NEW SYSTEM OF HYDROPONICS FOR GROWTH ANALYSIS OF SWEET POTATO TUBER

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NEW SYSTEM OF HYDROPONICS FOR GROWTH ANALYSIS OF SWEET POTATO TUBER

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EGUCHI T., KITANO M. and EGUCHI H. *New system of hydroponics for growth analysis of sweet potato tuber.* BIOTRONICS **25**, 85–88, 1996. hydroponic system for sweet potato plants (*Ipomoea batatas* Lam.) was newly developed for non-destructive measurement of tuber growth under the controlled environment. In the system, tuber growth was evaluated as changes in the volume in course of time, and the tuber of the plant with three leaves appeared in source-limited growth. Thus, new hydroponic system made it possible to evaluate the tuber volume in course of time for the analysis of the sink–source relationship in sweet potato plants.

Key words: *Ipomoea batatas* Lam.; hydroponics; tuber growth analysis

INTRODUCTION

In the previous paper, a solution–air culture system (*3*) has been applied for hydroponics of sweet potato plants (*Ipomoea batatas* Lam.), where the tuber was grown in the air space (*2*). Furthermore, for evaluation of tuber growth in course of time, it is necessary to develop new hydroponic system. The present paper deals with the hydroponic system for non-destructive measurement of tuber growth in sweet in potato plants.

MATERIALS AND METHODS

Plant materials

Cut-stems of sweet potato plants (cv. Koganesengan) with three, five and seven leaves were cultured for 28 days in a phytotron glass room (an air temperature of 25℃ and a relative humidity of 70%). Several number of tubers were formed in a plant, and the largest tuber was kept in the plant. Fibrous roots on the basal node of the stem were kept for uptake of nutrient solution, and fibrous roots directly extended from the largest tuber were excised.

Solution–air culture system and environment control

Figure 1 shows a schematic diagram of a hydroponic system newly developed for growth analysis of sweet potato tuber. A culture box consisted of the air space and nutrient solution, where the styrofoam plate was used to

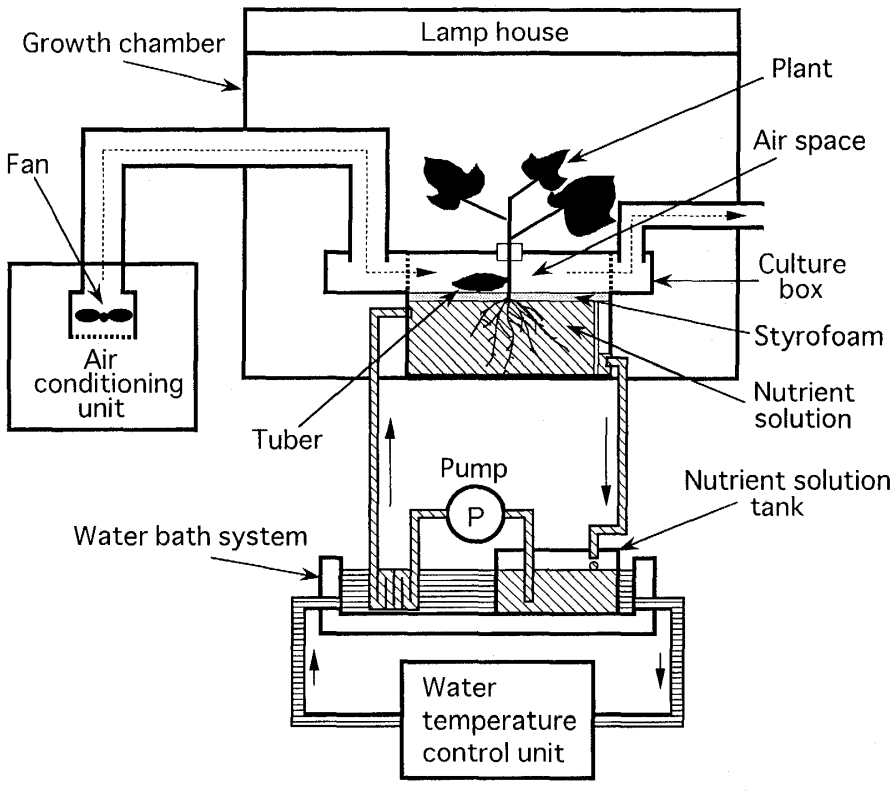

Fig. 1. Schematic diagram of newly developed hydroponic system for sweet potato plants.

