Waste Management in Horticulture—The Global Perspective

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INTRODUCTION

Waste management could easily be the most significant issue confronting world horticulture by the year 2000. Some countries are already addressing the problems of pollution of waterways, leaching of nutrients, and recycling of packaging materials, but there will be increasing pressures for horticulturists to manage all the waste from production systems.

Society is demanding that the responsibility for disposing of waste must lie with those who create it and that waste products must not be dumped into the environment.

Words which are sometimes interchangeable with "waste" include "refuse", "superfluous", "rejected", and "worn out". Waste products can be defined as "materials produced or used in a process, that are discarded during or on the completion of that process."

This paper reviews some of the horticultural waste problems around the world and indicates strategies in use or being developed to address the problems.

PHYSICAL WASTE

This category of waste includes packaging, polystyrene and plastic containers, rubber, chemical containers, polythene covers from greenhouses, fertiliser sacks, etc.

In Europe an EU directive on packaging waste has determined that:

- 90% by weight will be recovered
- 60% by weight will be recycled
- 10% by weight is the maximum to be allowed into landfills

Germany has taken a leading role based on a "polluter pays" principal. A "take-back obligation" is used with horticultural packaging being classified as either transport or sales. Protocols for transport packaging require exporters or German importers to make arrangements to have spent packaging collected and/or recycled by specialist companies.

In 1993, 50% of waste packaging collected in Germany was shipped overseas for re-processing. More than 4.5 million tonnes of used packaging was collected, of which nearly 4 million tonnes was fit for recycling, including 300,000 tonnes of plastic.

Cartons which are strengthened and waterproofed with wax coatings create difficulties with recycling but Australian and overseas manufacturers are developing improvements. There are additives which permit separation of wax from paper fibres and thus improve the re-pulpability of wax-coated corrugated fibreboard.

Australian carton manufacturers have been able to reduce the quantity of wax on containers while retaining strength and waterproofing.

German research with composting different types of waxed fibreboard has shown that the composted material can be used satisfactorily in medium quantities in

plant growing media. Contamination with heavy metals, from printing ink, and boron can occur when large quantities of composted wax fibreboard are used.

Strict regulations in the UK restrict the disposal of plastic, used polythene covers from greenhouses, plastic fertiliser sacks, etc. so that burning and landfill dumping are being replaced by collection by specialist companies.

Pesticide manufacturers and suppliers in Canada operate a rinsing, collection, and recycling scheme for empty plastic containers.

Expanded polystyrene (EPS) presents severe waste management problems. The high volume : weight ratio makes it difficult to handle. Japan banned EPS packaging in 1994. Disposal of EPS waste creates problems at wholesale fruit and vegetable markets since it is being banned at landfill sites. Woolworths produce distribution centre at Homebush in Sydney has a polystyrene shredding facility and there are some opportunities for recycling EPS into growing media.

Re-usable polypropylene crates are being developed and used for fresh produce distribution. They are used in Europe, South and North America, Israel, Australia, and North Africa. The crates can be used to carry produce throughout the marketing chain, from farm to the retail outlet. Many re-usable crates fold flat to one-fifth the original volume for return.

Rubber tyres are being recycled into products which may be useful in horticulture. Pacific Dunlop in Australia is utilising technologies from the U.S.A. to convert shredded tyres into weeping irrigation hose and into non-slip pavers. A national collection network delivers used tyres to shredding plants where the rubber is separated and ground into granules of different sizes. These are then formulated into new products.

CHEMICAL WASTE

Contamination of water courses and ground water with irrigation run-off, nutrient leachates, or pesticide residues is a major issue for horticultural industries. There are R & D activities in Europe, North America, Japan, and Australasia to determine the extent of the problem and to develop strategies to minimise pollution.

A recent survey showed that approximately 10,000 ha of containerised woody nursery stock are grown in the U.S.A. Annual rates of nitrogen application range from 188 to 866 kg per ha with an estimated retention rate of 5% to 8% within the plants. Further estimates indicate that 18,500 tonnes of nitrogen are applied each year with 92% being a potential pollutant. More than 48% of the leached nitrogen is discharged to effluent.

The Dutch government is committed to reducing pollution from glasshouses and has developed memoranda based on growing all plants in closed, re-circulating systems separate from the soil. Targets for the year 2000 aim to:

- Reduce nitrate and phosphate leaching to surface water by more than 50%
- Reduce the use of chemical plant protection materials by 50%
- Reduce the use of soil disinfection products by 75%
- Increase energy efficiency by 50%
- Reduce carbon dioxide emissions by 5%

UK surveys have shown significant levels of nitrates and phosphates in water supplies and high levels of herbicides, including 2,4-D, MCPA, and MCPB, in

surface and underground waters. More that 140,000,000 containerised hardy nursery stock plants are sold annually. Many are grown in conditions which favour the pollution of waterways through severe leaching.

