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A Double-pot Technique for Observing Potato Tuber Growth

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A method was developed to allow nondestructive growth measurements of potato tubers (*Solanum tuberosum* L.). The technique, consisting of 2 basic components, is simple and effective for observing tuber growth from initiation through maturity. The first component is a ''double-pot'', which facilitates washing the growth medium from the tubers. The other component filters the growth medium from the wash water for retrieval and reuse of the medium. Any number of double pots can be used, but only one filtering system is necessary. After observations and measurements have been made, the growth medium can be replaced with little disturbance to the tubers. We generally take tuber growth measurements at 2-week intervals, but we have uncovered tubers at less than one-week intervals without any visible damage.

Arcillite, a calcined montmorillonite clay (1), is placed into 30-cm diam × 30-cm deep tapered, black plastic pots (Fig. 1a) having a 5-cm hole drilled in each side about 7.5-cm from the top of the pot. Potato seedpieces are positioned so that their tops are slightly higher than the bottom of the holes in the side of the pot (Fig. 1d). This placement allows for exposure of the entire stem during the washing procedure. The container with holes in the side then is placed inside another plastic pot of the same size that does not have holes in the side (Fig 1b). The outer pot restricts the growth medium within the inner container. Foliage is tied to a stake placed near the perimeter of the pot (Fig. 1e).

The filtering system consists of a 45-cm × 40-cm × 30-cm deep untreated plywood box with a 1.5-cm hole in the bottom (Fig. 1f). Before washing, the inner pot is removed from the outer pot and placed into the plywood box. The size of the pots and box can be varied to meet individual requirements. It is, however, helpful to have a box that has ample room around the pot for the growth medium to be washed easily from the pot. The purpose of the plywood box is to retain most of the growth medium as it is washed from the pot. Excess water flows out the hole in the bottom of the box (Fig. 1g).

The plywood box rests on a 76-liter plastic garbage can that acts as a water reservoir and settling area for growth medium that flows out of the plywood box (Fig.1i). The garbage can is equipped with a 2-cm diameter siphon tube placed about halfway down the inside to prevent overflow (Fig. 1j). The siphon tube drapes over the outside of the garbage can and into a 4-liter plastic container (Fig. 1k). The garbage can and 4-liter container need to be filled with water. The siphon tube then is filled and the end not attached inside the garbage can is placed inside the smaller container. This placement allows a continuous siphoning of the water in the garbage can down to the level of the water in the 4-liter container. The level of water in the garbage can can be adjusted by

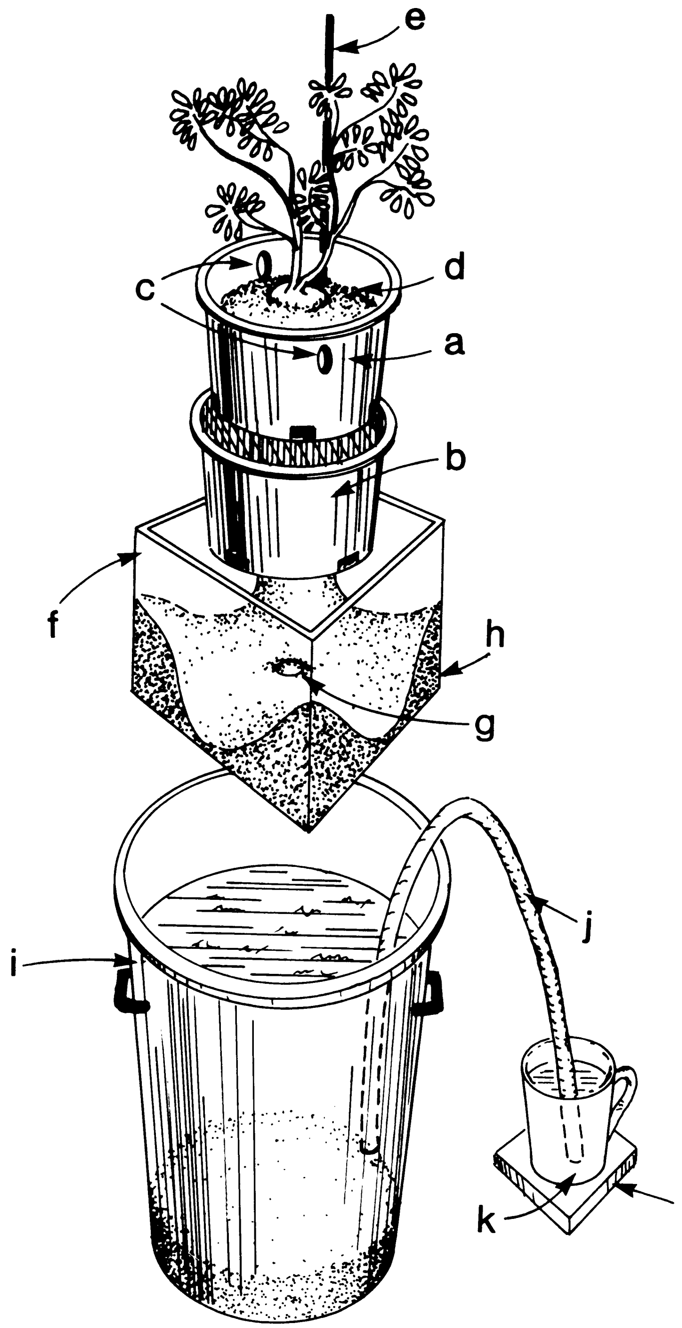

Fig. 1. Diagram of double pot washing system. **a)** inner pot; **b)** outer pot; **c)** side holes; **d)** seedpiece; **e)** support stake; **f)** plywood box; **g)** drain hole; **h)** washed growth medium; **i)** plastic garbage can; **j)** siphon tube; **k)** 4-liter plastic container; **l)** block for adjusting water level.