sustain the tuber in the air space and to separate the air space from nutrient solution. In the system, the environments of the air space and nutrient solution were controlled respectively: air temperature and relative humidity in the air space were controlled at 24±0.5℃ and 70±5% by the air conditioning unit, and temperature of nutrient solution was controlled at 24±0.5℃ by the water bath system. The hydroponic system was installed in a growth chamber, where the environment was controlled at an air temperature of 28±0.5℃, a relative humidity of 70±3% and a light intensity of 300 μmol m^{-2} s^{-1} in a photoperiod of 12 h. Those environmental conditions have been found to maximize the sink strength of the tuber (*1, 2*). The material plants were transplanted into the hydroponic system, and grown for 20 days. The tuber volume was measured by immersing the tuber into a measuring cylinder filled with water in course of time.

RESULTS AND DISCUSSION

Figure 2 shows photographs of tubers and fibrous roots grown in the hydroponic system. Healthy growth of the tuber was found in the air space on the styrofoam (Fig. 2a), and many fibrous roots were grown in nutrient solution (Fig. 2b). Figure 3 shows time course pattern of the tuber volume in the system.

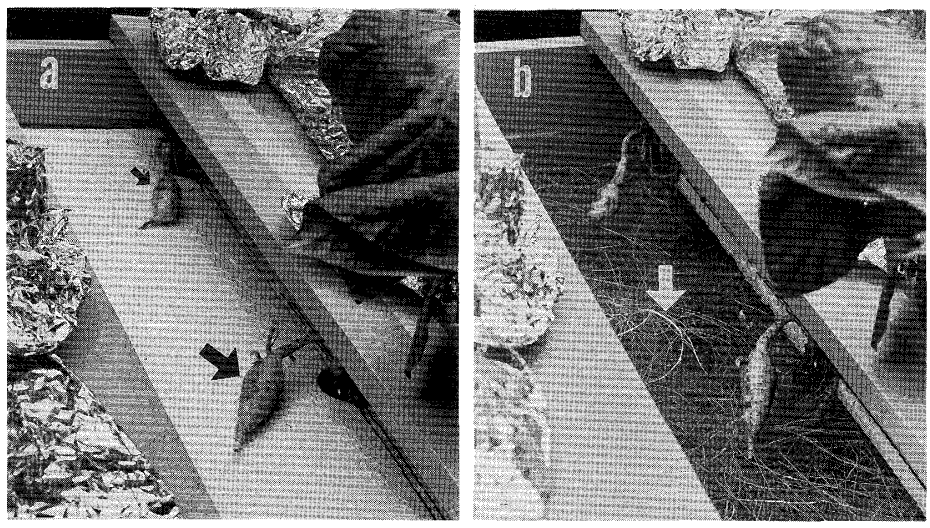

Fig. 2. Photographs of sweet potato tubers (a. black allows) in the air space, and fibrous roots (b. white allow) in nutrient solution after 20 days cultivation in the hydroponic system.

