LESSON 1

# MATERIALS AND EQUIPMENT

**Aim**
Identify a range of horticultural materials and equipment and sundries.

In order to run an efficient enterprise the horticulturist requires a range of materials and equipment that will help to complete jobs efficiently and within a structured time frame. The equipment that is chosen will depend on the size of the operation and the amount of money available. A small single person garden maintenance operation for example may be able to run quite successfully with a minimal outlay for expansive equipment, a lawn mower, range of hand tools and an appropriate vehicle may be all that is needed. However a large nursery will require a much complex array of materials and equipment. No matter how large or small the operation is, the horticulturist needs to keep abreast of what is on the market and how this equipment can help to run a cost effective, efficient business.

## POWER TOOLS

Power tools can make life much easier, but they can be expensive to buy and potentially dangerous to use. If used and maintained properly power tools can last for a long time, but be prepared to spend some of the time you save by using a power tool to maintain that power tool. Most power tools have parts which wear out and need replacing from time to time. Moving parts wear out but if kept clean and oiled and/or greased, the rate of wear can be kept to a minimum. Corrosion is another major problem, which will be greatly reduced by simply keeping metal parts clean and coated with oil. Whenever buying power tools, consider the following points:

- What size is the engine?
- Is it an established well known product name, and will parts be easily available?
- How easily can the salesman start the engine?
- How solid are the parts of the machine. Check whether the body is made of cheap plastic, cast iron, stainless steel or another material.
- What sort of guarantee is given for the power tool, and what does the guarantee cover. In general, good tools have a long term, extensive guarantee.
- Check the amount of vibration, and the strength needed to operate the machine. Are you comfortable using it, or will you find it too difficult to use?

### Types of Power Tools

Power tools come in two main types:

- Electric Tools. The main advantage with electric power tools is that they are generally cheaper to buy and more reliable to start. However, they tend to be less durable, and harder to repair if they break down. It can also be potentially dangerous to be dragging an electric cord behind you when using a power tool.
- Petrol Motor Tools. The "all thumbs", unskilled handyman frequently finds a petrol motor difficult to start. If you're in that category, don't give up. If you take time to listen to a mechanic and learn what you are doing wrong, you should be able to greatly improve your ability to start a petrol motor, and even undertake some of the basic repairs which commonly give problems. Once you learn how to set the choke, how to avoid flooding the engine, and how to clean a dirty spark plug, you should have eliminated a large slice of the troubles people commonly face.

### Buying Power Tools

Often power tools are purchased for one job, used once, and never used again. In such cases, it may be more economical to hire the power tool. At other times, the same piece of equipment is hired over and over when it might have been more economical to buy your own.

Deciding to buy should be based on a genuine need for that piece of equipment for such reasons as significantly reducing workloads, or the time involved in tasks, allowing you to expand the types of activities you undertake in the garden, for safety reasons or for improving the quality of your work.

The need for that equipment should be balanced against the cost, both initial and ongoing, and the operational requirements of that equipment. Is it really a worthwhile proposition? This must be decided on such factors as:

- Initial cost-how much does it cost to buy?
- Ongoing costs- this includes maintenance, parts, fuel, insurance etc.
- Reliability-does it break-down a lot?
- Longevity- how long will it last?
- Safety to use.
- Availability of parts and servicing.
- Does it do the job that you require of it?

**Hedge Trimmers**
*Manual or Mechanised?*

*1. Shears (manual)*
Manual shears are like a large pair of scissors, with two blades that cut upwards and downwards. They are useful for small areas of hedging.

2. *Reciprocating Blade Trimmers*
These are the most popular type of mechanised hedge trimmer. They have two long bars with sharp-edged teeth that move back and forth across each other. The blades are either single-sided, cutting only when moved in one direction, or double-sided, cutting when the blade moves up or down.

They can be powered by petrol, electricity or hydraulics (i.e. tractor mounted).
Electric and petrol trimmers are the most commonly used hand-held trimmers. Electric trimmers are useful for small to medium hedges. They either have a power cord or a rechargeable 12V battery. Rechargeable trimmers have the advantage of not having a cord (which means they're safer and don't need to plugged into an electricity outlet while they're being used), but they can only be used for short periods before losing power.

For frequent, heavy-duty use, a more powerful petrol-driven model is needed – typically with a 3 hp engine with the blades around 600mm long.

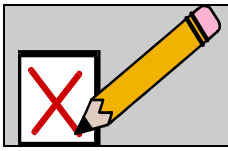
3. *Circular Saw* –driven by a hydraulic motor on the end of a long arm. These machines are fairly uncommon and are considered dangerous therefore are hard to track down. The average gardener would be better advised to use other models which are cheaper, safer to use and easier to maintain.

4. *Flail Hedgers*
These are used for large-scale hedging on acreages or by government authorities/parks, etc. They work by beating the foliage with metal flails connected to a central shaft spinning at high speed. The blades can tear plant tissue and are rarely used in domestic gardens.
They are usually used on compact tractors. A safety break switch is built in to allow it to swing back if it hits an obstruction.

**How to Use Trimmers**

Most electric and petrol machines need to be handled with both hands to ensure a smooth and controlled cut.
As with all power tools, safe use is a priority, especially if they're used standing on a ladder. Always be careful of sharp edges and take extra care with electric trimmers. Don't use them in wet weather and make sure the cord doesn't become tangled or a tripping hazard.

**Lawn-edger**
A Lawn-edger is used to give a neat and professional looking finishing edge to garden beds. Edgers are available as electric, two stroke and four stroke engines ranging from 850watt through to 5 hp motors. Although it is possible to use a whipper snipper (brush cutter) with a specific line attached, to create a lawn edge, the dedicated steel blade edger is easy to manoeuvre and creates clean cut edges that are difficult to achieve with a whipper snipper or spade.



**SELF ASSESSMENT**
Perform the self assessment test titled ' test 1.1'
If you answer incorrectly, review the notes and try the test again.

## OTHER COMMON HORTICULTURAL POWER TOOLS

### Mowers

Mowers can be either the push type or motorised. For small areas, a hand mower is cheap to buy, cheap to run and can give an excellent finish to a lawn. If you have a medium to large area of lawn or are in business, you will need a motor mower. Motor mowers are powered by either 2 or 4 stroke motors or an electric engine.

*2 Stroke Petrol Mowers*
Normally rotary, these engines are easier to maintain than 4 stroke engines, and cheaper to buy than 4 stroke engines.

*4 Stroke Petrol Mowers*
These can be rotary or cylinder mowers. These are normally more expensive than 2-strokes but generally longer lasting mowers.

*Electric Mowers*
These are less expensive than petrol mowers, because an electric motor is cheaper; but they don't last as long. A power cord trailing behind can be dangerous if you are not careful.

*Cylinder vs. Rotary*

Mowers are generally cylinder or rotary as follows:

- Cylinder -These cut the grass by a shearing or scissor action. The blade hits the grass at a sharp angle (e.g.: 45 degrees) this causes a clean cut with minimal bruising or tearing (blades are damaged by rough surfaces and by stones, sticks etc.) Cylinder mowers are generally safer to use than rotary mowers.
- Rotary -These cut by an impact action, hitting the grass at a 90 degree angle. This causes bruising, tearing and a less even cut than a cylinder mower. Rotary mowers will handle rough surfaces better than cylinder types. Rotary mowers are less expensive and easier to maintain than cylinder mowers.

