Benefits of Water Recycling in Nursery Stock Production

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INTRODUCTION

The horticulture industry worldwide is under pressure to comply with new environmental standards and regulations. These vary from state to state but in most cases the issues at stake are common. The following paper reviews the approachs that different organisations are making towards tackling the problems. Observations are mainly taken from the U.S.A. and Germany where legislation has been enforced more rigourously and for longer than in the U.K..

GROUNDWATER CONTAMINATION

The majority of the U.S.A. and parts of Europe now have laws to protect the quality of groundwater, drinking water sources, and the quality of waste water that enters natural water courses. As a result, container nurseries are having to address fertiliser and water management to ensure that they fall within the law.

In the U.K. at present there is no legislation requiring runoff to be controlled. However, the pressure to introduce such legislation, and to harmonise the situation across Europe, is mounting and it would be naive of growers in the U.K. to ignore the issue.

Unlike in North America, where liquid feeding plays a predominant role in the nutrition of crops, U.K. production relies heavily on controlled-release fertilizers, which offer more control over the nitrogen content of run-off water. Pesticide contamination of water is relatively uncommon unless concentrated spillage occurs. The breakdown of pesticides prior to water contamination is attributed to the development of more environmentally friendly products and the filtration of residues by the soil.

Many North American nurseries are now recycling their run-off water, not only to reduce their potential liability but also to make their products more economical and businesses more profitable. I believe that the British industry should consider this approach for a number of reasons:

1) To prepare for future laws that will control the quality of the water that leaves nurseries.

2) To provide an independent water supply to enable close control over quantity and quality of supply.

3) To reduce the cost of water.

I believe that the last two points offer enough cost benefits for growers to start recycling water. This is particularly relevant at a time when water costs are escalating and the granting of extraction licences becomes more tightly controlled. There are too many different practical approaches to water recycling to propose one single, detailed implementation plan that would suit every nursery. However, there are a number of basic considerations a grower should address in formulating a plan.

If growers simply need to reduce the volume of water used when irrigating, either because of high cost of water supply or because of restricted availability of water, this can be achieved through attention to choice of application method and application management. However, if water is to be collected, either for recycling onto crops or for safe disposal, then a more complex system has to be developed.

IRRIGATION TECHNIQUES

The method of water application and the refinement of irrigation practice will determine the amount of water that runs off growing beds which is available for collection and recycling. Considerable savings in water run-off can be made by optimising the use of water by the crops—that is, ensuring only sufficient water is applied to satisfy the plants' needs. This approach has been called "pulsing" in North America and is used extensively as a first step towards water recycling, where it has often reduced the volume of water applied by up to 40%.

For example, water usage for a crop receiving two applications per day for 20 min might be 1000 gal of water, including some run-off, compared to only 750 gal if applied in shorter bursts three times per day, and runoff may be reduced. Timing of water application should also be considered in any assessment of water usage.

In order to capture run-off water from container beds, the system must be partially or completely closed. Capillary sand beds provide the most commercially viable closed system, although initial investment cost is high. Water savings are made through the elimination of sprinkler drift and the maintenance of a low-level reservoir in the bed at all times. Considerable advances are being made in Germany in the use of capillary mats on flat and sloping applications which should offer a cheaper alternative for some crops. However, most trials have been carried out on *Erica gracilis*, which is sold as an autumn crop, and there is concern that the majority of crops may need more effective winter drainage than matting can offer. The design of capillary beds should allow all water running off the beds to be collected in a central drain or collection point, from where it can be taken for storage and treatment.

The application of water by overhead sprinklers will almost always result in some drift and waste, therefore conservation and recycling of water must come as a result of the design of a recycling system if an overhead sprinkler system is to be used.

RUNOFF WATER COLLECTION SYSTEMS

U.K. nurseries need to consider how to collect run-off water from growing beds to ensure they fall within possible future EEC legislation. Laws in North America and Europe generally relate to the contamination of water courses such as rivers, streams, and ponds by nitrates and chemical residues—and consider the soil as an adequate natural filter for groundwater reservoirs. Therefore, growers should concentrate on how surface run-off water can be contained.

Most American nurseries have developed a twin-bed system that shares a central collection drain. Beds are laid to slope slightly towards the drain (approximately 5 degrees of slope) to ensure water does not sit on the surface, while polythene or ground-cover fabric may be used to reduce loss of water to the soil. While this layout keeps run-off water off the roadways, it reduces efficiency by preventing machinery from working across the entire width of the bed. Water from the bed drains is channeled to a collection pool. Large collection drains ideally need to be strength-

ened to ensure that erosion damage does not occur in heavy rains. This is the same reason why many growers do not favour the use of roads as water collection conduits.

WATER TREATMENT

Where the availability and cost of water is not an issue, growers may be satisfied with regularly checking water quality in the collection pool to ensure it is within required standards, then allowing it to flow into the local water course rather than recycling it onto the crop. In the event of any water contamination the collection pool should be able to be isolated.

The natural filtration of waste water with bog plants such as *Phragmites australis* is becoming increasingly popular in Germany where similar techniques are used for the treatment of domestic sewage and industrial waste. This also allows the collection pond to be used as a site of environmental benefit. Many German growers are now relying on the filtration of water in this way before directly reapplying the water onto the crops. There is evidence that available nitrate levels can be reduced in this way and trials are in the process to establish whether the technique offers any disease control.

Approaches to water treatment vary considerably between North America and Europe. The majority of North American nurseries that recycle and treat their water use either chlorine, ozone, or ultraviolet radiation to ensure that all potential pathogens are killed. Treatment of this type can only take place after considerable mechanical filtration to remove larger solids and will still not remove chemical residues. Herbicide build-up in recycled water was a problem for a couple of American growers I visited. They had been recycling their water for more than 10 years and charcoal filters are now used to remove them. Recycled water was rarely reapplied to crops without blending it with at least 50% fresh water and even blended water was not used in propagation or liner production. The cost of such treatment and monitoring systems is very high and only cost effective on larger nurseries.

In contrast, Dutch researchers and nurseries have been using sand filters for cleaning recycled water. Results indicate that this technique will remove both pathogens such as *Pythium* and *Phytophthora* and small solids. This system can be operated at a fraction of the cost of the more elaborate North American systems and would appear a good option for smaller nurseries or nurseries that do not suffer from pathogens in their water supply. In combination with reed-bed treatment, sand filters would appear to offer growers a cost-effective approach to water treatment.

CONCLUSIONS

Within existing laws it is unlikely that the majority of U.K. nurserymen will be considering the issue of water recycling. This is because of the high initial investment in collection systems and treatment equipment. However, there are considerable cost benefits to those growers who do recycle their run-off water, even if this is restricted initially to the collection of water from glasshouse and polytunnel roofs which should require no treatment.

With customers and the public becoming increasingly environmentally aware we can no longer expect our products to carry our environmental front. Growers must

have forward-thinking environmental policies in order to compete in the future marketplace or the industry as a whole will suffer as a result of reduced public confidence and hence reduced consumption of plants.