SURVEY OF PLANT PROPAGATOR'S MEMBERS TRAY HANDLING AND CLEANING PROCESSES

INTRODUCTION

This survey of 22 Plant Propagators has been commissioned by HDC as a pre-requisite step to the drafting, discussion and issue of a "Best Practice Guide for Tray Cleaning".

The terms of reference for the Survey are attached (Appendix 1) and the survey was undertaken during May and June 2005.

BACKGROUND

Nursery hygiene practices are generally assumed to be a key element in the production of pest and disease free plants. And previous work funded by HDC (particularly with bedding plants) has shown the benefit of effective tray cleaning in the control of growing media disease, however no definitive best practice guidance is available for tray cleaning in edible seedling plant production.

The 22 plant propagators surveyed currently produce:

- some 1,700,000,000 module plants annually. Individual members production varying form 18,000,000 to 300,000,000 plants per annum.
- some 700,000,000 block plants annually. Individual members production varying from 30,000,000, to 270,000,000 per annum

The Trays and Handling Systems

In general three forms of seedling production have been identified in the survey

- Blocked Cells (commonly 150 or 176 cells per tray) of compressed peat placed in open topped, solid bottomed, trays (with some small drainage holes) with handles (660mm*440mm* 135mm) and lugs for securing trays thus allowing self stacking;
- Rockwool cubes of varying dimensions placed in (660mm*440mm* 135mm) trays with bottomless spacers to protect tall plants during transport – normally peppers, cucumbers or tomatoes;
- Module production using preformed trays (600*400mm*55mm) with variable cell numbers, loose filled with growing media, commonly peat, and topped with either sand, perlite, vermiculite or fine growing media.

Blocked cell trays share consistently similar designs irrespective of their manufacturer, and are principally used in the production of lettuce, chicory and celery seedling plants, finding an additional use for tomato, pepper and cucumber crops as identified above.

Typically these trays are laid directly on to mypex covered soil, hard standing or concrete and, in lettuce production can be used up to seven times in a growing season.

The handles of the blocked cell trays conveniently allow the mechanisation of tray handling – cleaning, seeding, laying out and collation for dispatch, and in respect of this, lettuce blocks are commonly moved during the propagation cycle and laid on hard standing outdoors for hardening off prior to delivery to growers.

Blocked cell trays are normally mechanically lifted, stacked (70 -80 trays / pallet, equivalent to 10,500-14,080 blocks per pallet) and banded onto GKN type pallets for transportation to and from customers. Plant raisers commonly report a 1-2% loss factor annually.

Whilst module tray dimensions remain identical, their design, cell numbers and cell size vary as set out in Table 1 below

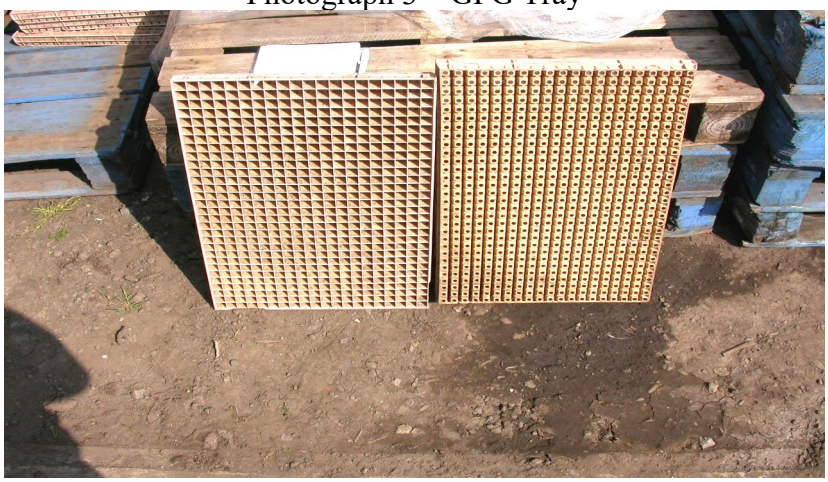
Tray manufacturer	No Cells	CC/ cell	Lt / tray
Plantpack Floppy	51	88.0	4.488
DM UK	54	210.0	11.340
DM UK	84	90.0	7.560
Solutions plastique	96	52.0	5.000
Hassey	104	48.0	5.000
GPG	126	60.0	7.560
DM (Portuguese)	126	55.0	6.930
SP	150	33.0	4.950
SP	240	19.0	4.560
SP	285	22.0	6.270
GPG	300	21.3	6.390
GPG	308	13.5	4.158
Cooley - Standard	336	18.0	6.048
Cooley – Deep	336	22.0	7.392
GPG	345	15.5	5.348
SP	504	13.0	6.552
ERIN	576	4.0	2.304
GPG	600	10.0	6.000

The numbers of cells per tray will undoubtedly impact on the cleaning / sanitation process. For example the numbers of blank cells that will have to be disposed of on return to the nursery will vary.