*Hover Mowers*
These are wheel-less mowers which float like a hovercraft on a cushion of air created by movement of the rotary cutting blade. They can be powered by either a petrol or electric motor. Hover mowers won't cut long grass or slightly damp grass very well at all but are very good on steep slopes and on rough ground (if grass isn't too long). Hover mowers generally cut faster than cylinder or rotary mowers, as long as the grass is not too long.

*Ride On Mowers*
There are many different types of ride on mowers on the market. Some are notorious for breaking down. Generally you get what you pay for. Shop around and talk to people who have used ride-ons before. Talk to several different mower repair shops and people who work in the horticultural industry. Some ride-ons are not very manoeuvrable in tight corners (e.g.: around trees) and can cause compaction on heavy, wet soils. You will almost certainly need a hand mower or brush-cutter to cut inaccessible places.

Ride-on mowers have the advantages of quicker coverage of the land area, a high degree of manoeuvrability, and a wide width of lawn can be cut in one run.

Modern hydrostatic drives give smooth rides and gear changes to offer quick, easy and light handling of the machine.

Mowers are available with front, mid or rear-mounted mower decks (the cutting unit). You can select to have the clippings left on the ground or an attachment will have them collected in a catcher for later 'dumping' (for compost).

Front mowers cut the grass before the wheels of the machine press the grass down. This means the lawns will be cut more evenly to produce a level finish. Additionally the front-mounted mowers tend to glide over uneven ground very well.

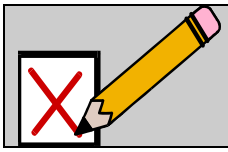
For the gardener there are two slight variations available:
*Ride-on Mower – these generally have a rear-mounted single cylinder engine
*Lawn Tractors – these are better suited to larger gardens with a mid-mounted two blade mower deck.

**What sort of mower do you need?**
Most small to average domestic gardens would use a mower with a cutting width between 30 and 35cm. Large properties may require a much larger mower

| Area you can mow in 1hr | Cutting width required |
|---|---|
| 800 square meters | 30 centimetres |
| 1600 square meters | 40 centimetres |
| 2400 square meters | 60 centimetres |

- Cylinder mowers are safer to use than rotary or hover mowers.
- 2 or 4 stroke motor mowers are safer to use than electric mowers.
- Rotary mowers cut overgrown grass better than cylinder or hover types. If you are mowing irregularly a rotary motor mower is probably best.
- Front mounted catchers are the most efficient for catching lawn clippings
- Self propelled or hover mowers require less physical effort to move over the lawn.
- The more complex the machine, the more that can go wrong with it. Self propelled, ride on and four stroke cylinder mowers are susceptible to a greater range of problems than a basic two stroke rotary.

*Mowing Guidelines*
- Never mow wet grass with a rotary mower
- Avoid mowing wet grass with a cylinder mower
- When the grass is long cut it higher. You might cut it a second time (lower) a few days later. You can badly damage turf if you mow it very low.
- Cut twice weekly when grass is growing fast
- Cut every 2-3 weeks if grass is growing slowly
- Cut grass up to 4cm tall when not growing fast (e.g.: under drought conditions or in cool weather).
- Never cut grass shorter than 1cm high (if you want grass to remain healthy): 2.5cm is a good length for all general utility grass surfaces: bowling and golf greens are usually shorter.
- Clean sticks, stones or other rubbish off the lawn before mowing
- Mow backwards and forwards across the lawn in parallel lines and at right angles to the lines you followed on your previous cut.
- Avoid mowing on days when it is extremely hot or cold as this can scorch the cut tips of grass.



**SELF ASSESSMENT**
Perform the self assessment test titled ' test 1.2'
If you answer incorrectly, review the notes and try the test again.

**Brushcutters/Trimmers**
Brush-cutters are mainly used to cut long grass, or trim weeds and grass along fence-lines, around the base of solid obstacles (e.g.: trees, statues, seats etc), or over ground too rough to use a mower on.
There are two different types of brush-cutters; those with a nylon cord which will cut grass and light weed growth, and those with a metal blade (i.e. like a circular saw), used to cut heavier growth such as woody weeds or scrub. Some brushcutters are able to do both with a simple change of the head equipment.

*Nylon cord cutters (e.g. Whipper Snippers, Trimmers)*

- A spinning nylon cord (up to 30cm long)
- These are generally smaller, more lightweight and used for trimming around the edge of lawns, the base of buildings or trees, or cutting grass on slopes or other inaccessible places.
- These are relatively cheap machines. The nylon cord is cheap and easy to replace when damaged.
- May be powered by an electric motor or petrol engine.

*Metal Blade cutters*

- A spinning disc with blades made from plastic or metal.
- These are more heavy duty machines able to cut long grass, blackberries or (in the case of the more powerful machines) more substantial brush.
- The machines and blades are more expensive than the nylon cord brush-cutters. The blades need to be kept sharp.
- Powered by petrol motors

**Mulchers**

In recent years a number of garden mulcher/shredder/chippers have become available. These range from small, portable, usually petrol driven types for the home garden up to large, heavy duty machines either petrol driven or operated by power take off units attached to tractors and trucks. They generally operate by feeding plant materials of a suitable size into a chute were it comes into contact with a rapidly revolving blade or series of blades that shred the material into small pieces and expel it into a container such as a truck tray or onto a pile on the ground. As the blade rotates and cuts the plant material it helps pull the rest of the material down the chute. For home garden versions the size of the material that can be shredded is generally up to about 2 to 3cm thick. Larger machines used by commercial operators can chip material up to around to 15cm in diameter. Only plant material should be put into the machine to be shredded. Other material can readily damage the blades and other working parts. These machines are noisy. Hearing protection should be worn when the machine is being operated and the manufacturer's safety instructions should be followed closely. These machines should only be operated by adults and they should be used in observance with the safety instructions provided by the manufacturer.

**Rotary Hoes/Rotovators**

Rotary hoes are used to loosen or cultivate soil, making it easier to dig in or move about. They may be self propelled or driven by a "PTO" (Power Take Off) attachment to a tractor or mini tractor. Self propelled machines normally use petrol engines and move forward by rubber tyre drive wheels or by using the rotating blades to pull the machine. Most need a reasonably strong and fit person to operate them properly. Tractor mounted machines are easier to operate but more expensive to buy (given that you need a tractor to operate them).

Small self propelled units are best in small areas and soil depths of 15 to 20 cm, while the tractor operated versions are best for larger areas and where greater depths of cultivation are required. A rotary hoe (with or without operator) can be hired at a very reasonable rate to cultivate soil prior to landscaping a new garden. The home gardener would not normally buy a rotary hoe unless they were going to use it regularly (perhaps to cultivate a large vegetable garden). In comparison, a business person may be able to justify the purchase of such a machine.

**Tractors**

Modern farm tractors have continually undergone changes and improvements, which make them effective and up-to-date agricultural power units. Changes have helped to make the tractors more efficient, safe, convenient, versatile and powerful.

