MASTER HNS46

Handling container grown nursery stock

from order collection to dispatch

Before watching the video for the first time please read:

How to use this manual *page 1*

Applying ergonomics principles for increased efficiency *page 2*

Key issues *page 4*

Glossary of terms *page 30*

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Working for Growers

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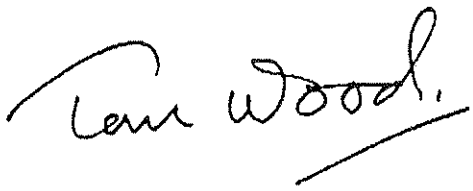
Preface

We have all thought long and hard about the layout and systems that we have for container handling on our own nurseries, and assume that we have satisfactory and efficient procedures. I wonder if you will take the same view after you have considered just some of the points raised in this video?

We hope that everyone in container production will find something of value in it for them, whether it's a realisation that your own systems need reviewing, some new ideas, or just some basic principles to set you thinking about your own situation more objectively.

I am sure that you will find it a useful training tool, to help your staff organise their own work efficiently.

I believe that like me you will find this video helpful to your business in addressing the matter of efficient materials handling and the possible cost savings which concern all of us today.



Tom Wood
Chairman, Hardy Ornamental Nursery Stock Panel.

Introduction

How to use this manual

This manual is designed to be used in conjunction with the video "Handling Container Grown Nursery Stock from Order Collection to Dispatch" produced by the ADAS Ergonomics Team 1993. Together, this manual and the video will help you to:

1 Identify in detail the separate elements of your working operations

2 Critically analyse how well these operations are carried out and how well they integrate.

We suggest that you read the next section on applying ergonomics principles and Key issues before viewing the video. This will give you an understanding of the issues involved.

You should then proceed to watch the video in its entirety **before** reading any further. The video shows many examples of the problems encountered in the practical situations which exist now on nurseries. You may well recognise mistakes you yourself make and problems you have encountered.

We then recommend that you then watch the video in several parts in conjunction with the manual. This is because the video is packed with a wealth of information and is therefore fairly long (60 mins).

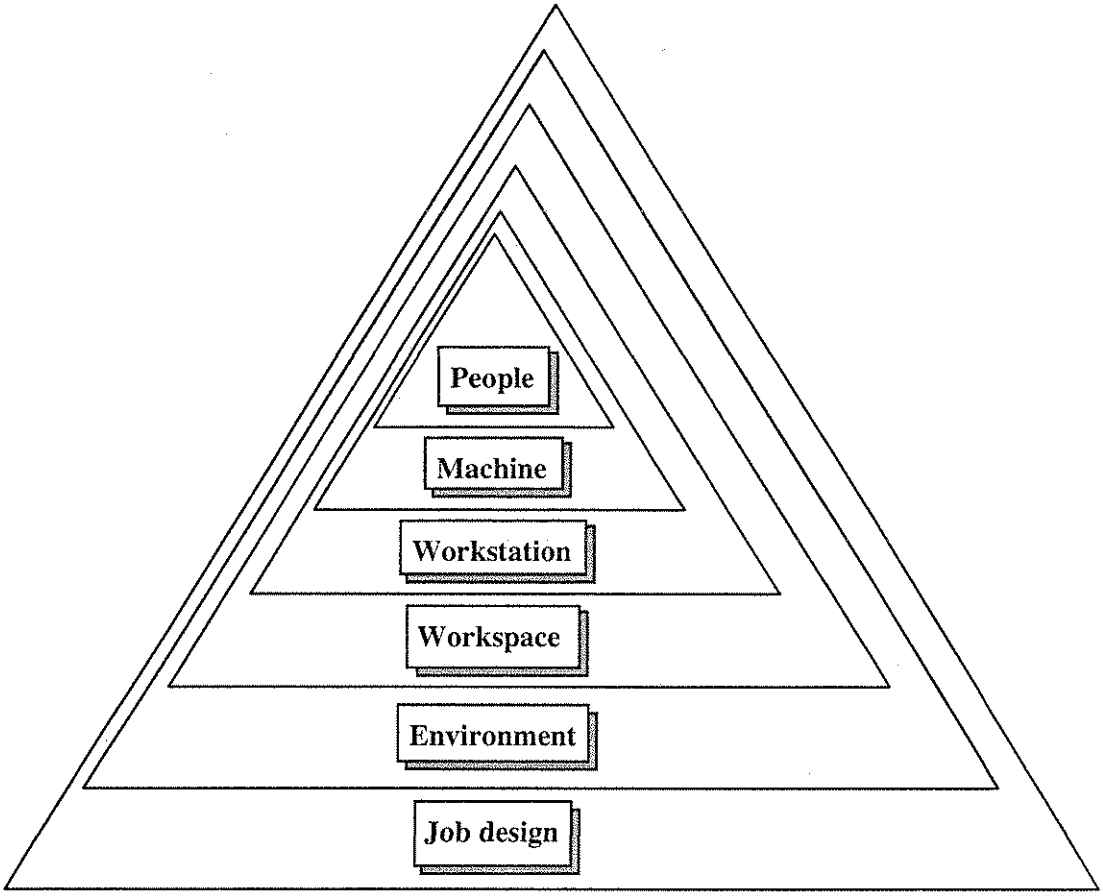
The video falls naturally into several sections, any of which provide natural rest pauses. We see the video as being a working video and a training aid. You will gain most out of it if you stop and think about each section in turn, discuss it, review it and question it until you are happy that you understand it.

We hope that having watched the video and read this manual you will have a far greater understanding of the problems and possible solutions and see not only ways to improve your operations straight away but also where advice dedicated to your problems could help.

Applying ergonomic principles for increased efficiency

A model for the analysis of core elements and integrated systems

The figure illustrates the analytical model employed throughout this project. It is the model employed for the analysis of core elements, examining the interaction between the operator (People) and his/her machine, workstation, workspace, environment and job characteristics. It also addresses issues when combining core elements into an integrated system. When examining your own nursery you should use this framework.



The list below shows the ergonomic principles to apply when considering improvements to an existing system. Examples of situations in the container grown industry are given to illustrate the practical application of these principles.

1 **Eliminating redundant tasks**
Example: Cleaning up activities.

2 **Minimising unnecessary movements - reduce transport and transfer times.**
On a macro level.
Example: Reducing the distances plants need to be carried; reducing the number of repeated visits to the same bed; by having materials close at hand and positioned consistently in the same place.
On a micro level.
Example: Reducing the number of times plants are moved when on a workstation.

3 **Promoting operator comfort**
Example: Design workstations eg. tables, trailers or conveyors to meet the physical requirements of the operators.

4 **Organising work methods and procedures**
Example: For all preparation activities define how it should be done.

5 **Imposing 'system control'**
Example: Not allowing operators to wander away from their tasks or create their own working strategy. Flexibility is important, but this should be built into a job specification.

6 **Eliminating time and procedure mismatches in the system**
Example: Waiting for picking labels or lists; collating plants onto trailers and then recollating on the floor at dispatch.

7 **Quality control**
Good design of systems will only pay off if they are maintained correctly. This means there must be adequate supervision of operators, proper training in methods and 'reminder' training when necessary. Moreover machines must be correctly maintained and calibrated.

Key issues

Man versus machines

In order to increase efficiency many growers have turned to mechanisation - machines can replace labour, or at least free-up labour to do certain tasks previously neglected. On the face of it, machines offer a very attractive way of increasing efficiency as they have many advantages over man. Consider the following:

- Machines are much faster than man
- Machines are more consistent
- Machines can produce larger forces and over a much greater period
- Machines are better at routine, repetitious tasks
- Machines do not get bored or take breaks
- Machines are better at precision tasks
- Machines are faster and more accurate at computations
- Machines are more reliable.

Given these advantages, it is not surprising that growers have invested heavily. However, this is not the whole story as there are many other implications of mechanisation often overlooked. Consider the following:

- Machines are poor at error correction
- Machines are poor at pattern detection
- Machines will breakdown suddenly
- Machines are not intelligent
- Machines are task dedicated.

In summary, machines are consistent but inflexible, whereas people are inconsistent but flexible. Growers must understand the advantages of people. Mechanisation may not always be the best solution and reorganisation of labour may prove more advantageous.

Health and Safety Regulations

New legislation came into force on the 1st January 1993. The Workplace Regulations 1992 directly relate to this project. It is strongly recommended that a copy of these regulations are obtained from the Health and Safety Executive and a detailed examination undertaken.

Part 1 Handling systems design

Identify how your business fits in and critically analyse your working operations

The following figures show you the sort of questions you should be asking yourself about each of the operations identified. It is important to realise that there can be many different approaches to the same problem and more than one ideal solution. Moreover, the advantages of one well thought out part of a system may be negated by poor integration between operations within the system.