The design of the tray will also impact on the efficiency of any cleaning systems as illustrated in Photographs 2 & 3 below.

Photograph 2 – note the smooth edge compared to the GPG tray below

Photograph 3 – GPG Tray



By far the commonest tray in use is the 345 cell tray manufactured by GPG.

Typically trays used for brassica production will be reused 2-3 times in a season; however those used for over wintered production (with larger cell sizes typically 126's) will only be used once per season.

Module production relies on the air pruning of the root system therefore trays have to be laid out (in UK this is by hand) on to structures that will support the tray above ground. Commonly this is on 4-5inch upturned plastic pots. Pots, normally sanitized annually, are commonly placed on leveled ground covered in Mypex.

Module trays are, by majority, lifted by hand for transportation to customers and stacked into wooden shelved pallet bins (1270mm*1370mm*1570mm) holding 48 trays – between 6,048 cells and 16,560 cells per bin. These bins are moved individually to dispatch areas, where they may be stacked two high for transportation to customers.

Primarily due to the lack of investment in the mechanization of module tray handling, only 10% of module raisers move plants from the growing houses to a hardening off area during the production cycle. The majority of Module Plant raisers keep their seedlings indoors for their entire life cycle.

Module plant raisers commonly report a 2-3% tray loss annually.

Cleaning Systems

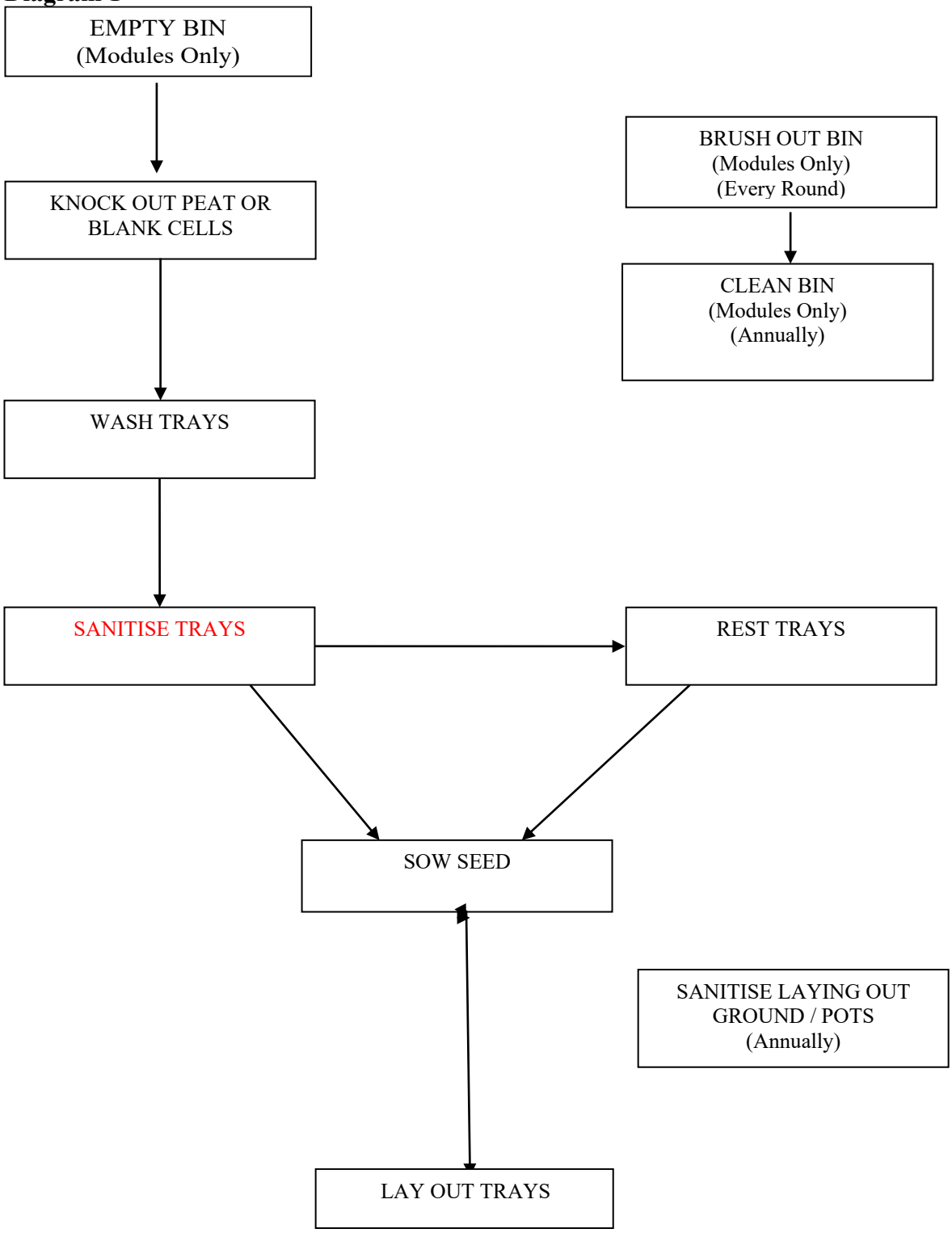
Only 10% of the current PPl membership raise both blocks and modules – the remainder either specialise in block raising (16%) or module propagation (74%).