There are tractors of all sizes, and developed for every imaginable task available. Tractors can be classified according to wheel or track systems e.g. three-wheel; two-wheel drive; four-wheel drive. They can also be classified according to use and size, e.g. industrial tractors; lawn and garden tractors. Horticultural tractors are machines capable of pulling, carrying and operating a variety of implements and machines. Broadly they can be divided into two groups: tractors on which the operator rides, and pedestrian-operated machines.

Tractors are now manufactured, providing for much greater levels of operator comfort for example air conditioning and radios in the cabin. These comfort features tend to lessen operator fatigue and therefore improve safety.

The engine is the source of power for the tractor. It must be properly coupled to the rear-drive wheels to make the tractor a practical machine. The clutch, transmission, differential and final drive are the parts that make the tractor engine versatile, adapting it to the job it is to perform.

The clutch disconnects the engine from its load. There are different types of clutches, those commonly used in tractors are the single-driving plate and multiple-disc type, they can be either hand or foot operated. They must be adjusted to ensure the parts run freely when disengaged and will not slip when engaged.

The transmission is a set of gears, providing speed reduction ratios between the engine and the final drive. Some tractors have hydraulic torque converters which permit the forward speed of the tractor to vary with the load at the draw bar, reducing gear shifting.

The differential in the tractor permits the two rear wheels to turn at different speeds while power is being transmitted through both wheels. This is necessary when it is driven on a turn, and the outside wheel must travel further and therefore faster than the inside wheel.

The power take-off shaft (P.T.O.) on a tractor enables power to be delivered to stationary machines as well as to field machines which require rotating power.

The 3-point linkage on the tractor is for the purpose of quickly attaching implements to the tractor. There are three points where the implements can be connected, (if only two points were connected with a heavy load, the tractor may tip backwards). Power from the tractor lifts the linkages.

The type of steering mechanism can vary with the tractor, though there are some basic parts which are common to many systems. For all wheel tractor steering systems, a gear reduction unit is provided. Most commonly used are the worm-and-lever mechanism and the worm-and-sector unit. They provide the necessary gear reduction to make steering easy under most conditions. Tractor wheel brakes can also be used to aid steering, as the brake can be applied to either wheel independently of the other wheel.

Steering gears usually run in oil, having a reservoir separate from other tractor parts. (Oil must be checked and kept at the proper level).
Power steering units are mostly standard equipment on new tractors.

**Chain Saws**
For some garden jobs, you can't go past a chain saw for making light work of an otherwise monstrous task. Chain saws are also dangerous, needing proper handling and regular maintenance.

Pruning trees
For small pruning jobs around the garden a chainsaw can be helpful to:
Remove low or obscuring branches
Lower the height of large shrubs
Creatively change a boring small tree into topiary

For large trees that need pruning it is best to leave the job for qualified arbourists. If a non-insured tree pruner, or yourself, causes damage to property, you may not be covered by insurance.

*Landscaping*
Use of timber is common in landscaping. A chainsaw can be very helpful for making rough cuts through sleepers or log sections. If you are planing to cut second-hand timbers and sleepers it is essential to remove all old nails, metal attachments, and any bits of debris, soil, and gravel.

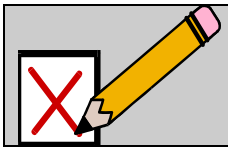
**Petrol or Electric**
Petrol powered chainsaws are more common and tend to be sturdier and stronger, and offer greater portability than electric models. They are however, heavier to use, require frequent refuelling, and require a fair amount of maintenance.

Electric chainsaws are significantly quieter, with no fumes, no difficulty with starting and no need for regular topping up of fuel. There are smaller in size, weight and strength, and their power cords can be

a real hazard, in particular for tripping over, getting tangled with objects, and their potential for being cut as you use the saw. They require a power source (power point) nearby.

*Bar Size*
The power of the engine will largely determine the size of the chainsaw bar - the larger the engine power, the longer the bar the machine will be able to carry, and the thicker the pieces of timber you can readily cut. For domestic use a 14 or 16 inch bar (400 – 450mm) is usually sufficient. For heavier use, such as tree lopping, or regular firewood harvesting a larger engine, with a blade of 18inches (500mm) or more is more efficient.
Safety is crucial. A chainsaw can be a very dangerous tool. All chainsaws should come with a cut-off guard close to the upper handle - this mechanism prevents the chainsaw jumping up towards the user's face while the blade is running, and can trigger a chain break that stops the chain from running.

**Lawn Aerators**
Lawn aerators help to loosen compacted soil that encourages moss and fungal disease in lawns. They work by creating air spaces that enables the soil to better absorb and retain water as well as oxygen.
Lawn aerators come in a wide range and choosing the correct one depends on the application and the amount of times you need to use it. Following are some examples:
*Simple strap on spiked sandals with 5cm spikes (good for small area)
*Spiking forks with or with a water assistance (also good for home garden situations)
*Push aerators un-motorised
*Aerator attachment for a roto-tiller
*Motorised aerators from 4hp with adjustable depth (commercial application)



**SELF ASSESSMENT**
Perform the self assessment test titled ' test 1.3'
If you answer incorrectly, review the notes and try the test again.

**Hand Tools**
*Bow saw*
Has a tubular steel frame in the shape of a C. It is designed to cope with heavy duty garden work i.e. cutting logs and thick branches

*Pruning saw*
Pruning saws - These generally have teeth designed to cut moist living timber; the teeth being generally larger than those on saws used for cutting furniture or construction timber.
There are two types of pruning saws:
- Straight bladed which allows variation in the type of cut according to the type and size of the material being cut.
-Curved blade with teeth on one side. This curved saw is generally used by the experts because the curved blade allows access to restricted areas such as near closely interlocking branches.

The pruning saw is ideal for pruning tall shrubs, hedges or trees it has a telescopic handle that allows you to extend your reach to at least two meters.

*Circular saw*
Is used by the horticulturist in the maintenance and construction of garden features i.e. retaining walls pergolas, gazebos etc. They are used to facilitate quick, accurate, straight cutting of any types of wood. They usually come with a fence guide that allows you to accurately cut straight lines, an adjustable rip fence that protects the blade and an arbour lock that means easily blade changes. Vertical height adjustment enables the user to set the depth of the cut as required.

*Screwdrivers*
The most common type has a flat tip designed to fit into slotted head screws. Phillips head has a cross, non-slip pattern and is used for screws that need to be tightened more than slotted screws. Square shaft screwdrivers are designed for use with a wrench or spanner to hold the blade into the slot. Ratchets have an adjustable action – forwards and reverse – so that you don't need to alter your grip. The stubby has a small blade and a large head for using in confined spaces.


*A range of hand tools (Clockwise from left): Gravel (hard tined) rake; grass (soft tined) rake; lawn edger; gooseneck hoe; folding soft tined rake; garden broom; three-tined cultivator; garden fork.*

*A range of hand-tools including various secatears, loppers, and pruning saws.*

*Using Hammers*
Hammers should be well-balanced and easy to hold
Hold the hammer at the base, not up the handle
Wear eye protection
Hammer directly in line with the nail
Use gentle pressure until the nail begins to grip

*Using a Screwdriver*
Use the longest screwdriver convenient for the work – you are able to apply more pressure to a longer screwdriver
The tip of the screwdriver should be the same width as the screw slot and it should fit snugly into the slot. If the tip is wider, it may damage the timber; if it is smaller, it will be difficult to get a good grip on the screw.
Hold the screwdriver in line with the screw to prevent it slipping and damaging the timber.
Rubbing soap or paraffin wax onto the screw will reduce friction and make driving easier.
Always drill a pilot hole to receive the screw – this helps prevents splitting.

