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Effects Of Smart Lighting In Agriculture

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Abstract

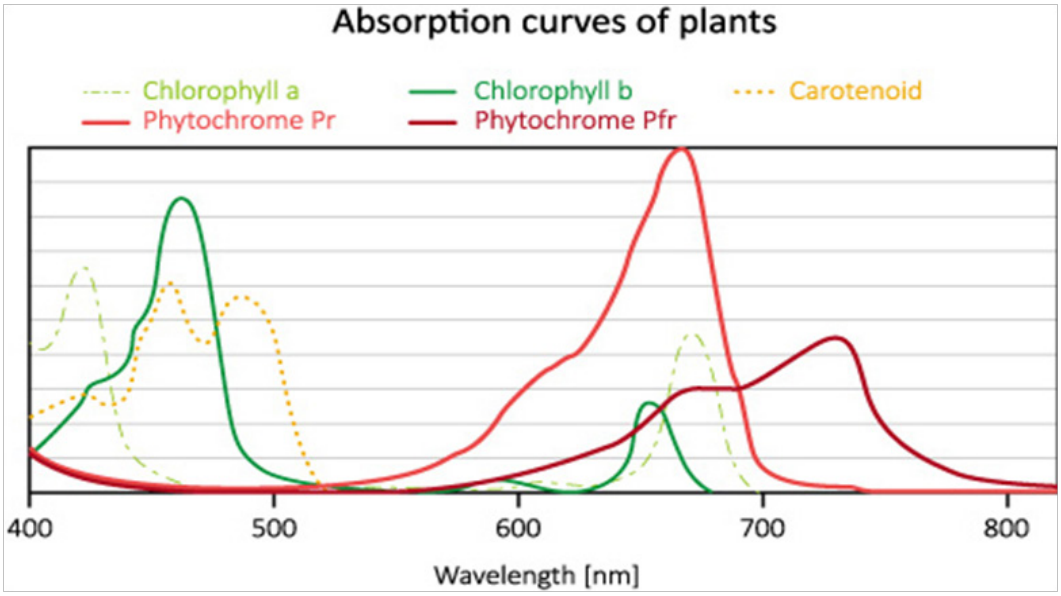
Smart lighting is now emerging as an effective and efficient way of providing photoperiod, energy and proper growth of crops in field of agriculture and horticulture. Smart lighting has a huge scope in aquaponics and environment-controlled cultivation. Smart lighting involves the use of LEDs, luminaries, sensors, and computer imaging. Due to the occurrence of uncertainty in the availability of natural sunlight and photoperiod, smart lighting tools play an important role in crop cultivation. These smart lights provide the optimum wavelength and photoperiod that improve the plant metabolism and growth, thus contributing to the improvement in the overall production and productivity of the crops.

Introduction

Agriculture is a vital field in mankind that involves the cultivation of crops using natural resources. One such inevitable natural resource is light. The natural source of this light is the sun. The amount, intensity, photoperiod, and quality of the sunlight play a crucial role in plant growth and development. The photooxidative and photochemical reactions taking place in the plants are completely dependent on the sunlight. The amount of sunlight determines the photosynthetic rate and photosynthesis in the plant. Sunlight also contributes to the phototropism of the plants. The daylength of the plants relates to the photoperiod of the sunlight.

Smart lighting applications

Smart lighting is an emerging trend in the field of agriculture that involves the use of LEDs (light-emitting diodes), IoTs, sensors, and computer imaging. This smart lighting tool provides an artificial source of lighting for the plants. In the enclosed environment, the LEDs are the inevitable source of light. As the light energy contributes to the rate of photosynthesis, it ultimately improves the yield of the crops. Incandescent lights



and LEDs are the major sources of lighting, but LEDs prove to be more effective and energy efficient than incandescent lights.

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In the stream of smart lighting, blue and red lights are proven to be more absorbing by the chlorophyll molecules and thus increase the photosynthesis rates. These photosynthetic rates trigger the production of carbohydrates that boost plant growth and yield. The optimum wavelength required for plant growth and development is 610–700 nm for germination, bud, and flower initiation. Wavelengths ranging from 700 to 800 nm have been proven to show increased photosynthesis. Thus, the plant shows the best growth in blue (400–500 nm) and red (600–700 nm) lights. One of the major advantages that smart lighting provides is its availability and modification accessibility, i.e. we can modify the desired light and wavelength of our choice by increasing and decreasing the intensity and wavelength of the light of our choice. This helps in maintaining the desired amount of light required by the plant for maximum yieldby the use of these high-precision lighting systems, optimum lighting can be supplied, which improves the photosynthesis in plants and overall growth and production and, in turn, increases the yield.

Advantages of smart lighting

Smart lighting emerges as the easier and more effective compared to the natural light. Reduced uncertainty and increased trapping efficiency proved to be the ultimate advantage. Further accessibility and availability is more easier. These smart lighting has a huge scope in research field and lab conditions thus the smart lighting can be installed wherever and whenever required.Moreover, the suitable wavelength and frequency can be modified as required, when the plant is in need of light source or does not require light source, it can be suitable altered and grown. In then closed cultivation system the improved lighting improves the metabolism in plant thus contributing for the effective increase in the yield. Hence theseadvantages prove that the smart lighting is best source for lab conditions and closed cultivation

The current trend light source

In the world of climate change, harsh weather patterns, increased pollution, and uncertain rains, the available sunlight and its quality are ultimately degraded and undesirable; thus, the solution to this would be smart lighting. Because the smart lighting is easily available, accessible, and easy to manipulate. In protected cultivation, these are the vital components. By using sensors and computer imaging, the stress in the plants can be monitored, mapping can be made, and the places on the map can be identified and marked, thus giving an overall importance to those places and improving them. These sensors can be used for monitoring the light availability in the plants, and the optimum light can be provided for the proper growth and development of the plants. Hence, in this modern system of plant cultivation, smart lighting is very useful in growing the plants and improving the yield of the plants in the fields of agriculture and horticulture.

Conclusion

Smart lighting is the most advanced method of supplying light energy to plants in the form of LEDs and bulbs. It is the most advantageous and best way because of its manipulating powers. The stresses and deficiencies in the plants can be identified, and adequate light energy can be supplied. In these ways, plant growth and metabolism can be improved, and overall productivity can be increased by the use of smart lighting.

References

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