There are two main levels of question to be considered:

1. The first is the overall scale of your business ie. order size and number of different varieties grown and amalgamated into orders. This will affect the type of investment that is feasible and the level of mechanisation which is practical or advisable.

2. The second is the more detailed level of individual core elements eg. workstation dimensions and organisation of raw materials around a workstation. This will effect the efficiency of each operation within the selected system and the comfort and well being of the operators in the system. It is important to recognise that 'comfort' and 'wellbeing' are not simply emotive terms - they have a very real and concrete impact on the level of output and the efficiency of the whole system.

Figure 1 - Critical analysis: Grading

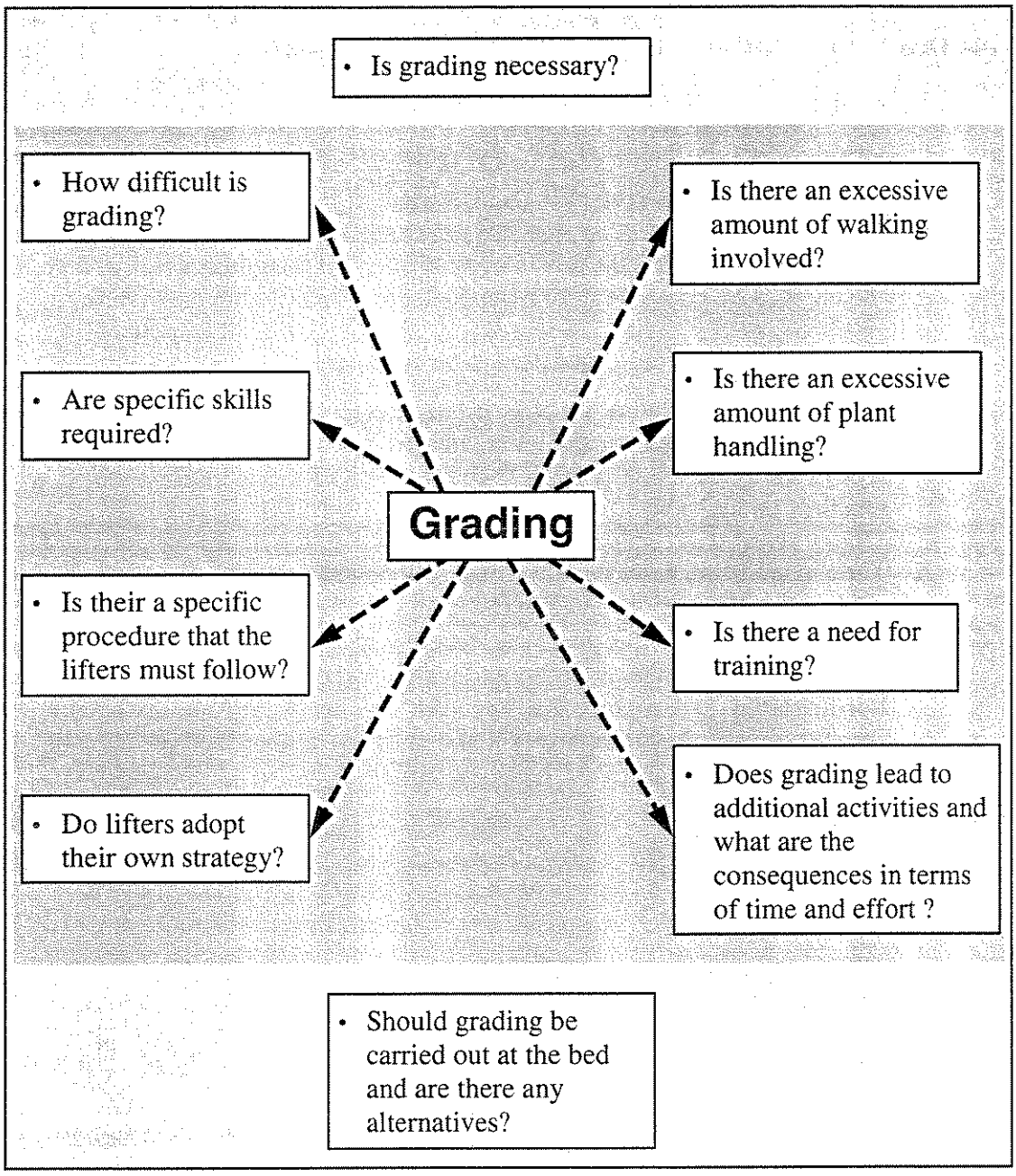


Figure 2 - Critical analysis: Moving plants to the end of the bed/mode of transport