Drinking water limits set by the EU are 10 mg litre^{-1} of nitrogen and 2.18 mg litre^{-1} of phosphorus. The Organisation for Economic Co-operation and Development (OECD) defines 0.09 kg litre^{-1} P as the level at which algae will flourish. Phosphorus is an essential nutrient for algae, contributing to the eutrophication of waterways.

Trials with containerised nursery stock in the UK captured leachates from plants grown with different levels of controlled release fertilisers in containers of open structured growing media standing on gravel beds and watered with overhead irrigation. Nitrate levels ranged from 100 to 200 mg litre^{-1} N while phosphate figures varied from 10 to 20 mg litre^{-1} P. High summer temperatures increased the nitrate release rate.

Several countries are utilising the pollution-treating properties of wetlands. The value of natural swamps and peat fens is being exploited and artificial wetlands are being constructed. Lockyer Seedlings in Australia are planting flaxes, reeds, and rushes as a living filter systems. UK authorities are using waste ash from power stations to construct reed beds which clean up polluted run-off water.

Researchers at the Institute for Horticultural Development, Knoxfield, Victoria, are monitoring run-off water from 30 nurseries and cut flower farms to accumulate base data for future studies. There are potential problems with high levels of leached salts, chemical residues, and pathogens. Initial results confirm the need to reduce the volume and fertiliser content of run-off.

The Environmental Protection Agency in the Republic of Ireland estimates that agricultural activities are responsible for 23% of serious river water pollution.

New EU directives for the Rural Environment Protection Scheme (REPS) enables farmers to receive up to Aus$360 per ha for farming in specified environmentally sensitive ways. REPS payments are only available for up to 16 ha on each property.

Developing countries who are moving from planned to market economies, such as China, with 48% of the rivers polluted, has introduced a system of fines for offenders with proceeds being used to develop methods of controlling pollutant discharges.

State Department of Ecology legislation will be introduced in Washington State in 1995 to control the chemical content of waste water from fruit packing sheds.

BIOLOGICAL WASTE

Un-saleable plant material, crop debris, pruning, liquid and solid food wastes, municipal and garden waste can be considered as biological waste.

Researchers from the School of Microbiology at La Tribe University in Melbourne have demonstrated that organic waste, such as citrus pulp, can be treated in a closed composting system to yield a useful material.

Local authorities in the United State are introducing municipal waste composting and there are now 50 to 60 schemes in operation. Composts are targeted for horticultural use and have been shown to be useful as a substitute for sphagnum peat, to improve soil physical properties and as a supply of essential plant nutrients. Release rates are slow and the composts need supplementation espe-

cially for nitrogen, phosphorus, and potassium.

Several local authorities in Australia are sorting municipal waste and composting the biological components into saleable products.

Victorian Department of Agriculture researchers are exploring the potential uses for potato waste from processing and packing plants. Disposal of waste on farms creates crop production and disease hazards. Cardboard manufacturers have shown interest in the project and are keen to develop a pilot plant where starch from potato waste is used instead of imported material. Potato production for industrial purposes already occurs in countries such as the Netherlands and the United States.

OTHER WASTE

Waste heat from power stations is used to supplement on-site heating with glasshouse units in Europe. Romania and UK glasshouse complexes have developed heat exchange units which enable the relatively low grade heat from power stations to have significant use in glasshouse heating.

Decomposing material in land fill sites generates noxious gases such as methane but there are several examples of the gas being used after the site has been sealed. A glasshouse complex near Leeds in the UK utilises the methane to fuel the heating boiler.

Prospect Electricity in Sydney taps methane from 700,000 tonnes of waste which was dumped in an old brick pit. Pipes are sunk 20 metres into the covered landfill to collect the gas which is then compressed and pumped to an electricity generator which powers 75 to 100 homes.

CONCLUSIONS

Disposal and management of waste is a growing problem for all societies. Governments are less inclined to meet the costs of industrial and household waste disposal. Waste policies are now based on prevention, recycling and re-use, and the safe disposal of non-recoverable residues. Horticultural industries will be forced to take full responsibility for management of their waste as traditional disposal methods are no longer available.

Research and development will provide technologies for:

- Reducing water use through more efficient irrigation
- Modifying growing media to reduce leaching losses
- Removing agrochemicals by innovative filtration
- The use of re-circulating, closed production systems which limit drainage from sites.

Nevertheless there is a growing pressure to improve recycling and re-use of materials. Wastes should not be viewed as un-wanted products but rather as raw materials which provide opportunities for the development of other products or systems.

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