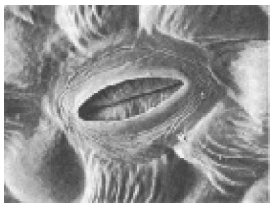
Dry Water in the Greenhouse

One might say, water is supposed to be wet. Well, not always! That is only one form, or physical state, we are familiar with. We will not be dealing with the liquid today. We will be considering the benefits and remarkable uses of water that has been atomized into micron-size droplets. You might think of this state as **FOG**. This is not the fog that you encounter driving on the way to work - this fog has different properties because of its particle size.

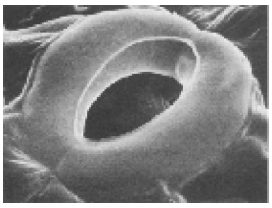
We will discuss various ways to use this "micron fog" and then how to build the equipment to produce it. Could we use fog to regulate the temperature in the greenhouse, or maybe speed up plant propagation, or even distribute insecticide to the underside of leaves? Wow! What if I could reduce water-borne disease problems, or what might I do to deliver a foliar spray? Could I cool my butterfly larvae and not risk getting them wet? When water is broken into particles of a size less than 10 microns, it has the ability to exchange heat instantly with anything it touches. Exchanging heat means it cools it. This flash-cooling property is what we can use to reduce the temperature in the greenhouse. To make small-particle fog, smaller than the smallest human hair, we shake the water real fast - faster than the speed of sound that a human can hear.

This vibration is called ultrasonics, and is accomplished with a hand-sized device set in the water. For fog to evaporate instantly it requires energy, or heat, which is just what we might like to get rid of in the greenhouse. This small-particle fog requires 600 calories of heat per gram of water to evaporate. Well, I am happy to give it the heat from my greenhouse because I get around 10 degrees F. of cooling along the Gulf Coast. In drier climates one might get as much as 35 degrees F. of cooling. The effectiveness of the cooling process improves as the temperature rises between 85 and 115 degrees F. As the humidity rises above 90%, performance is marginal. Conventional pad and fan systems will not take the process far enough and have high operation costs.

Here is what all of this means to the plants. As the temperature rises over 85 degrees F. the plants will cease transpiring and the growing process will stop. The stomata in the plant actually closes. The plant uses the stomata as a pump to exchange gasses and moisture with the air. When the stomata are closed, the pump stops and nutrients can no longer enter the root cells and be pumped to the leaves.



Closed Stomata



Open Stomata

With fog particles smaller than 10 microns you can actually feed the plants moisture and nutrients through the stomata. This lets you **propagate those hard-to-start cuttings** directly in the leaves with minimal heat and water stress. Minimizing stress reduces diseases and virtually eliminates water-borne root problems. The mist systems used in most cutting beds deliver the moisture and unfortunately provide the ideal conditions for most fungus. Utilizing fog will prevent this, and will result in less damping off and accelerated leaf growth. We will leave **foliar feeding** for another day, but keep in mind that nutrients are absorbed by leaves and stems, and not just roots!

Administering **insecticide through fog** opens an entire new world in the greenhouse. Residue analysis indicates that a high percentage of contact insecticide can be delivered to the lower leaf surface where those whitefly and other soft-bodied insects hide. Overall tests of plants treated with fog-laced insecticides show that just a fraction of the recommended doses are required.

Suppose we want to clean the greenhouse or our growing equipment. **Sterilization** can easily be accomplished with fog by adding hydrogen peroxide. A solution of 35% H2O2 as a sanitization agent can be transported easily and the small particles carry it into the most hard-to-get places that harbor bacteria. If you are already using hydrogen peroxide you understand that it is very effective at killing bacteria. What is left over is pure water and there are no environmental damages nor chemical fumes to deal with. **Fungusides** and **virusides** can also be added to the fogger to pre-treat growing containers.

Another amazing property of this dry-water fog is that it **functions as a humidifier** in the winter. What is so nice is that the surface remains dry, which eliminates the threat of mold and mildew. The particles are so small that ultrasonic fog is not apparent to the eye. Therefore, it has **no adverse effect on the light reception by the plants**. The lumens received by plants from artificial light sources cost a lot of money.