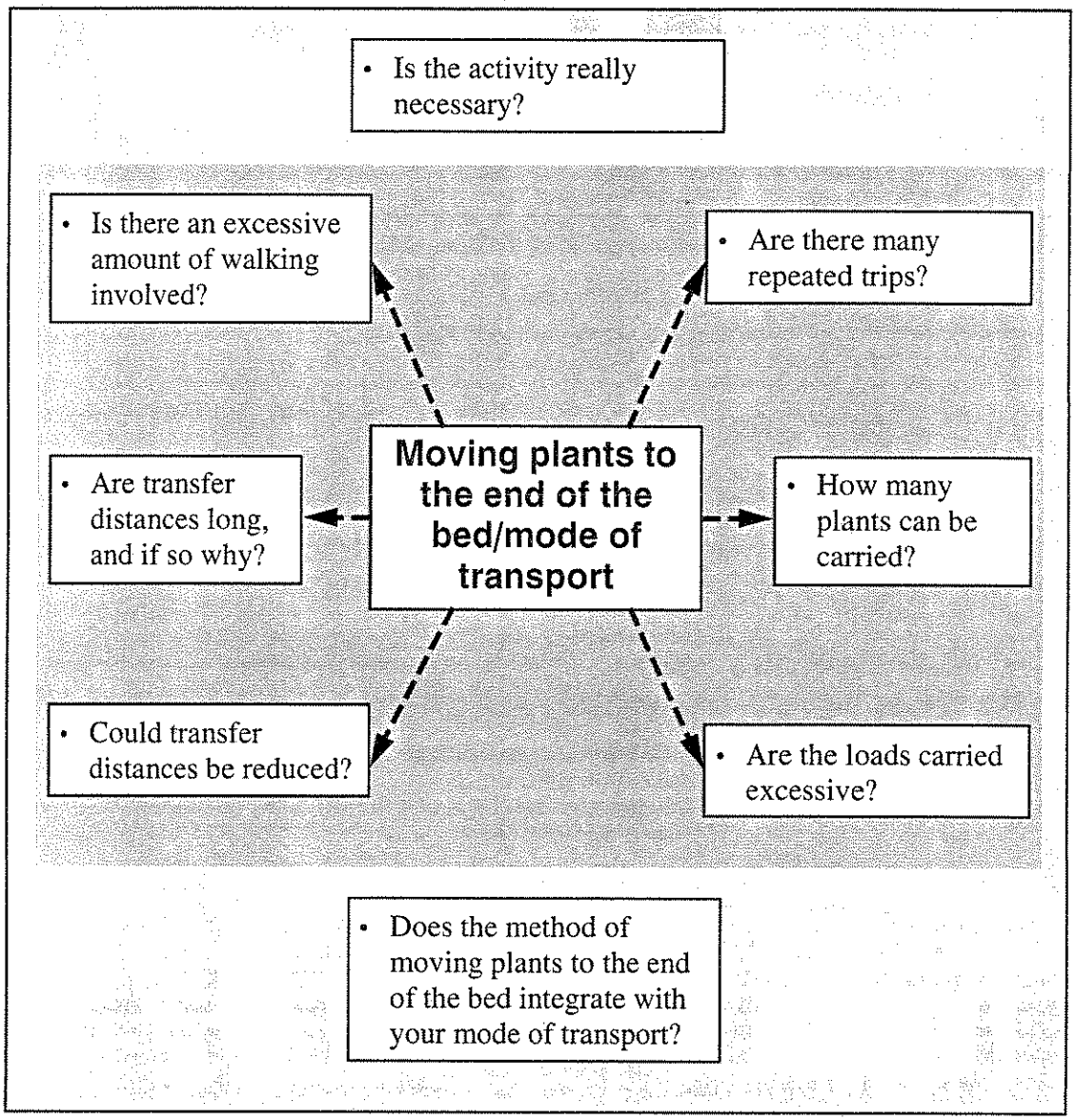


Figure 3 - Identification: Transporting from bed to dispatch

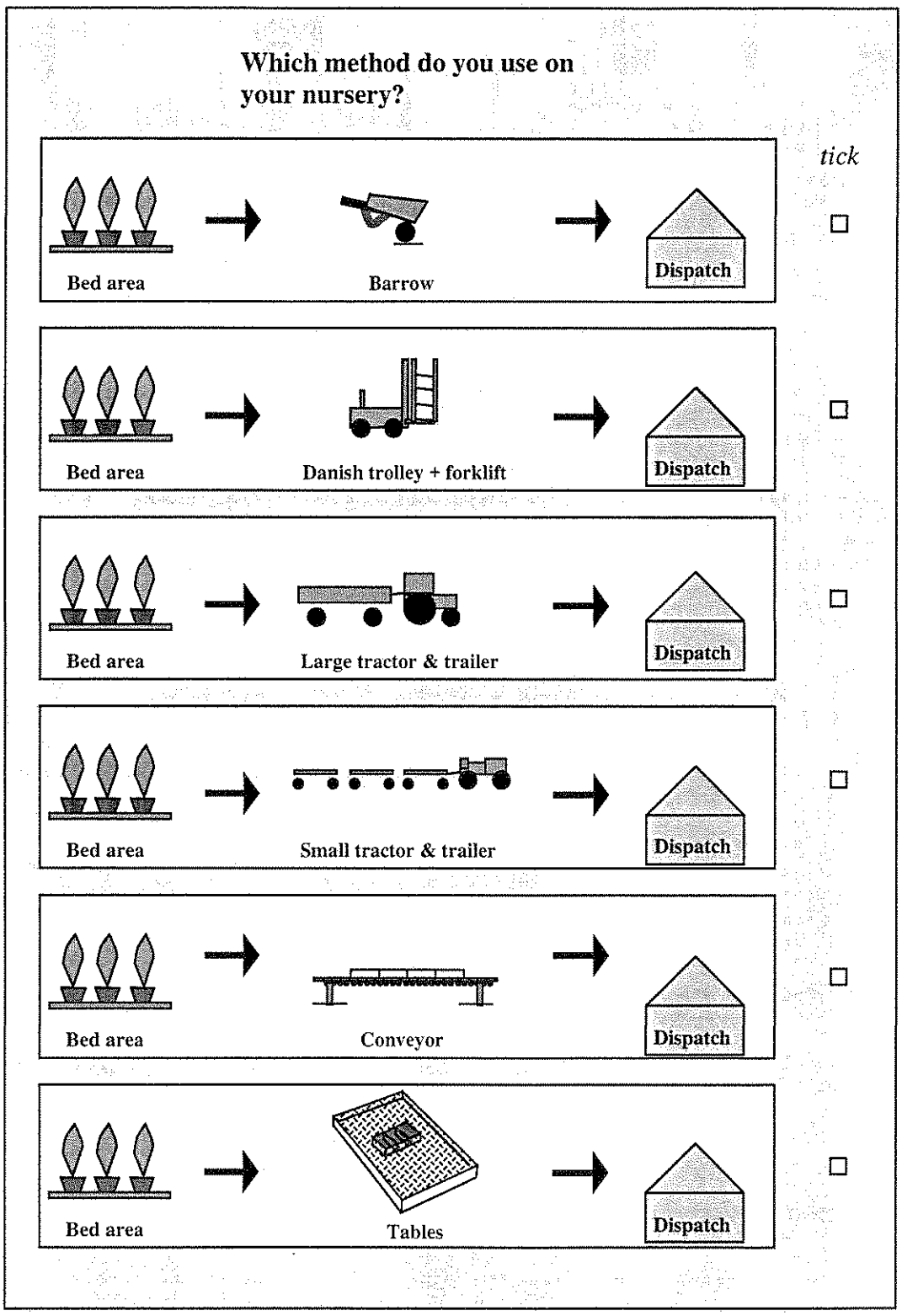


Figure 4 - Critical analysis: Transporting from bed to dispatch

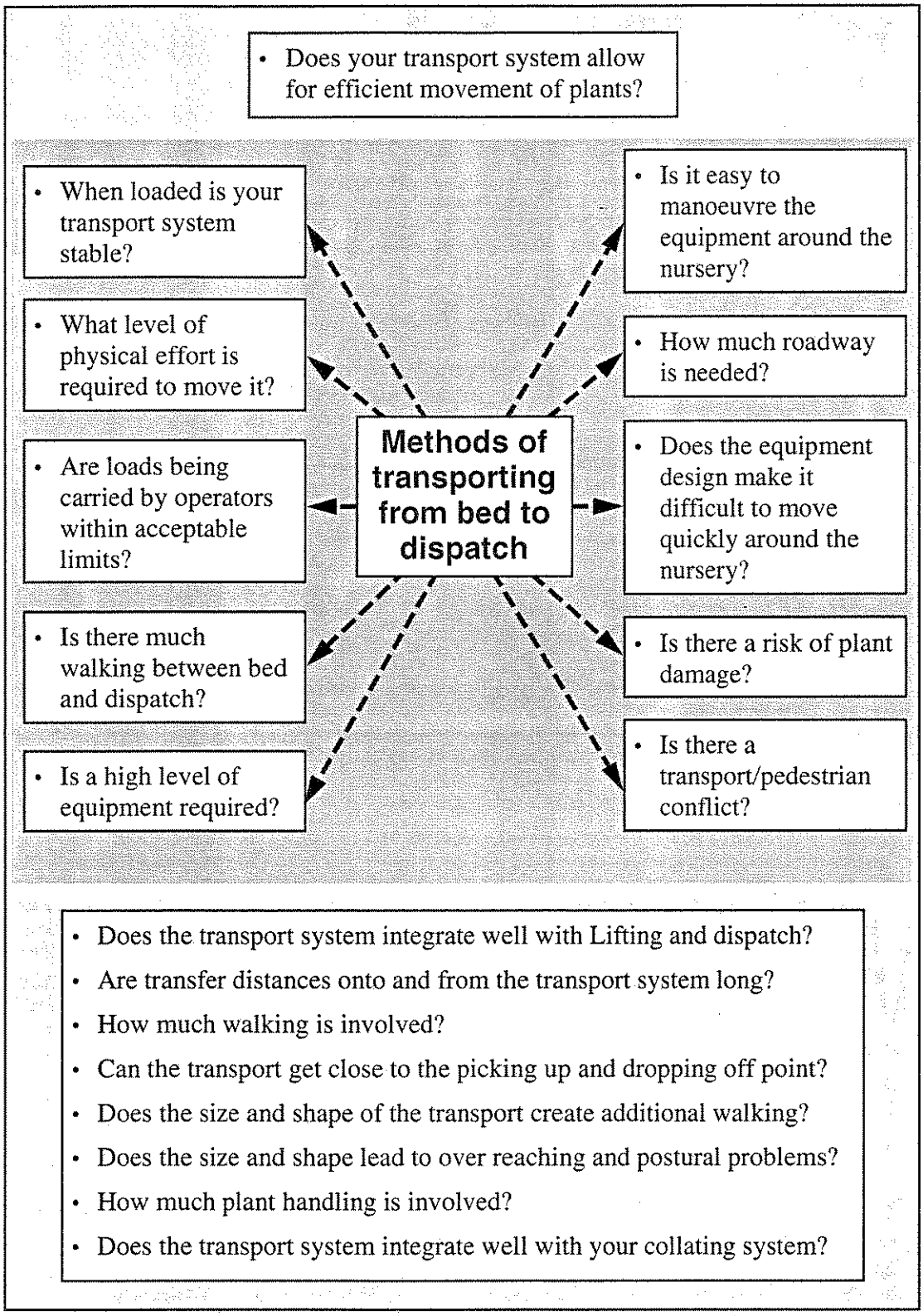
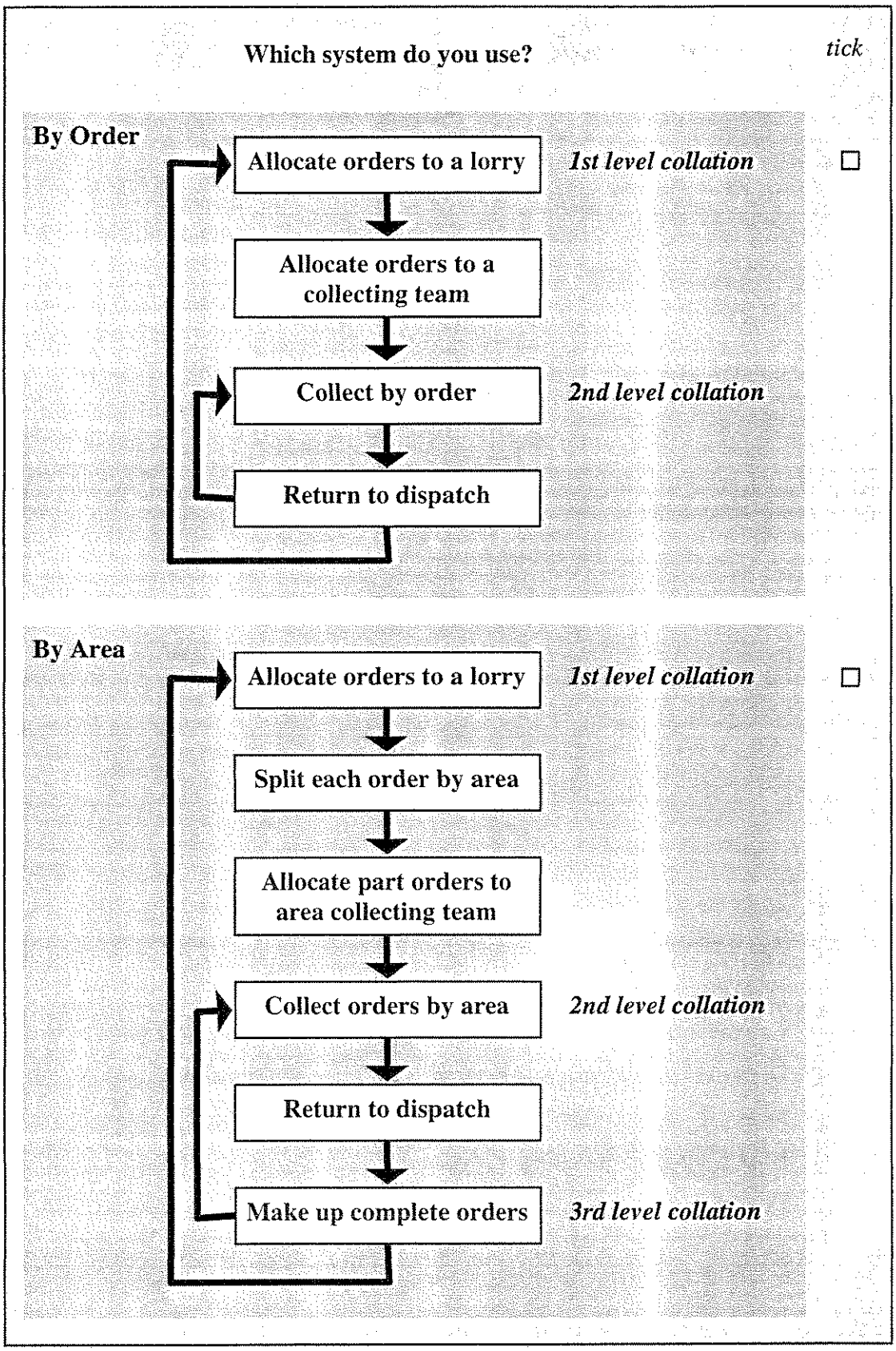


