

Energy Conservation by Changing Illumination Method in Plant Tissue Culture Lab

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Abstract

Plant tissue culture series of culture techniques used to grow plants in-vitro. Major components which plays role in culturing plants in-vitro are light-temperature maintenance, type of media used, type of enzymes provided for the growth of plants. In plant tissue culture laboratories, major cost is involved in maintenance of light and temperature. Current or traditional method of illumination in plant tissue culture laboratories is down-ward illumination method. This paper suggests sidewise illumination method thorough which number of tube lights is reduced. Lumen method and point calculation method of illumination calculation is used. It has environmental benefits like energy conservation and has economic benefits as well. Area uncovered in range of light is found to be more in down-ward illumination method than in side wise illumination.

Keywords: Energy Conservation, plants tissue culture lab, artificial illumination system.

I. INTRODUCTION

Plant tissue culture is series of culture techniques used to produce plant in-vitro. In plant tissue culture plant is produced in a culture room on specific media to provide nutrients to plant.

Small tissue section of plant is used for culturing it can be shoot, root or leaf of the plant. Artificial illumination system is provided to such plants to facilitate growth of it. Plants growing in tissue culture laboratory required specific light and temperature condition which is manually maintained.

Major factor which plays role in tissue culture lab is illumination. Traditional method of illumination is down-ward illumination method; tube lights required in this type of method is more.

II. LITERATURE REVIEW

Literature review regarding illumination in plant tissue culture lab reveals that light required for culturing is 300-5000 lux. Plant cultures can be maintained in rooms with air conditioners and tube lights instead of highly priced plant growth chambers. The conventional method of downward illumination can be replaced by sidewise lighting systems, which not only reduces the number of lights but also provides more uniform illumination to the cultures. In the tropical and Mediterranean regions, the electrical lighting systems can be replaced by sunlight . The tissue culture laboratories in Cuba produce millions of tissue-cultured sugarcane, pineapple and banana plants using natural light.

III. METHODS OF ILLUMINATION

A culture room where study is conducted 30 culturing racks are available with 5 shelves each. Shelving unit frames - each unit is 3.0 x 0.6 m with four tiers spaced 0.45 m apart; the first tier is 0.15 m above ground. Frames can be made from angle iron similar to that used in supermarket shelving. A corridor of 0.70-0.75 m should be left between the shelving units and 1.0 m in the front. The shelves are made of thick wire net or punched light iron sheets to allow air circulation. Shelving-unit frames can also be made of steel or wood. each shelf is provided with two florescent lights, hence total 10 lights per rack. In case of side wise illumination only 8 tube lights can be used. Number of lights reduced in culture room is 60.

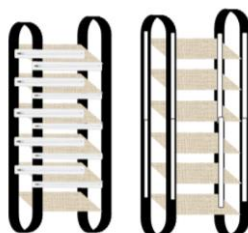


Fig. 1 Downward illumination method and side wise illumination method

IV. ILLUMINANCE CALCULATION

Light calculations can be done by two methods. Lumen Method determines average light levels in large open areas, Point Calculations determines light levels at a specific point on an object or surface .

	Downward illumination (foot-candle)	Sidewise illumination (foot candle)
In rack	103.7	82.9
In full chamber	518.6	414.9

Table: light calculation in downward and side wise illumination by lumen method

Downward illumination	4629.6 foot candle
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Table: light calculation in downward illumination by point calculation method

	Area out of range (in square feet)
Before	36
After	31.5

Table: Area out of range in both illumination method

Point	Side wise illumination (foot candle)
0.9	12345.6
1.8	3086
2.7	1371
3.6	771
4.5	493
4.9	416
4.5	493
3.6	771
2.7	1371
1.8	3086
0.9	12345.6

Table: light calculation in side wise illumination by point calculation method

V. CONCLUSION

High energy consumption is found in plant tissue culture labs due to maintenance of specific light and temperature condition. Illumination calculation from both point method and lumen method shows significant difference. Area out of range of light is also reduced by 4.5 square foot after adoption of side wise illumination method. Number of lights reduced after adoption of new illumination method is 60. Major energy conservation and cost benefits are found in plant tissue culture lab if downward illumination is replaced by side wise illumination in culture room which can conserve up to 134784 Units/year.

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