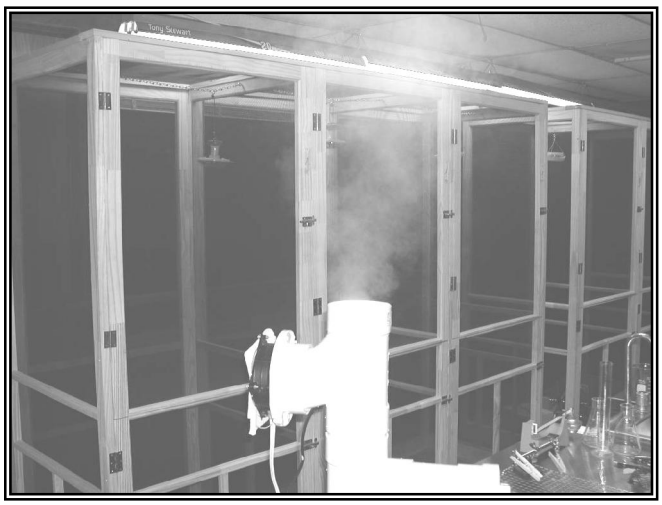
Did I forget to mention that fog will **keep plants from freezing**? It is just a miracle of thermodynamics. It requires some study to understand, but agreenhouse full of fog will protect your plants from frost. Fog is a wonderful insulator.

Air filtration , dust abatement and odor removal are all easy to manage. The dry water gathers around other molecules and they get heavy and drop right out of the air. You are left with fresh air, free of pollution.

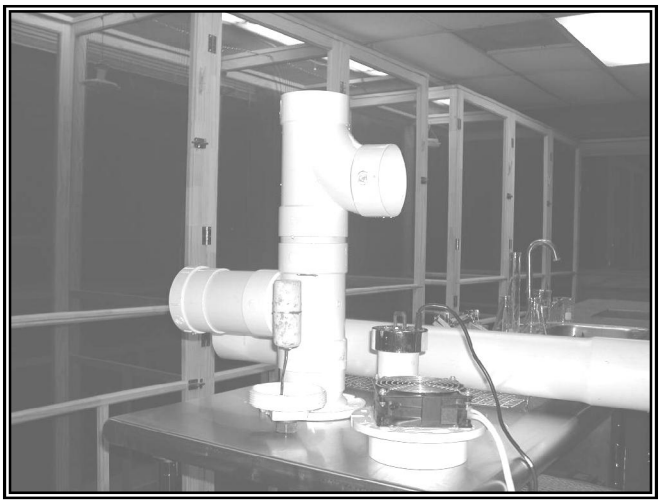
Easy to Build

Constructing your own ultrasonic fog generator is easy to do. You will need to purchase an ultrasonic transducer, a fan and some inexpensive plumbing pipe.

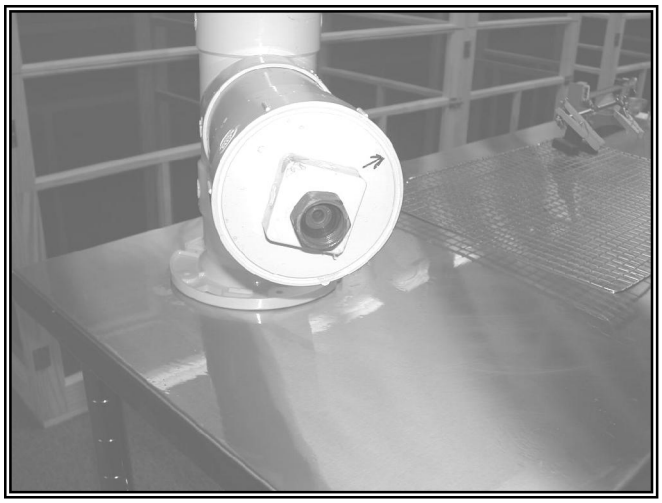
There are other methods of generating fog with very high pressure. I had to take a man to the hospital one day after an accident with 2000psi of pressure liquid. The pressure forced paint under the skin and all the way up his arm. An accident could easily blind you. I cannot recommend a high-pressure installation because of the accident potential. The maintenance of tiny jets is also a major problem with high levels of calcium or iron in most waters.



Above is the completed fog generator in operation.
Notice the fan on the left side. It is used to move the fog out of the generating tube.
It is bolted to a plastic pvc flange. The pipe is a plumbing T with a smooth transition.
Below is another T with a screw-down cap to contain a float valve.



Above you can see the cap removed and the float valve.
Any garden hose float valve will do. Most feed stores sell them for watering pans.
The float valve keeps the water level ½ inch above the ultrasonic transducer.



Here is the float valve installed and the water chamber. Notice the garden hose fitting. The hose attaches directly to it. The transducer atomizes about 1.5 gallons of water per hour. It has an automatic shutoff to protect itself if something goes wrong and the water level gets too low.

Here is the ultrasonic transducer. It sits inside the vertical tube on a piece of 4" pvc pipe. It has five transducers contained in one core. The outdoor power supply is remote. You can purchase these (depending on the power) from $50 to $100.

All of this is glued to a pvc pipe base. Above you can see that the base can be mounted in the greenhouse for stability.

Hope you enjoy the fogger!, Without the fan, you can pour fog like a liquid.

D. Gary Geer