Figure 5 - Identification: Collecting and Collating Systems



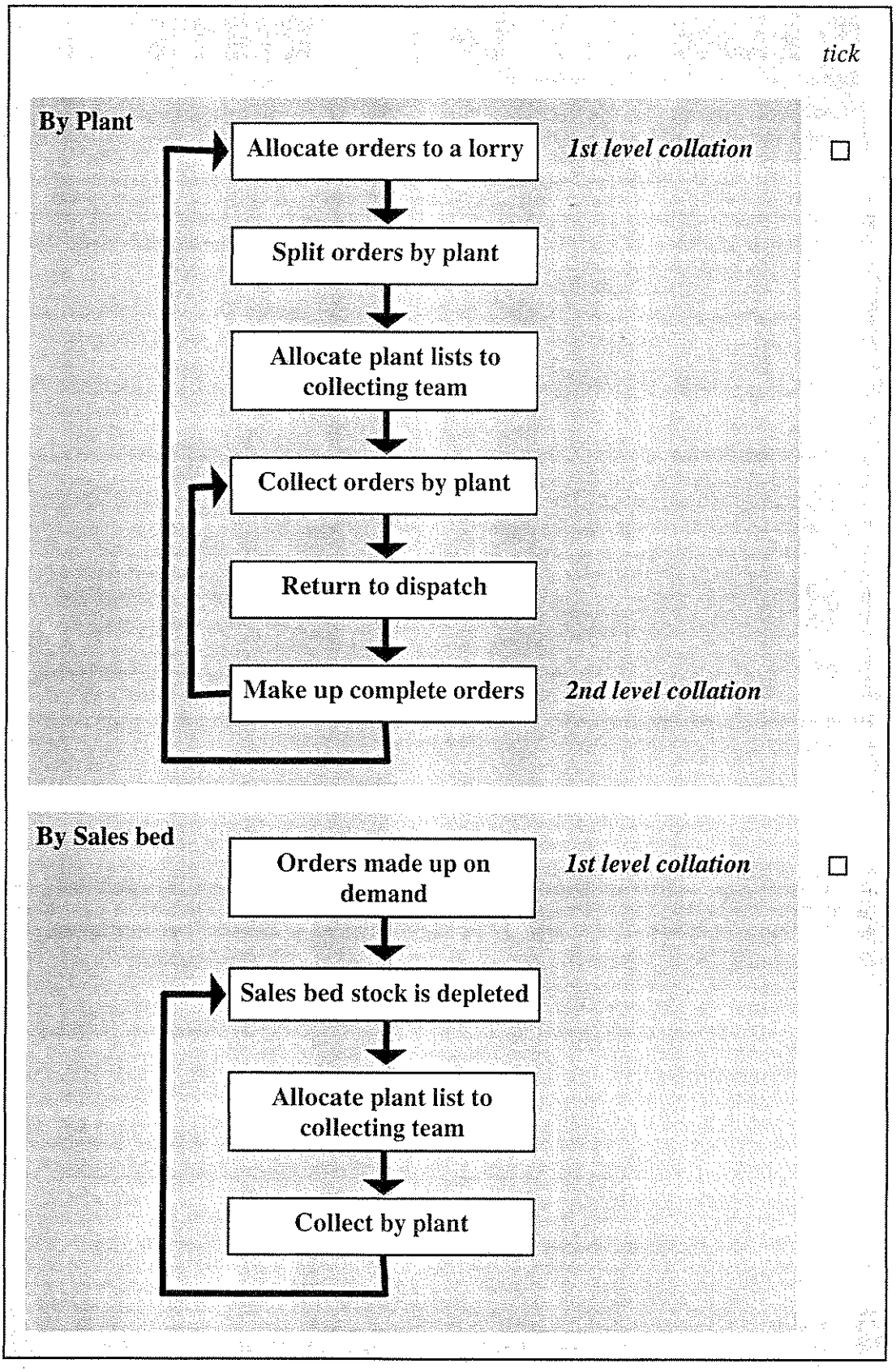

tick
By Plant
Allocate orders to a lorry
1st level collation
Split orders by plant
Allocate plant lists to collecting team
Collect orders by plant
Return to dispatch
Make up complete orders
2nd level collation
By Sales bed
Orders made up on demand
1st level collation
Sales bed stock is depleted
Allocate plant list to collecting team
Collect by plant