*Using drills*
When drilling a hole for a screw or a bolt, the drill and the drill bit must be suitable for the job. If you're drilling a small hole in a small piece of softwood or even an aerated concrete brick, a cordless drill will be suitable, but for drilling into hard timber or masonry, a power drill is essential.

*Secateurs*
Every horticulturist whether in a production growing, growing on or retail nursery, or in garden maintenance; needs a pair of secateurs.

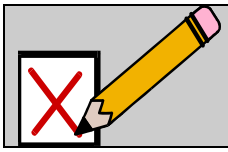
There are three main types of secateurs:
*By-pass secateurs*
By-pass secateurs use a scissor-type action and have a sharp upper blade which cuts against a sharp lower blade to make a clean, precise cut.

*Anvil secateurs*
Anvil secateurs have a sharp upper blade that cuts against a lower anvil. These secateurs can crush woody material if they are blunt.

*Parrot-beak secateurs*
Parrot- beak secateurs have rounded blades that use a scissor-like action. Use these with care, as they can be dangerous

**How to cut*
All cuts should be made at a sharp angle in relation to the ground. This prevents water from collecting on the cut surface, thus reducing the likelihood of disease problems. Where possible, cuts should be made just above a node (where the leaves and/or flower stems are, or have been, attached to the plant stem). This reduces the likelihood of dieback along the stem. It is also important to only cut material that is not too thick for the secateurs (ideally no more than 1-1.5 cm depending on the secateurs), otherwise you will find the cutting to be a strain on both the secateurs and yourself, and the final cut is likely to be rough, torn or uneven. When using anvil secateurs you should always cut down onto the anvil.

It is important to sharpen the secateurs' cutting blade regularly with a sharpening stone.
...on anvil types the blade should be sharpened on both sides.
...on scissor cut types, the blade should only ever be sharpened on one side
(i.e.: the outer edge - the side which is most further away from the other blade when a cut is made)



**SELF ASSESSMENT**
Perform the self assessment test titled ' test 1.4'
If you answer incorrectly, review the notes and try the test again.

**Nursery Tools and Equipment**
The equipment used by staff in a nursery can make a great difference to overall productivity. A lack of spending in this area can make it impossible for staff to do an effective job, even if they are very skilled and competent staff. On the other hand, excessive spending in this area can result in a significant waste of money that could be better spent elsewhere.

Good management of tools and equipment involves three things:
a/ Choosing the right type and quantity tools and equipment in the first place.
b/ Making sure tools and equipment are used and maintained properly.
c/ Upgrading or replacing tools and equipment at the right time.

*Design of tools*
When a piece of equipment is made, it is usually made for a particular job. Nursery tools are usually used frequently, maybe every day, whereas tool for the home garden are only used occasionally. You should choose tools and equipment which are strong enough to withstand constant and sometimes heavy use.

*Strong tools will take greater physical stress and handle heavier jobs without breaking. If you buy a cheap tool built with low quality materials it might not last till the end of the first day, particularly if you are doing heavy work.

*Sharp tools put less stress on the tool, and less strain on the user.

*Long handles give greater leverage and increased reach, putting less strain on the user's body. Long handles, however, are sometimes impracticable, especially where the tool will be used in confined spaces.

*Some tools are more expensive because long hours of thought have gone into their design, not just because they use better materials. Tools which do the job better and more easily may be more expensive ones, but they are worth it.

*Heavy clay or rocky soils are likely to put more strain on tools and equipment such as spades and cultivators - you will need better quality and more heavy duty tools.

*Metal tools made with stainless steel or aluminium do not corrode like those made with other metals.

**Deciding what is good to buy:**
Before you buy a tool or piece of equipment you need to decide 'do you really need it?'
Too often equipment is bought simply on a whim, or because every one else has one or because it seems a good idea at the time. Deciding to buy should be based on a genuine need for that piece of equipment, for such reasons as significantly reducing workloads, or the time involved in tasks, allowing you to expand the types of activities you undertake in the nursery, for safety reasons, or for improving the quality of your work.

The need for that equipment then needs to be balanced against the cost, both initial and ongoing, and the operational requirements of that equipment. Is it really a worthwhile proposition? This must be decided on such factors as:
* Does it do the job that you require of it?
* Initial cost - how much does it cost to buy?
* Ongoing costs - this includes maintenance, parts, fuel, & insurance.
* Reliability - does it break down a lot?
* Longevity - how long will it last?
* Safety to use.
* Availability of parts and servicing.

SHOULD YOU RENT OR BUY?
Often a viable alternative to buying is to rent equipment, either long or short term. These days you can hire most types of commonly used horticultural equipment (eg. rotary hoes, tractors, chainsaws). Factors to consider include:

* How often do you use the equipment? Why buy when you can hire the equipment on the occasions you need it.

* Upfront capital costs - can you afford to buy the equipment or would it be easier to pay periodical rental or leasing costs?
* Do you have the technical expertise to keep the equipment in good working order? Good rental companies keep their equipment well maintained and serviced and will replace equipment that is faulty.
* In some cases the lease or rental hire may be tax deductible.

**Manual Potting Equipment**

Smaller nurseries may find that their level of production would not justify the purchase of specialised potting equipment. The minimum potting equipment required could include:

*Solid washable workbenches (i.e. galvanised metal top) suited to propagation and potting activities with storage underneath for pots and trays and shelves above for labels, markers and propagating equipment.

*An adjacent under cover media storage area with a concrete base this should be located so it is accessible from both sides; for media delivery, and to enable the media to be shovelled onto potting benches.

*A mobile bench/potting cart is also a cheap investment. This allows the potting media to be moved to where it is needed and also seconds as a potting bench.

The cart can also be used to move potted tubes to the growing-on area.

*A rotating table (lazy Susan type) suited to potting up plants

*Nursery trolleys for moving plants

Nurseries with medium production runs may consider using:

*A potting station or potting hopper and bench.*

The potting station usually incorporates a gravity feed hopper that can be bulk or conveyor filled it is also easily adjustable to suit various pot sizes. This type of station has no moveable parts making it easy to maintain and reliable to use.

The hopper and bench type is usually made from heavy galvanised steel. The hopper is bulk filled and tubes trays and pots of all sizes can be straight filled.

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*Storage hoppers

*Trailers that are specifically built to suit narrow and confined spaces

*Small tractor particularly useful in the medium to larger type operation where a lot of material, equipment and stock is constantly being moved.

*Nursery trolleys are an essential item in every nursery. These are three or four-wheeled trolleys with a wide, shallow tray which is primarily used for moving plants around the nursery (most trolleys will hold both pots and seedling trays). The trolley tray is covered with a metal mesh to allow water to freely drain away when plants in the trolley are watered before unloading. Several trolleys should be conveniently located in both production areas for nursery workers and sales areas for customers to transport their selected plants in.

