2. Economic analysis of automated micropropagation

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1. Introduction

Tissue culture production has been commercialized for more than fifteen years. Due to the increasing cost of labor in developed countries, the conventional micropropagation system has been challenged by high production cost and low gross profit. In general, most of the micropropagation companies in high labor cost areas have had to either automate their system to reduce labor requirements, or move operations to a low labor cost area to reduce their production cost.

This chapter will analyze the cost components of each step in micropropagation and estimate the effectiveness of automation, using a case study approach.
2. Assumptions of the case

For a given size facility, production costs are very dependent on three major factors:
- Annual production units
- Number of product lines
- Seasonality of production

1. There is a common understanding that overhead costs of production will be different between 1 million units, 5 million units and 10 million units per year production. Since automation is only appropriate for large volume production, the assumption of annual production of 20 million units from a single operation was used in this case.

2. Management of individual product lines through the entire production process is also a major portion of production costs. This includes management of certification, initiation, build-up, inspection of contamination, off-type, production schedule, productivity, inventory, packing and shipping control. Even in a facility producing the same number of units annually, the greater the number of product lines, more costs are incurred. Since automation will require a limited number of product lines, the assumption of no more than 10 product lines was used in this case.

3. Year round capacity usage will have a large effect on the production costs in depreciation, supervision, utilities and other overhead expenses. One of the most important factors in being successful in the micropropagation business is to be filled to capacity, even during the slow seasons. Since automation will require a higher capital investment for facilities and machines, this issue will become even more important. Therefore, an assumption of year round full capacity operation was used in this case.

4. This production operation is only for microcutting production and does not involve liner production in the greenhouse.

3. Cost components of conventional production

Table 1 indicates the production cost and the percentage of each component under the assumptions of the case study.

**Direct labor:** Includes the people who are working individually in media preparation, dishwashing, cutting, planting, inspection recording, packing and shipping.

**Supervision:** Includes the person who is responsible for general supervision of direct labor. This responsibility may differ in each function.

In dishwashing and media preparation, the supervisor will need to coordinate with the Production Manager and calculate the number of boxes and media needed daily and weekly. This also includes preparation and