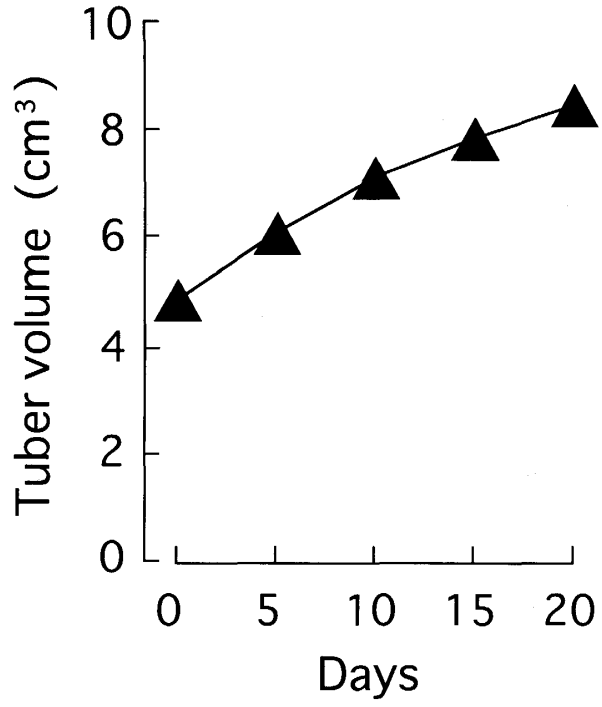

Fig. 3. Time course pattern of the tuber volume in the hydroponic system. Means of 4 plants are plotted.

The volume was increasing during 20 days, and the tuber yield of 8.7 g fresh weight was obtained. Thus, tuber growth was evaluated as changes in the volume in course of time. Figure 4 shows tuber volumes at 0 and 20 days after transplanting and tuber growth rates during 20 days in respective plants with

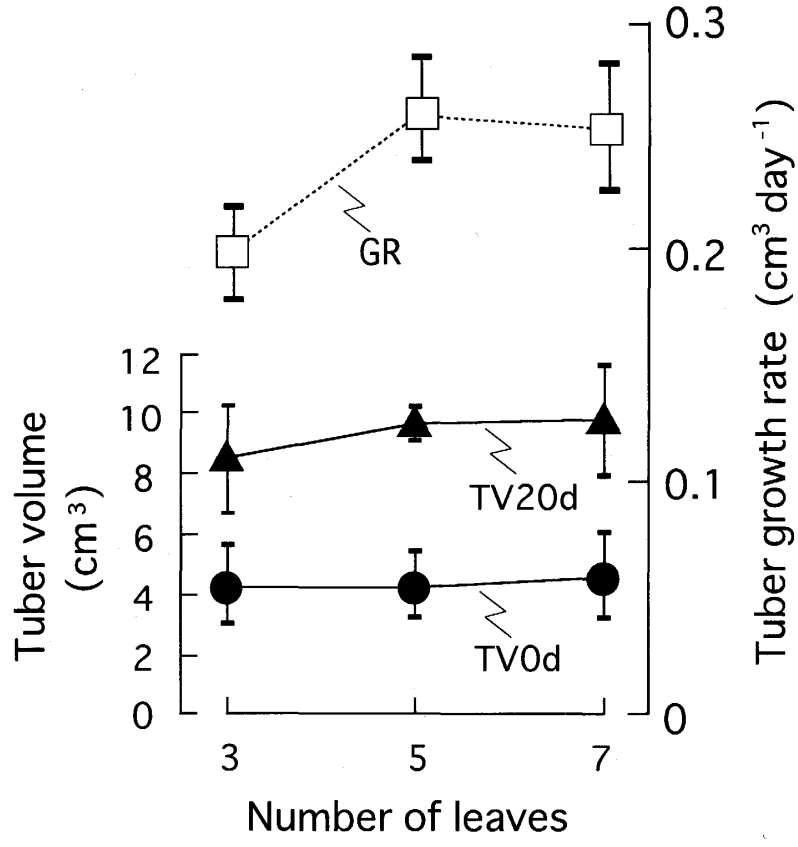

Fig. 4. Tuber volumes at 0 day (TV0d) and 20 days (TV20d) after transplanting and the tuber growth rate (GR) during 20 days in respective plants with three, five and seven leaves. Means of 5 plants are plotted with 95% confidence intervals.

three, five and seven leaves. Tuber growth rates of the plants with five and seven leaves were significantly higher than the rate of the plant with three leaves (5% level). Thus, the tuber of the plant with three leaves appeared in source-limited growth under the environmentral condition of this experiment.

Thus, new hydroponic system made it possible to evaluate the tuber volume in course of time for the analysis of the sink-source relationship in sweet potato plants.

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