From a commercial herb grower in Victoria.

How do I sterilise my recirculating solution?

I run a commercial hydroponic herb farm. My system is NFT (nutrient film technique) channels on tables. I grow over 20 varieties of herbs.

With a few of these herb varieties, in particular coriander, I have problems with root disease. The disease is probably pythium, *because it is apparently the most common problem in NFT in Australia. It also shows the classic* pythium *symptoms of blackening of the roots, starting at the root tip. Some varieties are more susceptible in winter and others in summer.*

Can you recommend a sterilisation treatment that I could use to prevent this happening?

Answer

Unfortunately, there is no easy answer. I'll start by reviewing what has developed in the Netherlands over the past two decades.

Over the following decade, significant concentrations of nutrients were detected in the ground water and their level was rising. The source was not only hydroponic run-off, but especially from soil-based glasshouses. Consequently, laws were introduced forcing growers in all affected areas to go to 'closed' (recirculating) systems by 2000.

Because of crop failure with a small proportion of earlier attempts to recirculate, the general approach taken was to sterilise the recycled solution to give total kill of any pathogens. For this to be feasible, the quantity of solution to be treated needed to be kept to a minimum. Consequently, the previous media-based systems were retained, but with the run-off solution collected, sterilised, and recycled. The volumes involved in continuous flow systems, such as NFT, were far too large to be financially feasible. For the same area, NFT flows are over one hundred times greater than a dripper-fed media system.

Because the cost of sterilising is high, not every grower decides to sterilise. This is a decision based on cost versus the risk of crop failure. Most of these growers have had no serious problems, but the occasional failure has been a disaster for the individual grower involved.

Initially, there were three main techniques used, namely heat treatment, ozone and slow biological filtration. To this was later added ultra-violet (UV) radiation. In recent times this has stabilised and virtually all new equipment is only heat treatment or UV, in approximately even numbers. This is basically because these are the only techniques, which can guarantee a 100% kill of pathogens, especially nematodes, which are a major problem in Holland.

The cost of these units is very high, and one suitable to handle your flows would be impossibly expensive for your size of operation because of your very high flow rates.

Background to NFT sterilisation

There are a number of other options that can give some degree of sterilisation without getting to 100% kill. There are several background issues here you need to be well aware of:

Low dosage techniques may help keep pathogens under control when there are low levels of infection. They cannot control higher levels of infection, which will probably lead to crop failure. Hydroponic systems are biologically active. This is the likely reason why unsterilised recirculating systems have fewer failures than you might otherwise expect. This is because they not only contain low levels of pathogens, but also a range of 'friendly' beneficial bacteria, etc. Sterilising the recycled solution to kill the pathogens will also kill the beneficials in it.

Most of these techniques involve adding chemicals, which are oxidising agents. These attack all organic matter, not only pathogens. That is, they will also attack healthy roots. To avoid this it is best to deactivate the chemical in the recycled solution before reusing it. However, it also needs enough storage time before deactivation for the oxidising agent to do its job. Some growers, and even some sources of advice, suggest operating with some residual active chemical recirculating through the entire system. This may sometimes be beneficial, but is a very risky strategy. I know numerous cases where the grower's problem has been solved very quickly – the residual was too high and killed off the crop! There have also been cases where the injection equipment (or perhaps a person) has severely overdosed the system and immediately killed the crop, that is, within a few hours.

- Most of these chemicals are nasty to humans and you need to have good practices in place for staff to handle them safely.

Low level sterilising techniques

The following are the major chemicals used for sterilising recycled hydroponic solutions:

- ***Calcium hypochlorite.*** Commonly used as 'pool chlorine'. The oldest, simplest, cheapest, and most risky technique. Bought as a solid – dissolve carefully before use. Do not use 'liquid pool chlorine', which is sodium-based and often contains other unwanted chemicals. It combines with ammonium in the solution to form chloramines, which give the typical 'chlorine' smell and extend its life. Deactivate to well below 1 ppm active chlorine before reuse. Eventually, hypochlorite degrades to chloride ion, which may be unwanted. The calcium component is a nutrient.
- ***Chlorine dioxide.*** Needs injection equipment to mix solutions of sodium sulphite and hydrochloric acid. It has less impact on organic matter (roots) than hypochlorite, so you can keep