*Hand Trolleys. Upright hand trolleys are useful for moving many things about the nursery including boxes of materials (eg. chemicals, pots, stationary, tools, etc) when delivered and large planter tubs when a forklift or tractor isn't available. They are particularly useful in retail nurseries or at shows and exhibitions where a small upright trolley can sometimes be more manoeuvrable than a larger nursery trolley in a confined space.

**Additional Potting Equipment for Larger Nurseries:**

*Soil mixing equipment*

Cement mixers (small or large) are sometimes used for mixing potting media in those nurseries which make their own mixes. In some larger nurseries large amounts of soils, composts, mulches or growing media may be mixed and/or transported using a front-end loader. Ideally these materials should only be mixed and stored on a 'clean' surface such as concrete so that they are not contaminated by soil particles and soil-borne pest and diseases from underlying soil.

*Conveyor Belts*
Conveyor belts can be used to move plants away from work areas to growing on areas as well as moving media from hoppers to potting machines or benches. They are not viable in small nurseries, but some large nurseries have found that they can contribute towards improved productivity.

*Potting Machines*
Potting plants is extremely labour intensive and many nurseries have found that automated potting machines have significantly improved nursery efficiency. There are a number of different models available, including machines which do the following:
1. Controllable volume system - the amount of soil which is poured into the pot is controlled by pushing a foot pedal/hand button. Soil will continue to be delivered until the foot pedal/button is released.
2. Pre-set volume - the volume of soil is pre-set, although this can be changed for different sized pots, plants, etc.
3. Combination of the above - more sophisticated machines can be set to either method.
   Pots can be moved along a conveyor belt or set on rotating benches.
   The soil may be fed through a central hopper or along a conveyor belt.

*Seeding machines*
There are a range of different types of seeding machines used by nurseries. Most feed seeds into soil or potting media by a vacuum mechanism (eg. seeds are picked up when a vacuum is created, then dropped in a desired position when the vacuum is disengaged). Plants grown in the field may be direct sown into nursery rows.
Plants grown in containers can be grown by using a seeding machine and a compatible transplanting machine. Many annual and vegetable seedlings are propagated into "plugs" using this type of equipment. Seedling nurseries have been known to effectively halve their manpower costs by using this type of machinery, and despite the high cost of the machine, the cost benefit has been enormous.

*Tray filler*
Used for the filling of seedling trays. This equipment has an adjustable vibrating system and the height adjustable rotor that ensures uniform soil density as well as equal soil distribution. The filled trays are then finished and cleaned with a height adjustable, fast rotating brush unit. This equipment also has easily adjustable speed and height settings improving the productivity rate, for example machines are able to fill from 700 to 2000 average sized trays (520mm x 40mm) per hour depending on the speed setting Capacity depends on the adjustable speed setting. This equipment usually comes with options such as automatic tray dispenser, watering system, conveyor, seeding/dibble equipment.

*Sprayers*
Sprayers are used for applying chemical sprays (insecticides, fungicides and weedicides) or liquid fertilizers.
It is advisable to use a different sprayer for each type of chemical.
(Weedicide residues left from previous spray jobs can contaminate insecticides and damage plants you spray for insects).

There are many different types of sprayers available:
a/ Disposable spray guns
Plastic bottles with a pump action handle on top. Many chemicals are sold as a ready to use spray in this type of bottle. Refills can be bought to screw on to the spray mechanism top.
b/ Pressurized back or shoulder (knapsack) pack units:
Is a container which can be pressurized with a flexible hose and connecting spray nozzle.
The unit is pumped by hand to raise the pressure in the container. A trigger is used to release pressure and spray as required.
c/ Motorized sprayers
A container which holds the chemical is pumped from by a motorized pump and out through a spray nozzle.

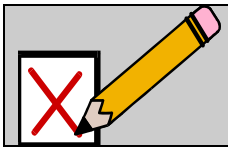
| Comparing Sprayers | | | |
|---|---|---|---|
| | **Disposable Spray Guns** | **Pressurized back packs** | **Motorized Sprayers** |
| Cost | Under $5 | $50-$200 | Most expensive |
| Durability | Use a few times only | Fair to good | Generally good |
| Parts | Not worth repairing | Parts available | Parts available can be repaired |
| Likely Problems | Pump action Seal damage | Washers leaking Nozzles blockage | Nozzle blockage Engine problems |

*Sterilising Equipment*
Larger nurseries mixing their own media need to use sterilising equipment to eliminate harmful bacteria but still leave beneficial organisms for healthy soil. Fan forced steam sterilisers with selected temperature and soak times are used for this purpose. The sterilisers are usually trailer mounted so that the top of the unit is removed and the trailer is then towed to the potting bench saving double handling.

*Heating Trays (commercial propagation)*
There is a range of commercial propagation trays available including: fibreglass, heating cable on wire mesh and flexible heat mats.

Some trays are available with both heating and misting for independent use or heating only for use in humidity controlled environment such as a hot house. There are a range of sizes available or they can be custom built to suit all commercial growing needs. Misting equipment and sensors are also available for hot house use.

*Capillary Matting*
Reduces water usage as less overhead watering is required; the water is absorbed into the pot through a wick action from the mat set in a galvanised metal tray underneath the pots. The matt has a water holding capacity of around 600% its own weight or around 2 litres per square metre. It also controls weeds, reduces fungal disease, ensures even moisture distribution and is very easy to install.



**SELF ASSESSMENT**
Perform the self assessment test titled ' test 1.5'
If you answer incorrectly, review the notes and try the test again.

**Miscellaneous Ancillary Equipment**
Humidity meters, soil thermometers, moisture meters, maximum minimum thermometers, digital thermometers

*Knives*
Knives can be used for a variety of jobs in a nursery including budding and grafting, preparing cuttings, layering, dividing plants and pruning. Because it is a small and convenient tool many nursery workers carry a knife at all times just in case they need it for these or any other jobs. With practice, a skilled nursery worker can do most things with a knife that other gardeners might need a pair of secateurs for.

It is best to use the appropriate knife for the job at hand, and there are many different types of knives. Knives can have either fixed blades, folding blades or disposable blades.

*Folding Blade Knives*
This is the most common type of knife used in nurseries. A normal pocket knife or even a Swiss army type knife might look like a propagation knife, but it isn't designed for, nor should be used for propagating plants. Different folding blade knives are designed for different tasks, so either use several different types of knives or choose a knife designed for the task which you will most commonly use it for.

*Fixed Blade Knives*
The main advantage is that the blade can't move when it is being used, so there is less chance of an accident damaging either human flesh or plant tissue.

*Disposable Blade Knives*
These came with both fixed and protractible blades. Protractible types allow a "sectioned" blade to be slid inside a handle for safety when not being used, and slid out when needed. When the blade becomes blunt a section can be snapped off and the next piece extended for use.

