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A NEW METHOD FOR GROWING PLANTS IN WATERCULTURE

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ABSTRACT

A waterculture method is described in which the level of the nutrient solution near the plant roots will automatically be held constant without any addition of water or nutrient solution.

A lot of physiological experiments have been carried out with the aid of the waterculture method. A brief review is given by HEWITT (1952). Often a bottle or container in which a nutrient solution is present is used. For attaching the plants there is a hole in the cap and for aeration air is bubbled through the solution.

This method has the disadvantage of a variable water level. The level will gradually be lowered by water uptake by the roots. After a certain time the level is raised suddenly to its original height by adding water or nutrient solution or by changing the whole solution. For tomatoes we found roots will be inactive very quickly in this intermittent wet and dry state, even if humidity of the air is very high during the "dry" periods. This problem may be solved by adding continuously water or nutrient solution by means of a float, but often it is undesirable to add water or solution during an experiment.

The new method depends on a constant water level without any addition of water or solution. The principle is that plants are growing with their roots in a container with nutrient solution in which continuously or with short intervals solution is pumped from a storage tank. An overflow will take care that the level doesn't change. Nutrient solution flowed out by the overflow is draining back into the storage tank. The result is a constant water level in the plant container, without adding any water or solution to the total system. Only the quantity of solution in the storage tank will decrease.

Container and storage tank may be constructed of eternite, polyvinylchloride, glass or other materials. In case of the use of an eternite container and storage tank, these have to be painted with a bituminous asphalt. The small pump is pumping the solution out of the storage tank into the plant container. For aeration the solution falls in the container from a height of at least 20 cm. To prevent splashing a plastic tube is placed around the jet. If necessary extra air is bubbled in for aeration through a plastic pipe with small holes at the bottom of the plant container. The overflow consists of a plastic tube.

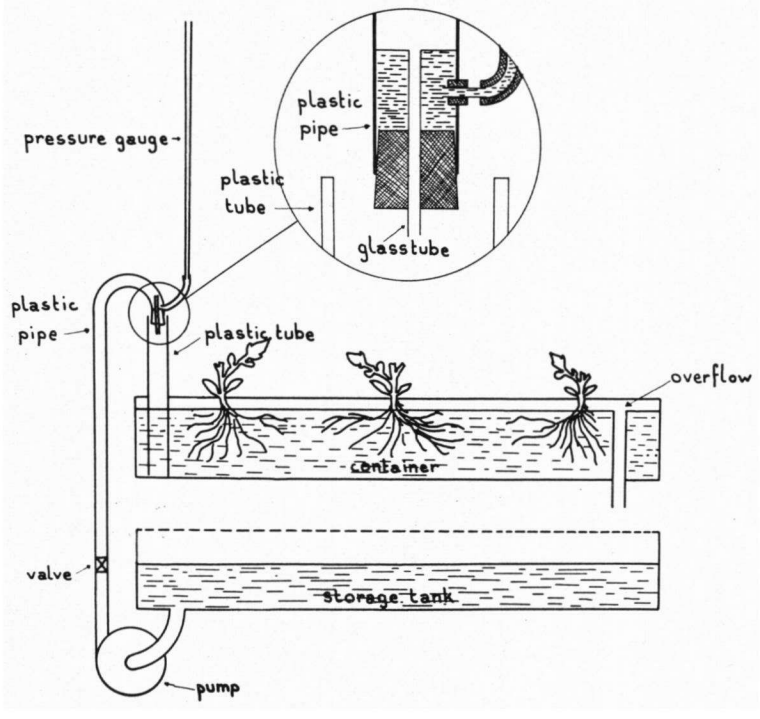

Fig. 1.

In Fig. 1 the same method is shown with a larger plant container for more plants. In this example the storage tank is placed underneath the plant container. This provides extra aeration by the free fall of the solution out of the overflow into the storage tank.

As shown in Fig. 1 a small pressure gauge is placed in the pipe above the plant container. This enables the operator to circulate the nutrient solution at a constant pressure and quantity by turning the valve in the pipe. This may be very important for comparative experiments. The details of the pressure gauge are shown in the detail of Fig. 1. For comparative experiments the glasstube has to be exactly of the same size for every plot. The glasstube is brought about 5 cm into the plastic pipe. This prevents the rising of airbubbles into the pressure gauge when irrigation starts; this is especially important for intermittent irrigation, e.g. 5 min. irrigation and 5 min. no irrigation and so on. Intermittent waterflow may be desirable as some pumps are raising the temperature of the nutrient solution a little bit when turning continuously.

On top of the container are two plastic layers, overlapping each other (see Fig. 2). The left one goes over the right one. Both are fixed together with a small pin through the holes a 1 and a 2. Young tomatoplants or other plants grown up in sand till a length of about

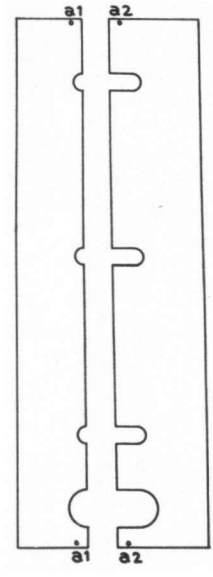

Fig. 2.

2 cm are hold upright by means of a wash clip, the hole of which is made large enough to hold the stem of a plant.

The method described has proved to be very suitable for growing uniform tomatoplants under reproducible circumstances for several plant physiological purposes.

REFERENCES

HEWITT, E. J. 1952. Sand and waterculture methods used in the study of plan nutrition. Techn. Commun. 22 Commonwealth Bureau of Horticulture and Plantationcrops, East Malling.