Figure 6 - Critical analysis: Collecting and Collating Systems

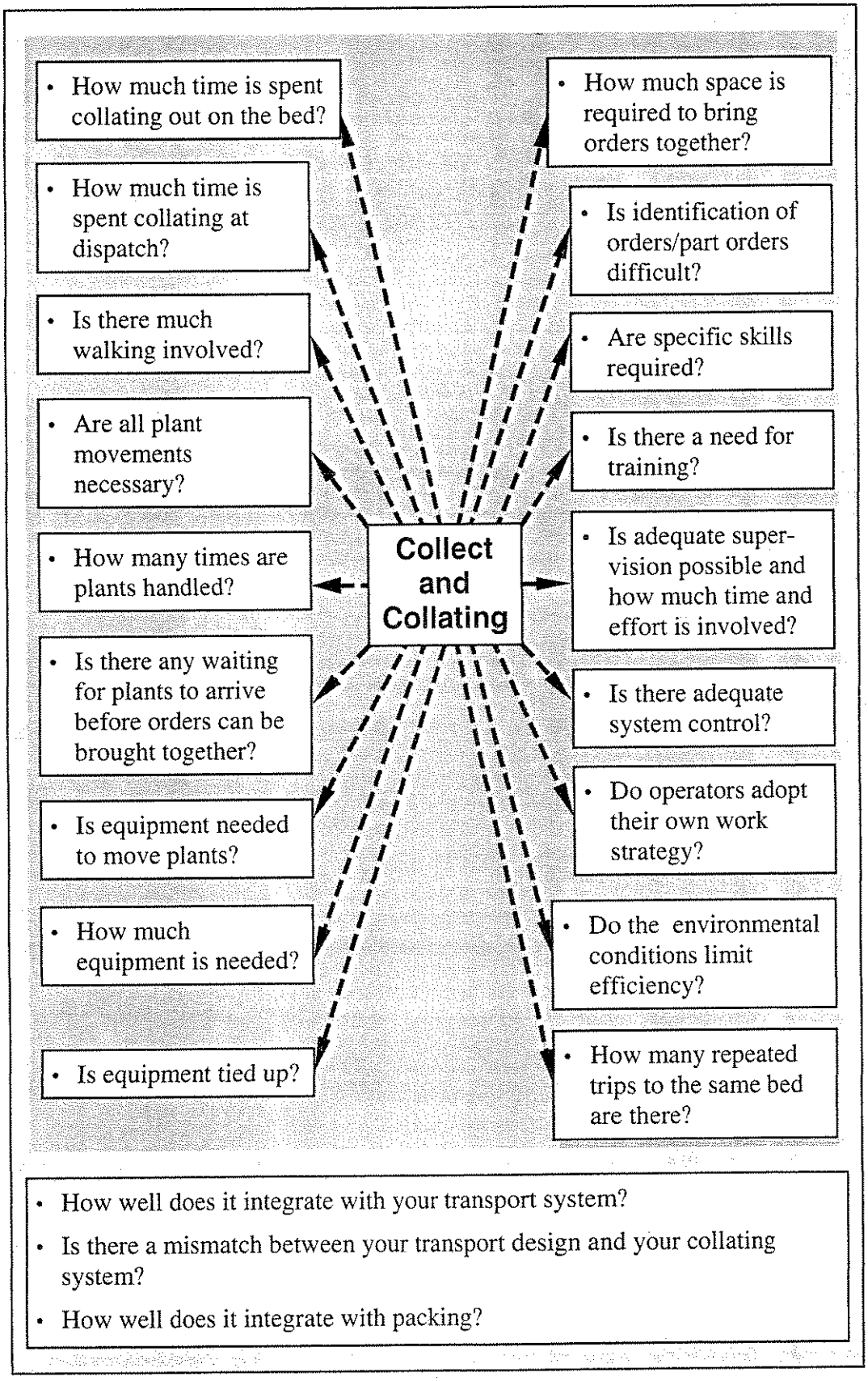


Figure 7 - Identification: Preparation

Individual plant labelling; Weeding, pruning and tying; Pot cleaning; Topping; and Watering

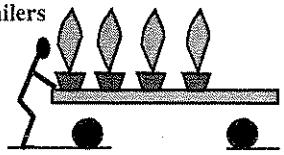
Which method do you use on your nursery?

tick

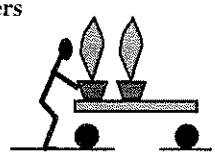
On the floor ☐

On barrows ☐

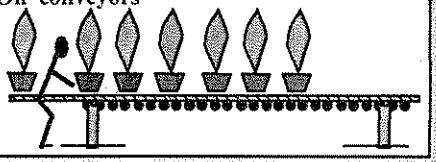
On large trailers ☐



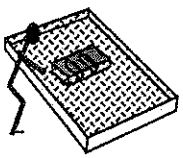
On small trailers ☐



On conveyors ☐

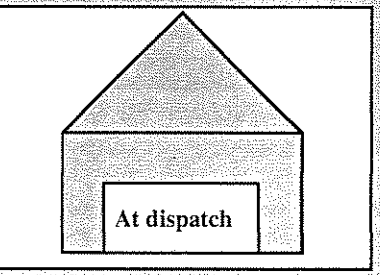


On tables ☐



At the bed

OR



At dispatch

Figure 8 - Critical analysis: Preparation

Individual plant labelling; Weeding, pruning and tying; Pot cleaning; Topping; and Watering