*Characteristics of Knives*
*Type of Metal
Stainless steel knives are often cheaper and do not keep their edge as well as more expensive knives made with high quality steel. Expert propagators need tools to suit their skills if they are to perform to the best of their ability, but unskilled labour will probably misuse and not get any significant value out of more expensive knives.
*Single or double angled blade
Single angled blades are ground on one side only so one side of the blade is sloped and the other is flat. These can only be used to cut with the flat side against what is being cut. Most specialist knives are single angled.
Double angled blades are sloped on both sides and cuts can be made any way. Knives for "T" budding are made this way.
*Weight
Knives are more efficient if most of the weight is in the handle. You can test where most of the weight is by balancing the knife on your finger.
*Handle
The handle should be comfortable in the user's hand. If it is to be used for hours on end, this will become extremely important.
*Attachment between blade and handle
This is a weak point and on less expensive knives the blade may become loose.

*Applications*
*For dividing large clumps of perennial plants, a large sturdy knife may be most appropriate. It will usually come in for rough treatment coming in contact with soil, and needs to be sharpened regularly
*For budding, a lightweight folding knife with a spatula on the end (for handling buds and lifting bark) is the traditional tool. Some nurseries find these knives are expensive and frequently go missing, so they have been replaced successfully with cheaper alternatives such as razor blades in a protractible plastic holder.
*Grafting knives come with both curved and straight blades though straight edged blades are preferred.
*Pruning knives are traditionally larger knives with curved blades used for de-heading (eg. cutting the tops off perennials at the end of the season), or taking the tops off rootstocks before grafting.

*Carpenters saws* -There is great variation in the types of saws used in carpentry work. Generally they have finer teeth compared to the pruning and bow saws and these are generally set to give a narrower cut. This is because they are mainly used for cutting processed timber (i.e. dried, milled, heat pressed and treated, etc) where a narrower, finer cut, in comparison to pruning cuts, is required. These saws are predominantly straight-edged with teeth only on one edge of the saw.

*Simple Rules When Using Hand Saws:*
*Always keep the saw sharp. This makes cutting easier and gives a cleaner cut.
*Make sure you are only cutting timber. This applies particularly when cutting second hand timber which may contain old nails, etc, and cutting in situations where the saw may come into contact with soils, gravels or other materials that are likely to damage the saws cutting edge.
*Always store the saws in a safe place and keep them clean. The saws may be readily damaged if dropped or banged against other materials. They will quickly rust if allowed to stay moist. Incorrectly stored saws may also be a safety risk, particularly if children have access to the area where saws are left.
*Use the right saw for the job at hand. This will make the task easier for you and produce a better quality job.

*Spades and shovels*
Shovels are used for moving loose soil (or some other loose material). Their blade is cupped and at an angle inwards from the line of the handle. A shovel is not designed to dig. Spades are used for digging and planting. The blade follows the same line as the handle. Spades and shovels can have short or long handles, with the blade curved (i.e. a round mouth) or straight across the bottom (i.e. square mouth).

Long-handled spades provide greater leverage (placing less strain on the back) and give greater reach (allowing you to dig deeper holes). They are best suited for digging holes or trenches, particularly in hard clay soils. Short handle spades are better suited to use in a confined spaces or for digging over established garden beds with relatively loose soil.

*Forks*
Forks are used to cultivate (or mix) soil, or to move organic material about (eg: turn over a compost heap). The prongs of a fork can either be round or flattened. Flattened prongs are more suitable for moving organic material about.

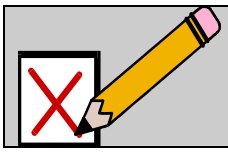
*Hoes*
A hoe is used to cultivate (i.e. mix up or turn over) soil. Soil is cultivated in order to either kill weeds or to loosen the soil enabling better penetration of air and water.
A long-handled hoe which has a handle the same height as the user places least strain on the user's back.
There are two main types of hoes:
a/ A vertical action hoe - which loosens the soil and chops under the weed. These include single prong or three prong hoes, chip hoes and draw hoes.
b/ A horizontal action - which moves through the soil just below the surface. The top of the weed is cut from the roots by the sharp blade.
In the case of annual weeds, there is little if any regrowth and the weeds die. These include traditional Dutch hoes and torpedo hoes.

*Rakes*
Rakes suffer a great amount of strain where the head meets the handle, and along with axes are perhaps the most likely tools to suffer from broken handles. The prongs (or teeth) of a rake also suffer a great deal of strain (particularly if being used to landscape a new garden). If landscaping a new garden, get yourself the sturdiest rake you can find - or else be prepared to go through several rakes before the job is finished.
Rakes may vary considerably in construction and in the type of materials used. The most common types of rakes include:
* Grass and leaf rakes - These have long flat tines or teeth that lightly brush the surface you are raking, catching light loose material such as leaves and grass clippings. Some of the better quality rakes can be adjusted to change the width of the rake head to cater for differences in the size of the materials you are raking. These grass and leaf rakes are generally constructed out of metal, bamboo cane or plastic. The metal rakes generally last longer, but may rust unless they are plated. They are also usually more costly. The bamboo and plastic rakes don't have rust problems, and are generally cheaper than the metal ones, but are nowhere near as durable.
* Nail rakes -Generally steel teeth are riveted to a steel frame. The teeth or tines are rigid and are shorter than the grass and leaf rakes. This enables shifting of heavier material and also for the rake to have a cultivator like effect on loose soils. If incorrectly used, the teeth may become loose.
* Single piece rake heads - generally formed from a single piece of carbon steel, sometimes from moulded plastic. This type has similar functions to the nail rake. Teeth size, shape and numbers vary according to the type of work to be undertaken. For example you may have 10, 12, 14 or 16 teeth depending on whether you are raking fine or coarse gravel, asphalt or soil. Both nail and single piece rakes usually have sockets welded to the frame for the easy attachment of wooden handles.

*Snap lock tools*
There are several modular tool systems with a range of "heads" that can be connected or disconnected to the one handle as required. Available heads include rakes, hoes and cultivators, aerators, seed-sowers and pruners.
Major advantages of this system are the space which is saved in storing tools and the flexibility of being able to vary the length of handle on a tool head.
The main disadvantage is that there is greater wear and tear on the handle and the locking mechanism than on any individual head.

*Wheelbarrows*
When buying a wheelbarrow make sure the main centre of balance is over the wheel and not on your arms and that you have plenty of leg room when wheeling the barrow. Choose a solid, well constructed wheelbarrow. A well built wheelbarrow will last for several decades if properly maintained. Keep tyres pumped up, grease all moving parts, wash out soil or rubbish after use and store out of the weather. If this maintenance is not carried out you will be lucky to keep a barrow in use for more than 5 years.

*Weed Bags*
Perforated plastic bags into which nursery plants in pots are placed the plastic bags let water and air in, but keep out light. They are however quite labour-intensive.
Weed bags (non-perforated) are also used to collect and dispose of noxious weeds in forest and other environmentally sensitive areas



**SELF ASSESSMENT**
Perform the self assessment test titled ' test 1.6'
If you answer incorrectly, review the notes and try the test again.

**MATERIALS**
Other then plants and associated materials (potting media, pots and so on) Horticulturists also use a large range of other material in the everyday pursuit of their tasks. Pergolas, fences, steps, retaining walls, paving, concrete, mulch, weed mat, garden furniture and so on, are all part of the horticulture business and when broken down into their component parts, cover a vast array of construction material. The Horticulturist's knowledge should include the ability to use the correct components for each application as this ensures efficiency as well as a quality, longer lasting construction.

