers to act only when needed, making possible to reduce chemical use, lowering both production costs and environmental impacts.

Keywords: greenhouse, natural ventilation, *Botrytis cinerea*, wireless sensors network, warning system

1. INTRODUCTION

In Mediterranean countries, like Portugal, most greenhouses are very simple constructions, covered with polyethylene films, being ventilation the main environmental control technique used. Conditions of high humidity prevail mainly in unheated greenhouses and is a major factor favouring leaf infection by *B. cinerea* conidia. Increased humidity and poor ventilation in the greenhouse have detrimental effects on plant development.

Most crops can withstand a wide range of relative humidity (RH), from very low to very high values, as long as the variation is not drastic or frequent (Papadopoulos, 1991). Humidity directly affects plant transpiration, which affects calcium uptake, hormonal distribution, ion pumping and stomata opening and closing. High RH (> 90%) may reduce growth and is often responsible for nutrient deficiency symptoms; due to the reduction of plant transpiration, not drawing sufficient water and nutrients to the roots, particularly calcium, which can result in physiological disorders (Bakker, 1984). The reproductive phase can also be affected by high humidity. Low RH (< 50%) may induce high stomatal resistance and plant water stress, depending on water availability. Jensen and Rarobaugh (2006) suggested for a tomato crop an ideal humidity between 65 and 75% during the night and 80 to 90% during the day.

Most fungi spores, responsible for the major diseases, will germinate only under high humidity or in free water. High humidity often leads to the condensation of moisture on aerial plant parts, and therefore the effect of free water is often difficult to separate from that of high humidity. The optimum levels of relative humidity to restrict the development of plant diseases are very difficult to define because they are influenced by the temperature (Elad, 1999).