

Reduce, Reuse and Energy Conservation 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. This paper suggest several strategies to be applied in plant tissue culture lab through which cost of production can be reduced and environmental benefits like energy conservation, water conservation can be achieved. Strategies like change in illumination method, waste water reutilization, reuse of plastic bags and trays, natural illumination, etc can be environmentally beneficial. Investment required for implementing strategies are less than economical benefits obtained hence it is cost beneficial as well.

Keywords: culturing plants tissue culture lab, natural illumination.

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. Basic facilities required at laboratory are washing area, media preparation area, aseptic transfer area and culture room for culturing.

II. LITERATURE REVIWE

Designing of agricultural cleaner production system showed Adoption of advanced field irrigation, Fertilization technique like organic fertilizer, farm fertilization and Straw used as- feed material, raw material of industrial production, fuel source - can save water up to 30-50%, improving soil fertility, Energy production, revenue generation from waste.

III. CASE STUDY OF PLANT TISSUE CULTURE LAB

The plant tissue culture company is leading pioneer in Gujarat, located in Baroda. facilities at the company include a 7000 sq. ft of state of art well equipped Tissue Culture Laboratory with the annual production capacity of over 2 million plants. It has 7' laminar work stations and 3 environmentally controlled growth rooms, each having illumination for excellent growth of in vitro cultures and fully equipped molecular lab. it has hardening facility includes 8000 sq. ft. of green house and 70000 sq. ft. of shade nursery equipped with micro irrigation. It is spread over 14 acres of model farm near Vadodara, Gujarat. . plug plants are also produced. Plug plants, liner plugs or starter plants are small-sized seedlings grown in trays in climate controlled environment, ensuring high rate of germination hence resulting plants can be successfully used by farmer . These plants have well established root systems, and are ready to plant in farmer's field. This reduces cost of purchasing hybrid seedlings for the farmer, ensures he has field ready plants with minimal mortality and can take an intermediate crop harvest faster than planting from seed .products produced by tissue culture labs are Banana, Sweet potatoes, potatoes, parval, fig, lemon , pineapple, tindora etc. Organic manure and micronutrient are also produced. For better production yield and improved quality of plants, it is modified at primary level before culturing. Tissue culture offers uniform yields, good selection of right varieties, resistance against disease and faster, larger yield compared to conventional planting material. With a production capacity of two million plants per annum.

IV. SUGGESTED STRATEGIES

A. Downward illumination method can be replaced by sidewise illumination.

Literature review regarding illumination in plant tissue culture lab reveals that light required for culturing is 300-5000 lux. Light calculations done by two methods- Lumen Method – which determines average light levels in large open areas and Point Calculations which determines light levels at a specific point on an object or surface

B. Waste water generated can be reused in irrigation to greenhouse and nursery.

Water used in plant tissue culture room is only in washing, hence there is no harmful chemical or any other material found in waste water. Waste water produced goes to municipal drainage. As water is reused, almost zero water goes to drainage. Total amount of waste water generated is 1500L per day, hence total 547500 L of waste water is used

C. Plastic bags used in culturing can be reused at least once.

Per day approximately 20000 bags are used in lab, which cost around Rs 500 per day. Hence there can be huge saving of Rs 1,82,500 per year. Waste generated due to plastic bags is 100 Kg per day, so per year 36500 Kg of waste is prevented

D. Aluminum foil used for incubation of media can be replaced by stainless steel plates.

Per day waste generated due to aluminum foil is half Kg. there is 183 Kg/year of waste generated due to use of aluminum foil which is disposed in municipal waste. If aluminium foil is replaced by stainless steel plates, waste generated is reduced and steel plates can be utilized again and again. Cost of investment in stainless steel is 40000 Rs which is an one time investment. Benefit from replacing the aluminum foil to stainless steel is found to be 3800 Rs for current year and 43,800Rs/year for successive years (i.e. cost of aluminum foil used per year).

E. Media preparation should be done only when it is required.

By adopting practice of media preparation only when it is needed, electricity consumption in refrigeration and reheating of media. Electricity used in refrigeration is 4 units per month and reheating is 45 units per month. This is conserved when media is prepared only when it is required.

F. Production of same plant for 6month or year

In plant tissue culture lab, production of different plant in same year is adopted. Large amount of chemicals and media is wasted due to production of different plants again. Wastage of chemicals/media per year is 6% of total raw materials, cost of Wastage of chemicals/media per year is 6% of total raw materials. (add)

G. Natural illumination system for culture room

Plant tissue culture lab contains artificial illumination system made by tube lights and temperature is controlled by air-condition. Natural illumination system that is sunlight can be used for growth of plants in tissue culture lab.

V. CONCLUSION

In plant tissue culture lab waste water generated can completely reutilized in irrigation as it is used only in washing. 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. Aluminum foil used daily can be replaced by steel plates which reduce waste generated by 183 Kg.. Plastic bags used in culturing and plug plants tray can be reutilized which can reduce waste by 400 Kg approximately and can generate cost benefit of 2,92,000 INR.

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