**Construction Materials:**
Construction materials are used in the construction of pergolas, fences, retaining walls, plant supports etc. and include:
Timber
Rocks and stone
Sand
Cement
Concrete
Nails, screws bolts
Paints and sealers

**Nails, Screws, Bolts** - A garden is more than just soil and plants. The built components decide the shape and structure of the garden landscape. Consequently there are many times when a horticulturist needs to attach one material to another. Knowing which fastener to use, and what tools to use them with is an important part of developing a well-constructed and safe garden.

*Timber Fasteners*
The most common materials for fastening timber are nails, screws and bolts.
Nails
Nails are useful for attaching smaller pieces of timber to larger pieces, such as decking boards for a back porch. They're cheap and quick to use but they're not suitable for timber subject to stresses. They can cause splitting so don't use nails within 15 mm of the edge or 60 mm from the end of the timber, unless you pre-drill a pilot hole. Wherever possible nails should be at least three times as long as the thickness of the timber they are attaching.

*Nail Types*
Bullet head – general purpose timber screw
Twisted shank nail – for attaching decking and soft timbers
Galvanised clout – for attaching soft timber such as lattice

*Screws*
Screws are used in place of nails for fixing larger pieces of timber subject to greater stresses. Different head shapes include countersunk heads that sit flush with the surface, hexagon heads that can be tightened with a spanner, and round heads where the head is left exposed.

The coach screw is useful for landscaping work – it has a tapered screw thread and a hexagon head that can be tightened with a spanner. It is used for fastening metal to timber or timber to timber, such as gates, timber frames, pergolas and post supports.

*Bolts*
Bolts are used to attach large pieces of timber such as retaining walls and pergola posts. To attach a bolt, first drill a hole slightly larger than the bolt into the pieces of timber that are to be fastened. The bolt is then fitted through the hole, and after a washer is fitted, a nut is tightened to secure the two pieces of timber together.

The two most useful bolts for landscaping work are:
Carriage bolts – a round-headed bolt with a square neck. The bolt is hammered into the timber and the square neck bites into the timber, holding it firm while the nut is screwed on. The round head gives a smooth surface finish.
Hexagon head bolts – the hexagon head allows tightening with a socket spanner.

*Brackets*
Metal brackets of varying shapes and sizes can be used to attach large pieces of timber or more than one piece of timber. Gang nails are square pieces of metal with sharp protrusions that are attached using a hammer. Other fasteners such as triple grips and joist straps are used when attaching timber at right angles. These are attached with galvanised clouts.

*Masonry Fasteners*
Masonry anchors
Masonry anchors such as dyna-bolts are used for attaching things like hanging baskets and gates into material such as bricks or stone. They work by placing the fastener through the material to be attached and into a hole in the masonry that is slightly larger than the anchor. By turning a screw into the anchor it expands and becomes wedged firmly into the hole.

*Paint, stains and sealers*
Paint: Paint contains resins, solvents, additives and pigment. Paints are generally opaque and offer a range of protective properties to the surface they are applied to. For example some paints withstand UV light better; others are waterproof, etc
Stain: A stain is basically a colouring agent that is applied to raw timber. Depending upon the type of stain, it may offer some protection against the elements. Stains are generally not opaque.
Sealer: A finishing coat that stops the absorption of succeeding coats. Often sealers are waterproof.

**Hard Landscaping Material includes:**
Pavers
Bricks
Toppings such as gravel, pebbles etc
Fences
Garden seats and other garden furniture
Ornaments i.e. statues, sculptures and ornamental pots
Fountains and other water features

**Pavers, Stone and Gravel**
Paths, driveways, terraces and outdoor living areas are commonly surfaced with either gravel, concrete, asphalt, pavers or some other material.

*Why Surface the Areas?*
*So you can walk on them when wet without slipping or getting dirty.
*So they don't erode.
*So they will take heavier traffic (eg. surfacing may be necessary to prevent cars getting bogged in the driveway).
*For aesthetics (so they look better).

*To control weed growth.

*Where should you use Surfacing?*
*Joining two areas which you move between frequently
(eg. A driveway is needed between the front of the property and the garage
A path between the laundry and washing line
A path between the house and tool shed
A path between the garage and house .....etc).
*On areas which are used for outdoor living or entertaining (these areas get more foot traffic than other parts of the garden, and need to withstand heavy use. Lawn might be damaged too much).
*On areas used for certain games (eg. for skateboarding, riding bikes, playing certain ball games etc).

**Paving**
Paving is the use of sections, such as blocks or slabs, of solid materials to create a hard surfaced area. This may be in the form of a pathway which link together the various parts of your garden, as a driveway, as the floor in covered areas such as sheds, carports or wine cellars, or for work, play or entertainment areas (both open and closed). They should provide a surface that is well drained, ideally low in maintenance, preferably attractive, and above all safe to use.

*Materials used in paving:*
Range from pre cast-concrete pavers to slate pieces to rounded pebbles or small rocks, to blocks of wood, to bricks and many more. Some of the more commonly used materials are discussed below:

*Bricks* - Kiln-fired clay bricks are one of the most common types of paving materials. Some types of bricks have a hollow or indented area in one or more sides which means that the bricks can't be laid that side up. Bricks can be obtained in a variety of textures and colours. They are generally rectangular in shape. The majority of bricks produced are around 9 inches (227 mm) long by 4.25 inches (109 mm) wide and 3 inches (75 mm) deep. Some types of solid house bricks can be readily used as pavers, with second-hand house bricks often being used in this role, however brick manufacturers now produce bricks specifically as pavers. These are designed to withstand conditions such as frequent use, and heavy loads such as vehicles, and are available in various sizes.

*Concrete pavers* - these have become very popular in recent years. They are available in a variety of shapes and sizes ranging from the traditional square types through to L-shaped, octagonal and various interlocking types.
Colours typically range from natural cement colouring to browns, greys and pinks.

*Slate* - this is usually thinner in depth and generally less hardy than the other types of pavers. It requires a solid base to reduce damage, particularly from heavy loads. Slate is very variable in price with imported varieties generally more expensive than local types. It is often sold as irregularly shaped pieces and can therefore be harder to piece together into a closely fitting pattern than the more regularly shaped pavers. Slates can have very attractive colouring and patterning and are most commonly used in entertainment areas, both indoor and outdoors.

*Natural rocks* - a) cut sections i.e. bluestone pitchers
b) Cobblestones i.e. rounded river pebbles
These are less common than brick or concrete pavers. Such materials are generally not as readily available as are bricks or concrete pavers. This material can also be fairly expensive, as in the case of blue stone pitchers. Such rocks can provide an attractive hard wearing surface but they tend to be a bit uneven.

*Wood (e.g. tramway blocks)*
Wood blocks can come in many shapes and sizes. They provide a softer surface than other types of pavers. Lifespan of the blocks depends on the type of wood used. Some river red-gum (Eucalyptus camuladensis) blocks have lasted in excess of 50 years and are still in good condition. These blocks can often make a very attractive addition to informal type areas such as Bush/Forest or Natural Gardens. They can also be a lot easier to cut to required shapes than the other types of pavers.

