# PLANTS THRIVE IN ULTRASONIC NUTRIENT MISTS

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DIAGRAM BY JIM STONE; COURTESY PAMELA WEATHERS

**The Mistifier, Prototype 2. The controller (apparatus A) contains transducer power knob (A-1); a mist generator level sensitivity knob (A-2); indicator lights for transducer on/off (A-3), for heater on/off (A-6), for minimum mist generator fluid level (A-4), and for level sensor emergency (A-5) equipped with an audible beeper; a transducer on/off duty cycle (A-7) that can be varied from 0.1–10 sec. per cycle; and a gas flow meter (A-8). Gas is supplied to the controller via the gas source, and flows from the controller to the mist generator (apparatus B).**

**The nutrient feed system utilizes a medium reservoir (apparatus C) with an outlet (C-1) to the pump (apparatus D) and a sterile filter pressure equalizer (C-2) added to facilitate pumping. The pump is a low-delivery, peristaltic type with a main power switch (D-1) and an autoclavable tubing junction loop that is easy to insert and remove.**

**The mist generator (apparatus B) is completely autoclavable and consists of the transducer (B-1) in a sealed housing (B-2) with level controller sensors (B-3), and a power cable (B-5) tie-in to the controller. The chamber of the mist generator is a clear glass tube (B-4) that is seated between the transducer housing and the top plate (B-6) containing five access ports (B-7): one for gas input; one for mist output; one for nutrient medium input; and two others for optional needs.**

**The cassette (apparatus E) is completely autoclavable. Nutrient mist enters the cassette through a port (E-1). One endplate contains a tissue loading drawer (E-5) that is sealed in place by two clamps (E-7). Tissues, calli, or even cell suspension inocula are placed inside the cassette through the loading drawer, which can be opened via a handle (E-6). At the bottom of this endplate is an exit drain port (E-3) for the condensate and gas from the nutrient feed mist. This drain port is equipped with a check valve to protect the sterile integrity of the cassette should the usual positive pressure suddenly drop and become negative.**

**Inside the cassette, a fine mesh screen (E-2) is seated 2–3 cm above the base of the cassette. The screen can be made of several different materials, including polypropylene and stainless steel. Beneath the tissue support screen is an optional cassette heater (E-4), which is sealed into the base of the cassette.**

WASHINGTON, D.C.—A prototype bioreactor expected to become commercially available later this year uses ultrasonically driven mists to deliver nutrients to plant tissue cultures. The apparatus "provides useful benefits" for growing a wide variety of plant types, according to Pamela Weathers. She described the technique at the recent "AgBiotech '88" conference held here. In conjunction with several commercial concerns, Weathers and Ron Cheetham at Worcester Polytechnic Institute (Worcester, MA)—along with Ken Giles, vice president for research at Twyford Plant Laboratories (Baltonsborough, U.K.)—are developing instruments for research applications and commercial use.

So far, Weathers says, seven plant species—including ferns, carrots, and bananas—have been tested for growth in the system. Speed and avidity of shoot growth are greater for mist-fed plants when compared to control cultures grown on conventional solid agar support containing dissolved nutrients. Moreover, she adds, the response to nutrient aerosols is so favorable that some "averaging" of nutrient requirements seems possible, enabling several different species to be "co-cultured" instead of each being grown separately with its own optimized nutrient mix. Such adaptability could make the technique attractive to companies that micropropagate several species of plants—an effort that is currently relatively slow and entails a great deal of manual labor, thus making it difficult to scale up.

In the growth compartment of prototype versions of the bioreactor, plant tissues are situated on a mesh support. There they are bathed by nutrient mists formed by sonicating a liquid medium in a separate compartment. The mists are wafted from one compartment to the other by a stream of gas. Reliance on nutrient mists cuts down considerably on the quantities of nutrients—including any expensive ingredients—needed for tissue growth, Weathers notes.

Another advantage of the newly designed system is that the entire bioreactor can be sterilized. And, because the system remains closed during a growth run, chances of contamination are reduced substantially.

The underlying technology is owned and has been principally developed by BioRational Technologies (Stow, MA), which is run by Weathers. The equipment has been engineered in cooperation with Cerex Corp. (Gaithersburg, MD), and it will be manufactured and distributed as the "Mistifier" by Manostat (New York, NY).

Experiments to test how mammalian cells respond to nutrient mists are now being planned, Weathers says.

—**Jeffrey L. Fox**