It was noted that it is not currently practical to use the same washing equipment for either blocks or modules. This was not necessarily because of any design constraint on the washer, but rather arose form complications in the scheduling of sowing on those nurseries where dual production was undertaken and where a dedicated in- line washing system had been installed.

All members have some form of tray cleaning process, however records of the testing of the effectiveness of any such cleaning is not retained on any nursery.
All members have either current exemptions for a requirement for a "Consent to Discharge" or have such consent.

In general it was noted that block raisers had made a significantly higher level of capital investment in tray handling systems than module raisers

THE OUTLINE CLEANING PROCESS
Diagram 1



CLEANING / SANITISATION SYSTEMS EVIDENCED
The were four basic systems evidence for the cleaning / sanitisation of trays:

- **Fumigation** using methyl bromide -15% of Module Raisers

- **Tank Dipping** 10% of Module raisers

- In **Line Washing** – 100% of Block Raisers and 30% of Module Raisers

- **Stand Alone Washers** – 45 % of Module Raisers

Fumigation
Generally, where this was practiced it was undertaken once per year. Only one member had a system in place which segregated tray returns from each round and fumigated after each round.

Methyl Bromide as a fumigant for tray / pot sterilization will not be available in 2006. Chloropicrin as an alternative fumigant would be available as an alternative however its physical properties mean that the lead time between fumigation and trays availability for use would be 4-5 days, rather than the 1 day with Methyl Bromide.

Trays do need to be knocked out and should also be free of obvious physical contamination before fumigation.

Tank Dipping
Where this is practiced the sterilant is either a formaldehyde 1% or perchloracetic acid solution at 1%. The treated dip water is retained and topped up as required. However no system for the effective management of this "top up" to ensure the achievement of the desired sanitiser concentration was made available at the time of the survey.

Trays do need to be knocked out and should be free of obvious physical contamination before dipping.

In **Line Washing**
A number of manufacturer's equipment is used MBE, MJF, MAFO, ELIONA and Brinkman for example. These systems commonly have a water throughput of 60-70 liters/ min and typically incorporate:

- A mechanism for knocking / blowing out module trays (or emptying block plant trays out) followed by (brushing) and high volume or high pressure washing systems which can incorporate:
    - Hot water cleaning. Where hot water is currently used this is commonly at 50-55 deg C
    - The addition of a Sanitiser commonly Hyperox / Jet 5 at 1%
- A re-circulation tank – no defined systems were evidenced for the dumping of this re-circulated wash water
- A final rinse usually with 1% Hyperox / Jet 5 which commonly runs back into the re-circulation tank.

And then straight to the seeding line

Stand Alone Washers
These are basically the same design concept as for in line washers but there is a gap between the washer and the seeder to allow a dwell time for any contact sanitiser – Hyperox or Jet 5 to work.