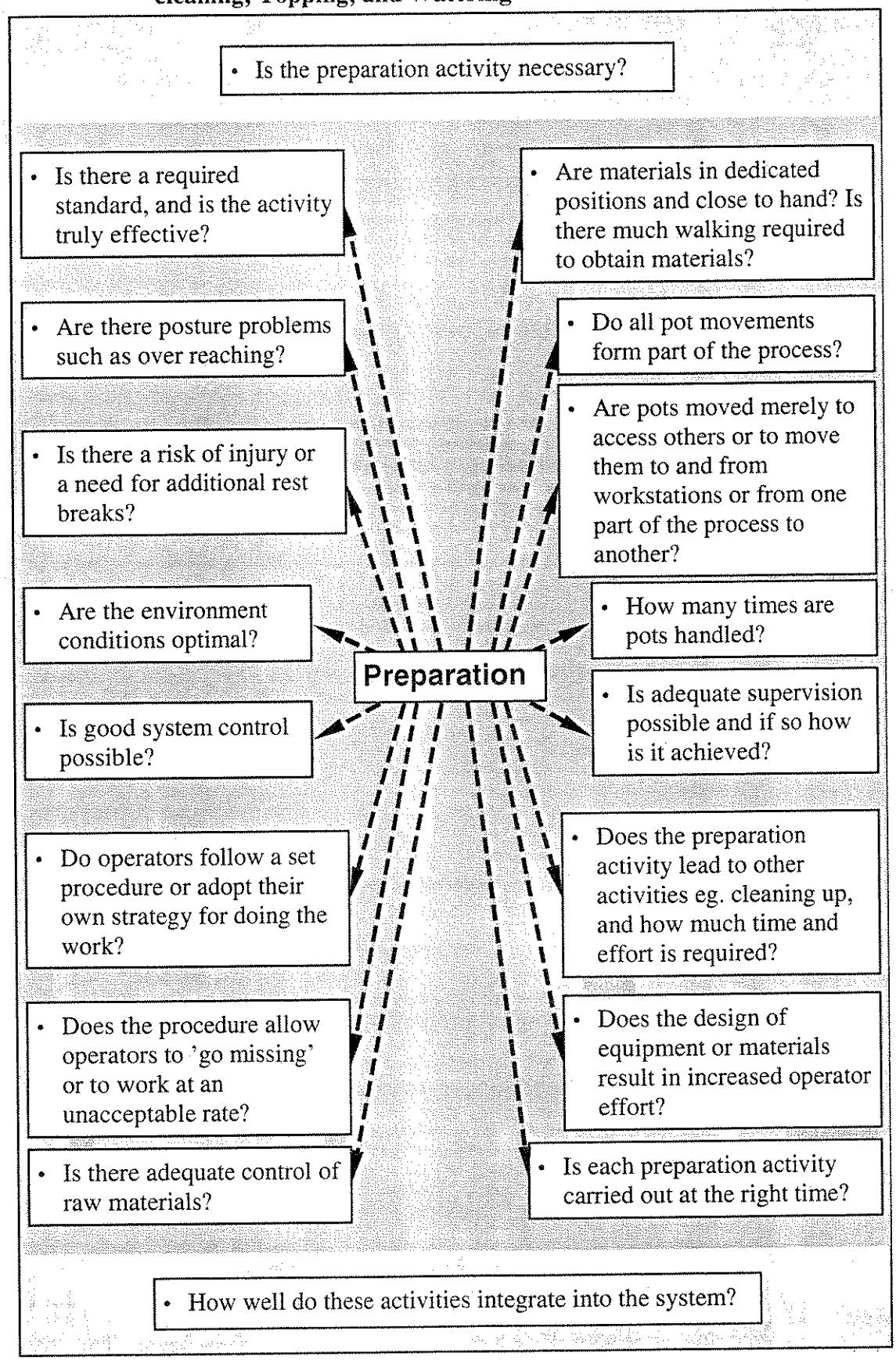


Figure 9 - Identification: Packing

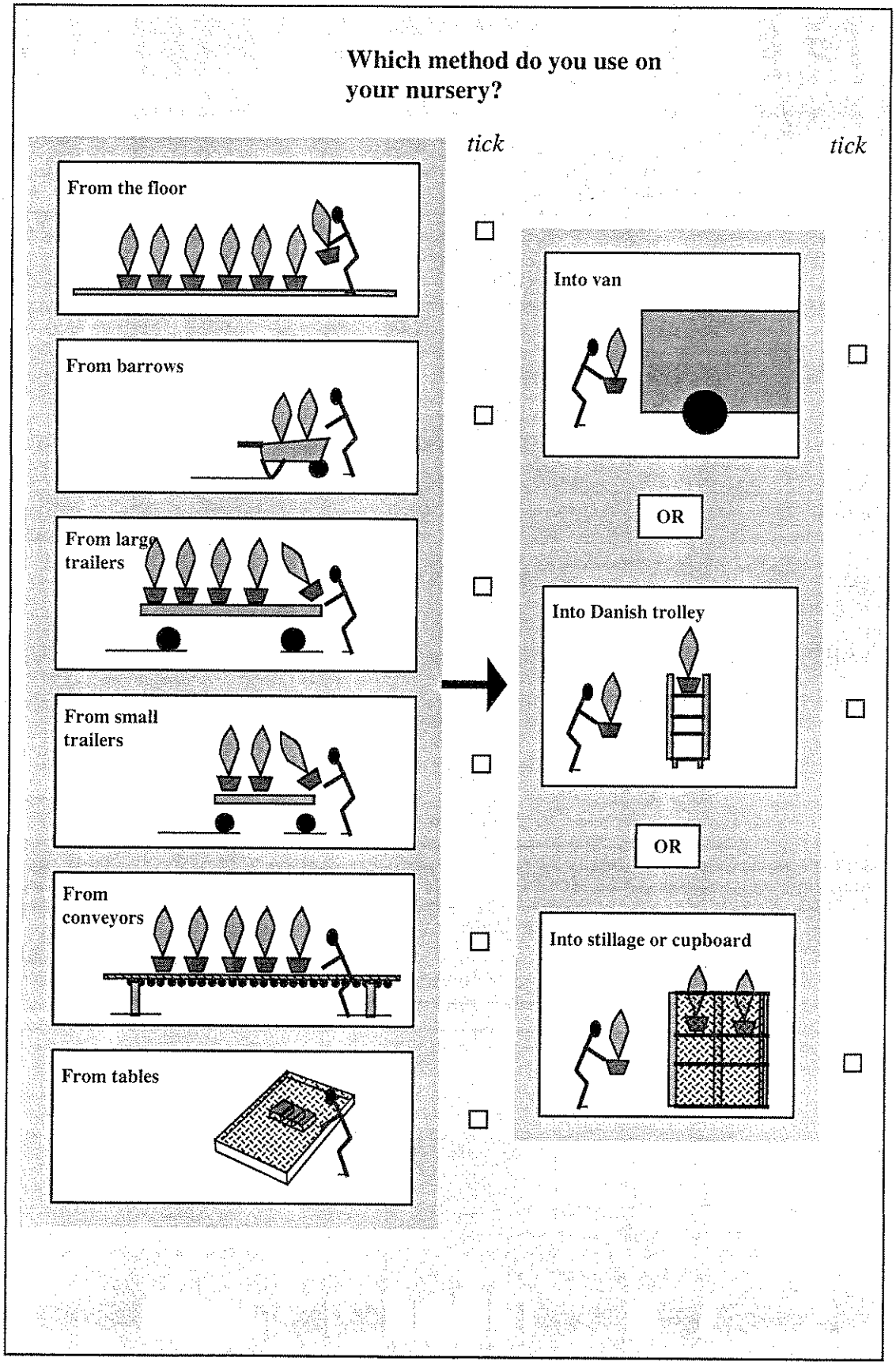


Figure 10 - Critical analysis: Packing

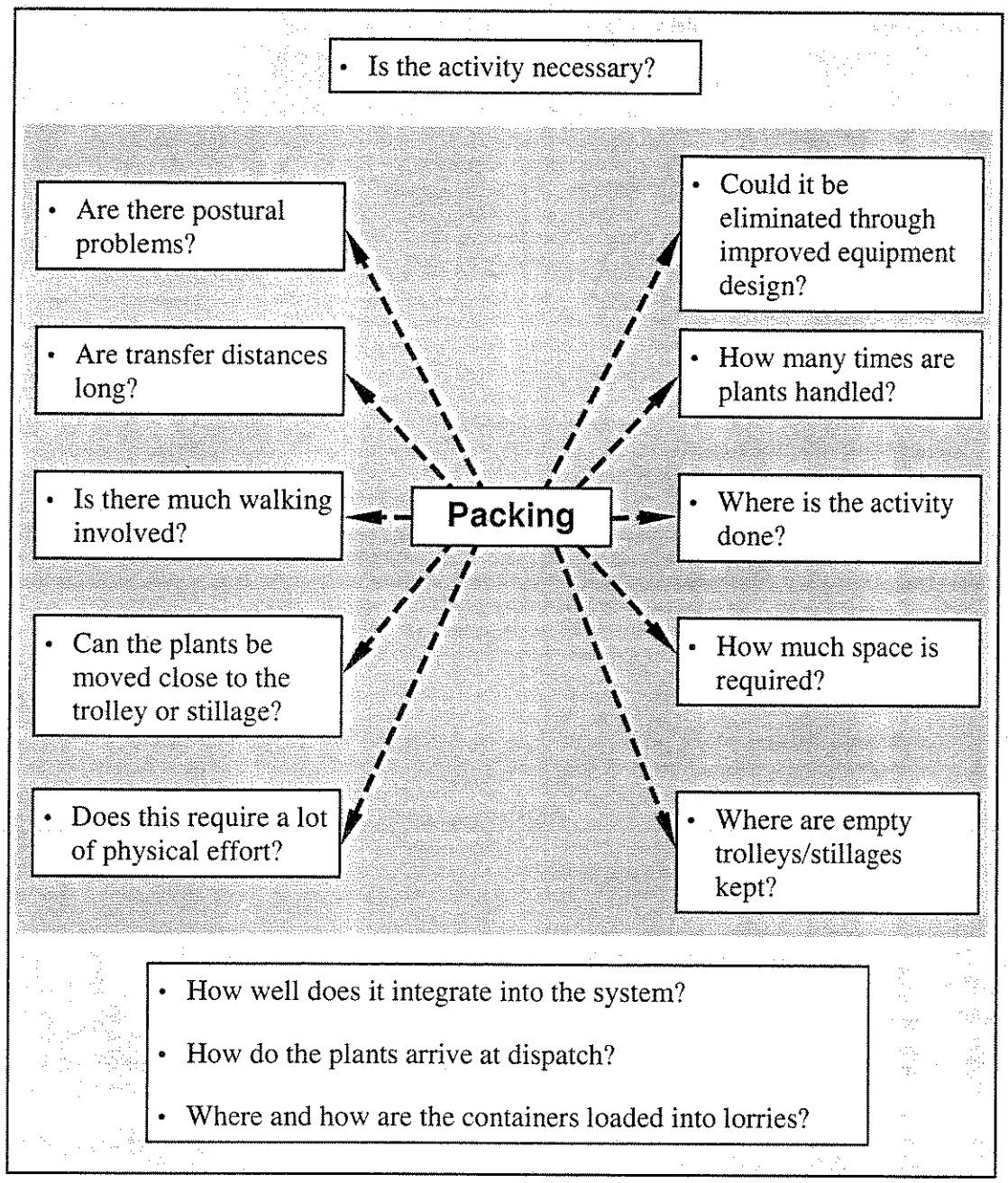


Figure 11 - Critical analysis: Wrapping

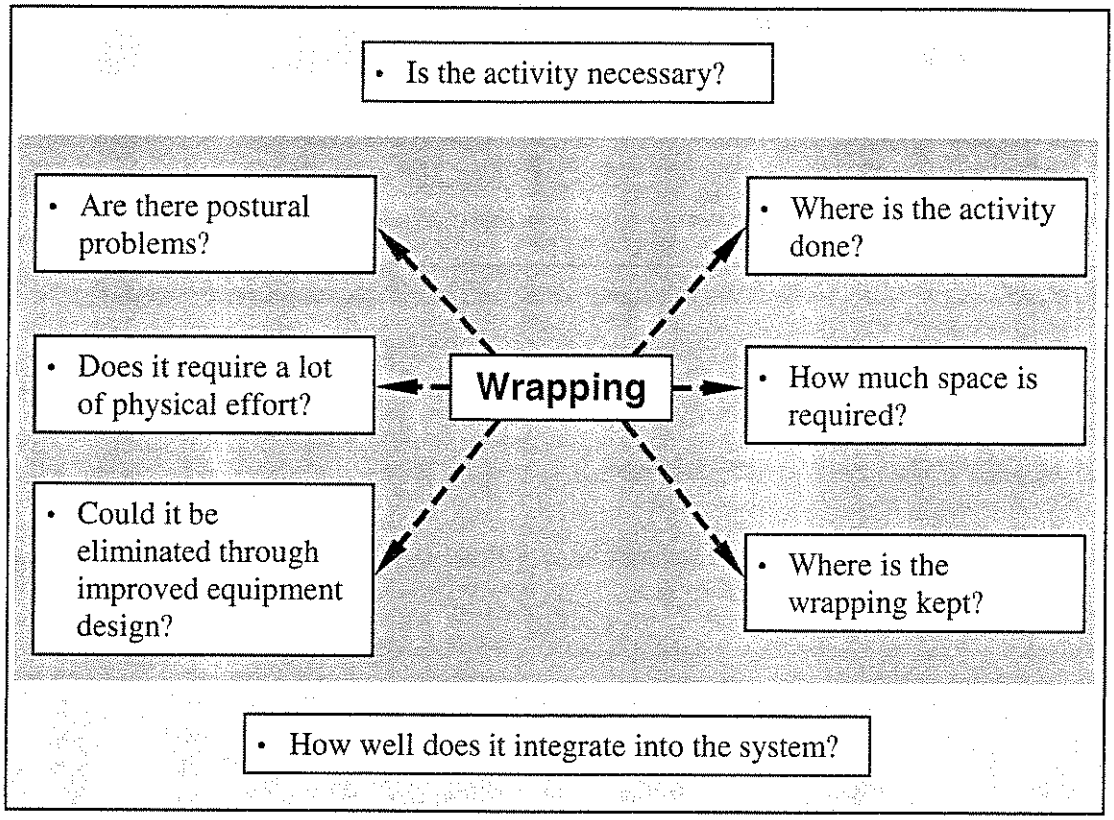
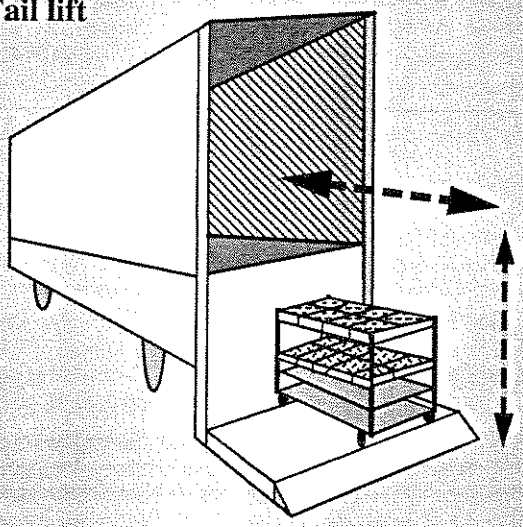


