MAXIMIZING GROWTH OF BELL PEPPER PLANTS BY OPTIMIZING CLIMATE CONDITIONS THROUGH INFRARED TEMPERATURE SOLUTIONS

General info
The internet of agricultural things (IoAT) has revolutionary potential called The Third Green Revolution. A smart web of sensors, cameras, robots, drones and other connected devices allows for an unprecedented level of control and automated decision-making.

Plant Lighting, based in Bunnik the Netherlands, provides innovations in protected crop cultivation by translating scientific knowledge into practical uses. They started a study on measuring the optimizing effect of the right light spectrum and daylength of bell pepper plants. The preliminary results have been very promising as infrared temperature sensing allows for optimized plant health monitoring (i.a. stomatal behavior).

Optimal solution
Plant Lighting aims to monitor and control the bell pepper plant conditions to optimize yield under a variety of conditions and at the same time, develop models and best practice measuring tools for greenhouses to monitor crops. For this they needed an infrared temperature sensor that is able to measure the temperature of leaves in a very precise and reliable manner in order to optimize plant conditions and crop yield.

Contact probes have many disadvantages in measuring leaf temperature: they are extremely hard to fix on a leaf reliably, and they only measure a minute spot on a leave that could not be representative for the average leaf temperature. That is why non-contact infrared sensors are the sensor of choice for leaf temperature measurements. Exergen's non-contact temperature sensors are very suitable to measure leaf or crop temperature. They are unpowered devices that don't drift and don't need recalibration. They have an unparalleled resolution and repeatability.

Why Exergen IR non-contact AutoSmart AGRI sensors?
Plant Lighting used the AutoSmart Agri in their research as this model is especially designed for measuring leaf temperature. The AGRI solution is specifically calibrated for leaf temperature and comes with a flexible gooseneck for easy sensor positioning towards the leaf, even if they move during the day. It also includes a Teflon housing for protection and stability and a clamp for mounting. This ensures that the AGRI sensor measures the average leaf temperature accurately and reliably. The sensor generates an analog output that can be read out by data acquisition systems easily - for data analysis and monitoring platforms in the cloud.

Last requirement was that the sensor needed to be extremely accurate. To optimize the plant's condition the Vapor Pressure Deficit (VPD) needs to be calculated. This can only be done if the delta T (difference between leaf and ambient temperature) is measured precisely. Delta T variations of simply tenths of degrees have already major consequences for VPD calculations. The AGRI solutions come with a resolution of 0,1°C so is ideally suited to measure minuscule yet significant temperature changes in leaves.

Commercial advantages
Temperature affects the speed at which a plant develops, and it is not the ambient temperature within the greenhouse but the plant temperature that is the primary regulator. By calculating the VPD based on the delta T, the plant growing conditions can be optimized by adjusting ambient temperatures (heating or cooling of greenhouse) and by precision irrigation (watering the plants or nebulization of greenhouse sections).

The goal is more than ambitious: to make precision farming a reality and to take a vital step towards a more sustainable food production outcome using precise and resource-efficient approaches. Objective is that smart farming will finally realize the goal of feeding a fast-growing population (9.6 billion by 2050) in a sustainable and efficient manner.

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