Washed Trays are either stored undercover of if stored outside, wrapped prior to seeding

Steam is not currently used as a means of sanitizing trays, neither are microwaves.

It was noted that 13% of propagators had installed Chlorine Dioxide water treatment facilities for their nursery water supplies. This commonly maintained 1ppm chlorine in the water supply, and had been identified to have an effect on the control of Phythium and Phytopthora spp, with an addition Heath and Safety benefit in respect of Legionella. With the increasing cost of the use of mains water options to use glasshouse run off water stored in lagoons will be come of interest to propagators and this may encourage the further use of Chlorine Dioxide water treatment systems.

SUMMARY

All evidenced tray cleaning process incorporate, to some degree, the above process flow chart (Diagram 1 on page 5).

If a HACCP analysis were to be applied to this process flow chart then the following could be identified a Critical Point in the process.

1. Sanitising Trays to remove any residual biological contamination

In this circumstance the
HAZARD is contamination of trays by plant pathogenic organisms
CONTROL is effective cleaning and sanitization (of trays, - however the possibility of cross contamination from unsanitised bins, and tray contact ground surfaces (or pots etc) should not be ignored)
CONTROL LIMIT is No Pathogens
Propagators must MONITOR Pathogen levels
CORRECTIVE ACTION would be a review of the cleaning and sanitization processes including a review of the strength of any sanitiser used.

To apply a "food hygiene maxim" surfaces should be ***smooth, impervious and capable of being effectively cleaned***.

Unfortunately

- Wooden Bins are not capable to being effectively cleaned and there was no system currently evidenced for the verification of the effectiveness of any on nursery "cleaning" in the management of potential pest / disease transfer from bins to seedlings or into nurseries in general.
- To effectively remove physical debris from trays a combination of brushing and significant quantities of (high pressure) water are required. This leads either an expensive use / waste of water. Commonly tray washers have an output of 1000 trays per hour and this would mean a usage of 4,200 liters of water per hour. Hence the reason why wash water is re-circulated. Unfortunately such re-circulation has the potential to build up / concentrate contaminants and therefore compromise the "cleaning" process.
- Sanitisers used are either used at too low a concentration (commonly 1%) and or, are not given enough contact time from application to sowing, for the product to be effective.
- Vehicle, stillage (bin) and pedestrian movement within a nursery (typically in module raising) could be a source of cross-contamination.
- Tray contact with unsanitised structures / pots / ground could be a source of cross contamination.
- Movement of trays from protection to outdoor hardening off areas could also be a source of cross contamination – more so with modules than blocks as module movement requires re handling into and out of bins and there was no evidence of the segregation of bins for internal use from those returned from growers.

Given these issues it would seem appropriate to:

- Develop a system for the verification of the effectiveness of "Nursery Hygiene Practices" as a whole – as the possibility of cross contamination within the nursery must also be examined. This would probably involve the need to:
  - Map / Identify existing process hot spots – on nursery by nursery basis.
  - Define a Cleaning / Sanitation procedure for each nursery.
  - Implement the defined procedure.
  - Maintain records of implementation and
  - Externally verify the Effectiveness of the Cleaning / sanitation processes used.

  It would therefore be important to ensure that any verification could be rapid in response – that is current diagnostics for club root for example take some two weeks. It would perhaps be more appropriate to develop a test on an indicator organism. If this were possible then in-hose sampling could be undertaken and the frequency of external verification reduced perhaps to coincide with current Plant Health Visits.

- Investigate the potential for installing tray washer monitoring and dosing systems for sanitisers, to ensure that concentration levels of the sanitiser are consistently maintained at an effective level.

- Investigate the potential for the development of module tray handling systems (stillages) that can be effectively cleaned.

- Investigate the potential for retro fitting a system for hot water treatment of wash water, and define the ideal water temperature / dwell time for such treatment (> 75deg C for 1 min?).

- Re-Look at the commercial potential for using *steam* as a tray / stillage sanitiser (75-80 deg C ?). For larger propagators this may be onsite but for smaller propagators the shared used of a mobile facility may be an option. Such a potential solution would have the added benefits of:
  - Not requiring the use of a sanitiser
  - Not requiring the use of significant volumes of water
  - Not impact on any environmental considerations such as consent to discharge.

- Look at the commercial potential for the use of *microwaves* as a sanitiser for trays as this would have the potential for significantly reducing water usage and potentially avoid the need for the requirement for a "consent to discharge".