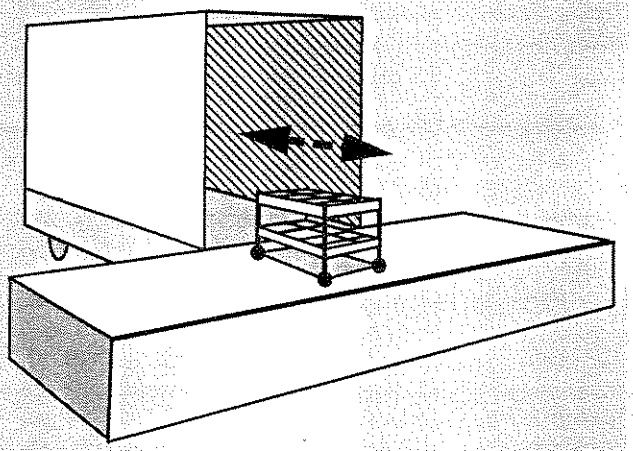
Figure 12 - Identification and critical analysis of Loading

Which method do you use? *Tick*

Tail lift ☐



Loading bay ☐



- How much time is spent loading the plants onto the lorries?
- How well does it integrate with the other dispatch activities?

Summary

The efficient use of labour in Hardy Nursery Stock production is dependent upon the design of the core elements described. Insufficient attention to the design of the core elements and their integration will lead to the following consequences:

- **Redundant tasks**
  Unclear operational objectives can lead to the inclusion of unnecessary and superfluous operations. Always question whether a task or an element of a task needs to be done!

- **Poor posture**
  In the short term poor posture leads to neck, shoulder and lower back pain. In the long term it can lead to Repetitive Strain Injury (RSI).

  This has production implications, with employees suffering from fatigue and requiring additional rest breaks. In the long term this can lead to absenteeism, increased labour turnover and decreased productivity.

  Examples of poor posture are frequent during the preparation stages and are usually associated with poor workstation design.

  Wherever possible work should be carried out at workstations specifically designed to fit operator requirements.

- **Unacceptable manual handling**
  Unacceptable manual handling occurs when operators are required to lift, move or carry heavy or awkward loads.

  It can result in severe damage to the back or upper body. The production implications are similar to those outlined for poor posture.

  This problem can occur at all stages of the dispatch process, and is the result of poor workstation and workspace design, and inadequate integration of the system elements.

  Growers should make every effort to eliminate such operations.

- **Unproductive and excessive handling**
  Whenever a pot or plant is handled this should form part of the dispatch process.

Unproductive or excessive handling can occur through poor workstation design where, for example, plants are moved merely to gain access to other plants. It also occurs through poor workspace design, where plants are handled excessively between workstations.

- **Excessive walking / transport**
  Transporting plants from one location to another on the nursery is necessary. Poor organisational design, or inadequate integration of the system elements, can lead to transports that do not directly contribute to the dispatching process or are unnecessarily long.

  Repeated assembling and splitting of orders is an example of this.

- **Unnecessary / unsuitable machinery**
  Poorly integrated system design can lead to the perceived need for capital investment in unnecessary or unsuitable machinery.

  A thorough analysis of the dispatch system will identify areas where machinery is required, and ensure that the specification of the machinery matches the physical characteristics of the nursery and the requirements of the task.

  An example is where fork lift trucks are used to load lorries when the provision of a loading bay would suffice.

- **Lack of control**
  Poor workspace or task design can lead to inadequate control of the work process. This can result in poor productivity, lack of quality control and insufficient feedback on the progress of each order.

  An example is where the employee has control of what to do, when to do it and how to do it, this is typical of all the preparation work that has been shown.

- **Health and Safety**
  There are increased pressures for employers to consider health and safety issues as a integrated part of running their business.

  Avoiding the problems shown in this video will help to ensure good health and safety practice.

Potential for cost savings

The potential for saving costs will vary from nursery to nursery depending upon the systems and methods for handling container grown nursery stock currently in use. There is considerable variation in the time taken to carry out operations both within and between nurseries.

Two other variables have to be taken into account:

- The scale of production on your nursery
- Individual nursery rates of pay. In our calculations £4 per hour has been used.

It is therefore only possible to indicate the potential for cost savings by providing you with basic information which taken with the prevailing circumstances on your nursery provide a base from which to work.

The time spent transporting on trailers, forklifts or in wheel barrows from the bed to the general dispatch area will always largely be a function of the size of the nursery and the distances involved. The system used for collecting orders is also a significant factor.

For each key operation the range of times, shortest and longest, and the typical time is given. These times are taken from the video shot in the course of this study, your times may not fit these.

The shortest time is attainable only in special circumstances, for example, a time of 3 seconds for picking up and taking to transport can only occur when the distance from the plant position to the transport is 3 yards or less and the operator carries 2 containers. This assumes the operator walks at 3mph (1.5 yards a second) and takes 2 seconds to locate the plants on the transport and turn ready to pick up 2 more containers.

The typical time could also be described as that which it has been observed is the most frequently occurring.

The longest time also needs some clarification. It does not include situations which are perceived as the exception but only those circumstances where the system and organisation is such that it will take that length of time to do the operation on a significant number of occasions.

The target time has been modelled based on what is perceived as current best practise and what can be achieved with improved organisation and systems. It is not expected that each and every time the operation is carried out the target time will be achieved or that it always can be achieved but that it is an average time for the operation for which growers should aim.

Times in seconds per operation per container
Total times from order collection to dispatch per container
Total cost (pence) from order collection to dispatch per container

Operation	Shortest (secs)	Typical (secs)	Longest (secs)	Target (secs)
Grade	1	4	15	2
Pick up and take to transport (trailer)	3	12	25	5
Transport back to dispatch (driver time)	6	10	15	6
Transfer at dispatch to handling line	1	5	10	1
Weed	0	5	10	4
Tie	4	10	13	5
Label	4	10	13	5
Pot wash/clean	0	5	15	4
Collate	5	20	30	4
Quality control	1	2	10	3
Pack	1	10	20	3
Load	2	10	20	3
Total time - collection to dispatch	28	103	196	45
Total cost pence per container	3.11	11.44	21.78	5.00

The typical time and costs calculated for collection to dispatch fit well with independent ADAS studies of Hardy Ornamental Nursery Stock (HONS) labour costs.

Best estimates of labour costs are around 30% of the farm gate value of HONS that is £37.5 m. Dispatch labour is again estimated to be in the region of 20% of total labour ie. £7.5 m. Achieving the target could therefore reduce this to £3.3 m, a saving of approximately 56%.

The above table indicates on a task basis where it is considered savings can be made. The actual achievement of the savings can only be made by adopting improved methods and organisation, in particular:

- Improving nursery layout to reduce transfer distances
- Designing fully integrated systems and methods throughout the process from order collection to dispatch
- Having available a sales order system which provides complete information to allow efficient order collection - software based.

In terms of specific tasks or operations the following will need to be addressed:

- Container bed size, layout and orientation
- Transport systems for taking containers from container bed to dispatch
- Dispatch area design, organisation and control including workstation, workspace and environmental design
- Requirement for cultural improvement to reduce the need for weeding, root pruning, pot cleaning and grading
- Requirement for improvement to nursery infrastructure to reduce/eliminate the need for pot cleaning
- Study at the individual task level for weeding, labelling, tying and pot cleaning
- Devising systems for order collation.

The investment into research will be justified on the basis of the potential improvement to the industry if funded by HDC or to the nursery where carried out on a nursery basis.