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raising or lowering the small container (Fig. 1l). As a result, water used to wash medium from the pot goes into the box where most of the growth medium settles (Fig. 1h). The remaining medium is carried to the plastic garbage can where it settles and can be retrieved later (Fig. 1i). Meanwhile, fairly clean water is drawn up the siphon tube and into the small container where it overflows and runs into a floor drain.

The double pot method probably is not appropriate when nutrients are included as a component of the growth medium because of the washing involved. In our studies, a 20N–8.8P–16.6K soluble fertilizer was applied daily in the irrigation water at 100 ppm N. We have not detected any problems with disease transmittance from one plant to another, but this transmittance is a potential problem because of the difficulty of keeping growth medium of different plants from intermixing. We have found that it is better to begin the first washing within 2 weeks following plant emergence. If the first washing is delayed, the root mass makes it difficult to wash the medium from the pot. This apparatus, suitable for many observations and measurements of tuber growth, is simple to construct and use. It allows excellent plant and tuber growth without expensive or time-consuming procedures.

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Small-plot Liquid Injection Wheel Implements for Fertilizing Polyethylene-mulched Vegetables

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First introduced for strawberries in the late 1950s, polyethylene mulch has been used widely for vegetable culture in Florida (4, 5). Currently, about 40,000 ha of vegetables are produced in Florida using polyethylene ground mulches. A full-bed mulch system is used for most of the tomato, pepper, and strawberry crops in Florida (2, 3).

In the full-bed mulch system, most fertilizers and soil-applied chemicals are placed in the bed before application of polyethylene mulch. Once the mulch is applied, it is difficult to replace fertilizer that is lost to leaching from flooding rains and high water tables, which are common during late spring and early fall.

Several methods are used currently by Florida growers to apply supplemental fertilizer to crops grown on mulch. One method involves punching holes through the polyethylene into which fertilizer is placed manually (1). This method is labor-intensive, difficult to calibrate, and often results in crop damage. In a 2nd method, an implement is used to raise the edge of the mulch and to apply fertilizer along the edge of the bed. This technique often results in damage to the mulch and to plant roots. A 3rd method involves placing fertilizer in the soil in the area between the mulched beds. This method usually results in poor efficiency in plant use of applied fertilizer, and the fertilizer is highly subject to leaching.

The same methods are used to apply supplemental fertilizer when successive crops are grown in used, mulched beds for a double-cropping system. Double-cropping is becoming popular, but the technical problems associated with fertilizer application frequently restrict profits. Growers often place extra fertilizer under the mulch for the first crop so that there will be a residual amount to produce a 2nd crop. Soluble salt damage commonly occurs to the first crop, and heavy rainfall may leach the fertilizer intended for the 2nd crop.

Two years ago, a liquid fertilizer injection wheel was developed by a private manufacturer (Liquid Ed Inc., 5796 Western Way, Lake Worth, FL 33463), which might be useful for improving fertilizer management capabilities in the full-bed mulch system (Fig. 1). This implement is pressurized to only 200–300 kPa using a variety of pumps, including power take-off types. As the wheel rotates, spokes pierce the polyethylene and inject liquid fertilizer into the soil.

Research with the injection wheel was begun in Florida in 1984 by Paul Everett at the Univ. of Florida Agricultural Research and Education Center in Immokalee. Presently, studies are being conducted at several locations in Florida to determine the usefulness of the injection wheel for sidedressing vegetable crops and for providing fertilizer to mulched beds for double-cropping. In addition, the injection wheel is being studied as a method to place most N and K in the bed during the season rather than in one large preplant application. To facilitate these small-plot research and demonstration studies, 2 manually operated liquid fertilizer injection

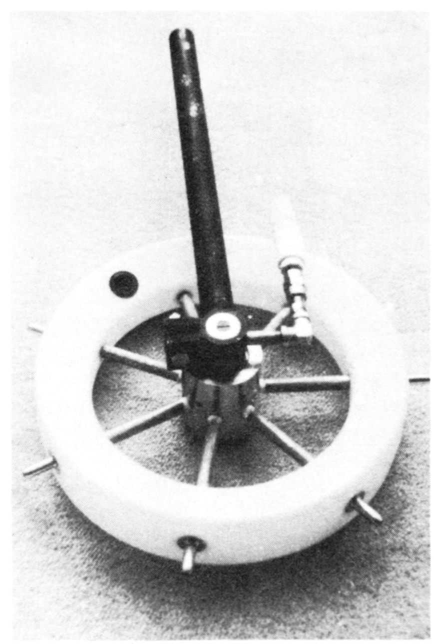

Fig. 1. Liquid fertilizer injection wheel (The "Liquid Injector", Liquid Ed, Inc., Lake Worth, FL 33463). Photograph courtesy of *Florida Grower and Rancher* magazine, Orlando, Fla.

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