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Popular Article

Effect of light, temperature, and humidity on plants

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Abstract

All types of tissue cultures should be incubated under conditions of well-controlled temperature, humidity, air circulation, and light quality and duration. These environmental factors may influence the growth and differentiation process directly during culture or indirectly by affecting their response in subsequent generations**.** Light, humidity, and temperature are major Physical factors in environment that decide how the in vitro plants will turn out to be, in addition to other physical and physiological factors.

Key Words: Light intensity, LEDs, Flowering, Vernalisation

Introduction

Plant growth regulators control the growth and development of plants. In addition to PGRs, extrinsic factors such as light, temperature and humidity also influence the growth and development of plants. In fact, plants give response according to the duration of light and dark exposure. Flowering in some plants is induced by their relative exposure to light and dark periods. This response of plants to the relative period of day or night is called photoperiodism. Apart from light, temperature also influences flowering in some plants. Some plants produce more flowers when exposed to a specific period of low temperature. This kind of development of flowers due to the influence of low temperature is called vernalisation. Since these plants need to be exposed

to low temperatures for a specific period, vernalisation provides the time for vegetative growth and hence prevents early flowering. This article covers the effects of light, temperature and humidity in tissue culture and how these different physical factors play a different role in creating a suitable environment for plants.

Physical factors:

- Light
- Temperature
- humidity

Light

Light energy is used in photosynthesis, the plant's most basic metabolic process. When determining the effect of light on plant growth there are three areas to consider: intensity, duration and quality. Light influences major physiological changes in plants, such as plant development, growth, morphogenesis and metabolism. Plants possess two types of photoreceptors: photosynthetic pigments that harvest light for photosynthesis, and photosensory receptors that regulate non-photosynthetic light responses**.** Light-emitting diodes (LEDs) are a light source with low energy consumption and high photoelectric conversion efficiency, and they can satisfy the energy-saving needs of plant tissue culture systems. LED colours or combinations commonly used for plant tissue culture are white, red, blue, and mixture rates of blue and red. red and blue light are most preferable for plants. It has been reported that red light is important for shoot and stem elongation, phytochrome responses and changes in plant structure. In contrast, blue light is important in, stomatal opening, chloroplast maturation, and photosynthesis. Blue and red combination LEDs have been used for studies in many areas of photobiological research such as photosynthesis and chlorophyll synthesis.

Temperature

Temperature is a critical environmental factor that affects plant growth and development. Each plant species has a suitable temperature range. Usually, higher temperature promotes shoot growth and stem elongation with thickening. However, temperature above the optimal range suppresses growth. Typically, the culture room for growth of plant tissue cultures should have a temperature between 20 ℃- 27 ℃. But it also varies depending on the genotype of plants with a temperature fluctuation of less than ±0.5°C; however, a wider range in temperature may be required for specific experiments. For most plant species, vegetative development usually has a

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higher optimum temperature than for reproductive development. Cardinal temperature values for selected annual (non-perennial) crops are given for different species. Photoperiod sensitive crops, e.g., soybean, would also interact with temperature causing a disruption in phenological development. Temperatures which would be considered extreme and fall below or above specific thresholds at critical times during development can significantly impact productivity.

Humidity

Humidity is the amount of water vapour present in the air. Apart from the water and light, moisture in the air in the form of water vapour affects plant growth. Usually, plants evaporate water to cool themselves. If the humidity level is too high, plants evaporate too much water, and cannot get rid of the water vapour, which stops the evaporation process and affects plant growth. The plants' roots can no longer take on new nutrients. Or if the humidity is too low, plant growth is often compromised as crops take much longer to obtain the saleable size. Also, growth is hard, and overall quality is not very good.

Conclusion

These three physical factors are the light; temperature and humidity mainly determine plant development, such as leaf size, stem elongation, and plant anatomy. Light plays a pivotal role in a plant's life, not only for photosynthetic energy production but also for its regulative role of molecular, biochemical and morphological processes that support plant growth and development. For the in vitro culture these factors play a most important role.

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