In terms of the investment into capital works or equipment this again will need to be justified by the benefit to the nursery. For example a nursery producing 500 000 containers a year spending an average of 5 seconds cleaning each pot would have available £2 777 per annum to service investment in the necessary infrastructure to keep pots clean or provide other means to avoid the need to clean pots. This is simplistic since there will be other potential benefits and costs.

Part 2 Information systems design

Information requirements

No matter how quickly pots can be physically moved from the bed to dispatch, optimum efficiency will not be achieved unless the *right* people in the *right* place at the *right* time have the ***right*** information. Moreover, the ***right*** information is that which is ***accurate, complete, up-to-date*** and ***suitable.***

All nurseries require an efficient information system, and with increasing scale the need for this becomes more and more vital. Many of the problems encountered on nurseries are a result of one or more of these criteria not being fulfilled.

Problem identification

Over recent years many growers have turned to computers and various software packages to meet their information needs. However, as many have discovered to their cost, numerous pitfalls exist and this has often led to nurseries retaining and relying on a paper based system despite its inherent inefficiencies.

The following are examples of computer related problems frequently identified at many nurseries:

Hardware design problems

- Terminals are not robust
  - In the past, terminals have been susceptible to dirt and this has meant they could only be located in a clean office environment. This has limited their application.
- Access limitations
  - With terminals in fixed locations, operators that need to use them are constrained by their lack of flexibility.
- Input limitations, which have had to be via a keyboard
  - Efficient input has depended on typing proficiency.
- ROM and RAM Memory limitations
  - This has resulted in insufficient storage capacity.
- CPU limitations
  - This has resulted in unacceptably slow processing and printing.
- Output limitations in terms of printer characteristics:
  - A mismatch exists between output files and print files with conversion required.
  - As with terminals, printers have not been sufficiently robust so they can not be located near to operators that need them.
  - Many printers cannot perform some of the essential operations such as label production.

- Printers are often slow.
- Printers are often inflexible and cannot switch between different output requirements such as labels and lists.

• Network limitations

- Linking a number of terminals and printers in various locations on the nursery has been problematic.

Software design problems

• Limited application

- Basically, it cannot do what you want it to do.
- This is especially the case where off the shelf business packages have been customised.

• Inflexible

- Software cannot cope with changes in information requirements.

• Poorly designed interface

- Accessing specific information entails scrolling through screen after screen.
- Comparing information is difficult without facilities to compare screens of information.
- Interface design is very complex and is a key area in determining the ease of use of a computer system. Ergonomics has a vital role to play. A well designed interface will increase efficiency, reduce errors and minimise training times and encourage users to make full use of the systems facilities.
- The interface design is addressed in the EC directive on VDU workstations.

• Poorly presented output

- Operators need to be able to understand and interpret the information they receive. Information can be presented in a way that is difficult to read, confusing and prone to error. It must be presented in a way that takes into account the limitations of human information processing.

Operator limitations

• Operators do not have the skills to take full advantage of the computers

• A mismatch exists between computer user skills and horticultural knowledge

Information limitations

To reiterate, the information available needs to be ***accurate, complete, up-to-date and suitable.*** The value of the information may well depend on the capability of the computer and the software. However, it can not be over stressed that the quality of information you get out is only as good as the quality of information you put in. This means that the *right* people in the *right* place at the *right* time also have to input the ***right*** information.

Potential applications

Here are a number of illustrations and suggestions for improvements to an information system that could increase efficiency. We recognise that an indepth feasibility study is necessary.

Order taking

In order to achieve efficient selling it is vital that those taking orders have access to the necessary information on current and expected stock. This information could include:

- Quantities of plants
- Varieties
- Pot size
- Grade
- Stage of growth
- Location
- Sale price

A powerful, user friendly system is required in the sales office. In-the-field selling represents a particular problem. At present many in-the-field salesmen rely on weekly printouts of stock information which becomes quickly out of date. Lap top computers offer a viable alternative where stock information could be quickly up dated in the office or in-the-field via a modem.

Direct computer linking with customers is another alternative. Customers would have access to availability lists via networking and would be able to send there orders in response. Once received this list would be automatically updated.

The failure to maintain the information is likely to result in over or underselling. This in turn leads to additional phone calls and man hours of work that could be spent more profitably. Whilst we recognise that buyers accept the problem associated with growing a dynamic product, growers must tackle this issue if efficiency is the goal.

Methods for maintaining stock records

If stock records are to be kept up to date then the right information has to be inputted quickly and accurately. At present nurseries often depend on a paper based system to update records, but there are a number of time lags inherent in this method and it is prone to error. Attempts have been made to computerise the process, but unreliability has meant that sales people often lack confidence in the information. Thus, time and effort is spent tracking down those individuals out on the nursery that have the required knowledge 'in their heads'.

If stock control is to be truly effective, then the process must be fully automated. A bar coding system offers a potential solution. Hand held scanners and data loggers could be used to record the information, and terminals out on the nursery to input the information.

Due to the dynamic nature of hardy nursery stock production, it has been argued that the time spent inputting data cannot be justified - it will always be out of date. In response we suggest that a suitably designed computer package would

allow for an extremely fast updating process ie. the transfer of information from data loggers to software. The information would be immediately available to the sales office.

Stock control should be thought of as a front line activity vital to efficient selling. It must receive significant attention and investment.

Order input / processing

Order taking and order processing are usually discreet activities carried out by dedicated teams of operators. This results in much time and effort being spent per order and duplicated tasks being performed. Once again, a suitably designed system together with adequate training of operators could dramatically increase efficiency.

In-the-field sales people should be able to use their lap tops to input orders immediately. In the sales office, if orders are taken over the phone then direct input is preferable. There is an argument that writing out the order acts as a quality control. However, a well designed package should identify and highlight input errors or even not allow them to be entered in the first place. Thus, task duplication would be eliminated.

A hands off telephone system would be necessary if inputs are to be made via a keyboard. It would also require the sales and order processing roles to be amalgamated with operators having the required skills for both activities. There is also the potential in developing other computer interfaces such as light pens and bar code readers.

If orders arrive by fax or post then information contained within should be presented in such a way as to make order processing quick and efficient. This may just require simple layout design of order forms.

Producing lifting lists and labels

As the scale of the nursery increases, getting the right information to the right people in the right place at the right time represents a significant problem, especially given the common practice of processing late orders.

In general, the information supplied to lifters is relatively good. However, growers must still examine the information to make sure it is always accurate, complete, up-to-date and suitable. It must also be easily understood and readable, even in poor weather conditions.

The speed of producing lifting labels or lists and the speed with which they can be transferred to those that need them represent a common problem.

As outlined, computers and printers for various reasons are often slow or are just not capable of performing the required activities. A suitably designed computer and software package is essential.

Printing labels or lists in the sales office can result in frequent trips to and from dispatch, and so to significant transport costs. It also creates a bottleneck where those at dispatch are left waiting for the necessary lists or labels to arrive.

Locating the dispatch office close to the sales office would reduce this problem, but restrictions on nursery layout will usually make this impractical. Alternatively, a remote printer could be located at dispatch. Labels would be immediately available to the lifters and so there would be no transport costs and no time lag. The printer could still be under the control of the sales office and a printing run would be initiated at their command.

Other applications

A fully integrated information system should also be able to deal with producing packing lists, transport and route lists and all other relevant customer paper work.

A well designed system

Any information system must be designed to fit the needs of the user. The needs of the Hardy Nursery Stock industry are very different to other industries, but also the needs of one nursery will be very different to another. A custom built computer package is essential, but will be most likely developed from existing software.

The suggestions for increased efficiency outlined in this manual may have been documented in previous studies. However, it is only now, with the advances in digital communications, that they are feasible. Computer hardware has improved considerably and many of the problems outlined can be solved with an acceptable level of investment. Software design is more problematic. There is a need for research focusing on the development of a standard software package tailored to the Hardy Nursery Stock industry. That package must have a capability of being further tailored to fit the needs of the individual nursery.

A word of warning

Growers must also realise that a poorly designed information system will create more man hours of work than it will solve. Growers must be aware of the strengths but also the limitations of the computer environment.

Appendix 1 Contributors and acknowledgements

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Appendix 2 Glossary of terms

The video and this manual rely on an understanding of certain terms. These terms are defined here to avoid confusion.

Core element
A key operation. A discrete and essential activity within the larger system.

Integration
The connection of core elements in the system.

Lifting
Selecting and grading plants and moving them to the end of the bed or to the mode of transport.

Selecting
Choosing a batch of plants from the nursery bed.

Grading
Matching plants based on a specific criteria.

Collecting
Transporting plants from the bed area to dispatch.

Collating
The bringing together of plants into individual orders.

Preparing
Activities carried out on individual plants prior to dispatch.

Packing
The placing of plants into a trolley, stillage, or similar container.

Wrapping
Wrapping netting or cling film around the trolley, stillage or similar container in order to prevent plants from falling out.

Loading
Putting the trolley, stillage or similar container onto a lorry.

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