*Various surfacings (Clockwise from top left): Rubber matting; rough bricks; gravel; concrete; wooden decking.*

*Stones and mulch are both suitable surfacing materials for informal paths*

**Selecting Materials**
The type of paving material that you select will generally be based on such factors as: -

i) *Cost* - this will vary considerably from material to material; for example, imported slate may cost a great deal more than locally derived slate.

ii) *Availability* - some materials may be readily available in your area whilst some are not. This is also closely linked to cost. Materials may be available but only at high cost because they may have to be transported to your area. Second-hand material may need to be cleaned up prior to use.

iii) *Appearance* - each material has its own distinctive appearance, particularly in terms of colour and texture. Some have smooth polished surfaces eg. Slates; some have a rough coarse surface, e.g. brushed concrete pavers; some have attractive patterning, eg. Slate and many types of bricks; others have a consistent colouring, e.g. some concrete pavers.

iv) *Ease of laying* - some materials, such as slate may require shaping or cutting before being used, some may require a mortar base while others may not. Some materials, such as bluestone pitchers may be very heavy to handle.

v) *Use* - if the paved area is going to be used for frequent traffic or heavy loads then you will need to use pavers that are capable of withstanding those pressures. Footpaths and swimming pool surrounds require a non slip finish, while sloped areas may require a coarse enough texture to provide grip, while for other areas that are frequently swept clean a smoother surface may be required.

**Fences**
Fences and walls provide privacy, security and decoration. They can also be an attractive feature of any property in their own right.
They keep things both in and out of parts of a property. Some are very practical (eg. a pool fence or pet enclosure). Others are used as an aesthetic feature to complement the style of the house, as a backdrop to another area, or to screen off an unsightly area.
Fences are free standing structures; usually you can see through them. Sometimes they are built out of necessity; others are a luxury that can be added to the garden later on.

*Inexpensive fences*
Chicken wire – is useful in the vegetable garden, particularly for supporting climbing plants. Also used for animal enclosure. Mesh with larger holes (eg. rabbit wire) is also available.
Chain mesh – sturdy, durable and maintenance free. Can look municipal and doesn't provide privacy.
Brush fences – suit informal and bush gardens. Sold in prefabricated wired panels, this type of fence is quickly and easily erected. The brush is harvested from the bush so this type of fence is not environmentally friendly.
Paling fences – excellent fence for dividing the side and rear of properties. Can look drab until plants grow up and screen the fence.
Picket fences – traditional wooden picket fences are used along street fronts to complement cottage style gardens and houses, requires ongoing maintenance (painting).
Lattice – wooden lattice can be used as an attractive short-medium term screen, and is good for supporting climbing plants. Not very strong or long lasting - metal lattice is more durable.

**ASSOCIATED HARD LANDSCAPING MATERIALS:**

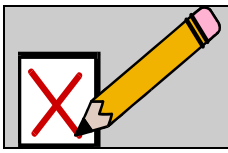
**Permanent Mulches**
Some gardeners choose inorganic mulches for their gardens. Pebbles, scoria, gravel and even small river stones have been used for this purpose. Coloured stones or pebbles can add an extra dimension to your garden.
Permanent mulches tend to be more expensive, but are highly durable and may not need replacing for many years. Their heavier particles are also less likely to be disturbed by birds.

This type of mulch should have a fairly uniform particle size. Do not use material with too many fine particles, as this may form a layer that will prevent water passing into the soil below.

**Weed Mat**
Weed mat has the potential to cut weeding time in the garden, produce a larger harvest due to water conservation and a lack of weed competition in crop production, produce clean crops
Weed mat come in various grades, as woven or non woven geo-textile fabric some are biodegradable. Weed mat still allows air and water to penetrate the soil unlike plastic mulch which tends to turn the soil sour over time.

**Erosion Matting**
Erosion matting and netting comes in a large range of synthetic or organic (biodegradable) mats. The matting (anchored to the soil with pegs) is used to prevent water erosion through run-off and rain particularly on steep sites where mulch tends to slip and be ineffective. By the time the organic matting (which is usually made of coconut fibre, wood or straw held together within a net) has decomposed, the plants that have been inserted through the mats will have stabilised the bank through the growth of their roots system. It is a very effective form of erosion control in most areas but can be less effective where consistent and concentrated flows of water pass over it.

**Hydro Mulch**
Hydro-mulching (sometimes also referred to as hydro-seeding) is an effective and economical process that uses machinery i.e. truck mounted, helicopter, or a specialised hydro-mulcher with a tank, pump and sprayer unit, to spray a specifically blended mix of water, binders, fertiliser seed and mulch onto steep ground or large areas of bare ground. The seed mix may contain grasses alone or in the case of revegetation projects (i.e. mining companies, road works etc), a mix of native trees and shrubs and grasses. It is becoming an increasingly popular revegetation system world-wide as well as a popular way to establish golf greens. Although the mulch material (usually a paper or wood product with green dye and a type of 'glue' added to help it bind to the soil)) is weed free, the fertiliser and water sprayed with the seeds and mulching material also helps to initiate weed growth from weed seeds already present in the soil.



**SELF ASSESSMENT**
Perform the self assessment test titled ' test 1.7'
If you answer incorrectly, review the notes and try the test again.

**STATUES, SUNDIALS & FIGURINES**

**Garden Art**
You will need to plan ahead, and give thought to the type of artwork before buying or creating something.

1. Consider the artwork …size, colour, style (eg. classic, modern etc) and texture. Does it suit the garden?
2. Identify a range of potential locations that are sympathetic with the needs of the garden.
3. Select the best location.
4. Make adjustments to the garden as necessary.
5. Position the ornament in place.

*Tips for positioning garden art*
- Don't lose it in similar colours. A green statue amongst green plants just won't be noticed.
- Don't put it somewhere just because there is room.
- Don't put a small ornament in a big garden or a huge ornament in a tiny garden – keep it in proportion.

*Framing the view*
To make a feature of your new ornament, arrange it so the eye is drawn to it. There are a number of ways to do this:
*Position your garden art near the front door. This means that everyone entering the house will have his or her eye drawn towards the object. (Be careful it doesn't become an obstruction!)

* Position the ornament at the end of a path or at the intersection of two paths. This method makes use of the path or paths to draw the eye towards the object.
*Locate the ornament beside a pond or pool. So long as the water is still, the ornament will be reflected in the water. You can also create reflections at night by spotlighting the ornament.
*Arrange your garden art so that it can be seen when sitting on a garden seat or from an outdoor living area. This will provide something to look at when you are relaxing outside.
*If you locate your garden art in view of a window, you will be able to use the window to make a viewing 'frame' and be able to see it from both inside and outside the house.
*Place the ornament on top of a stand or other support. By raising it off the ground, it becomes more visible.
*If you are building a new wall, create niches set into the brickwork. These "shadowboxes" are ideal for displaying small pots and statues in courtyards.
*If you have a pond, set the artwork to stand just above the water level, in the middle of the pond.

**Paintings**
Paintings need to be carefully placed so they can be seen from a range of angles. If you choose to include a wall painting, it should face onto parts of the garden and house where it can be viewed. Murals are a great way of adding character to your garden, and you can get together with the kids to produce something unique to your family.

**Pots**
There is a wide range of pot styles, colours and shapes. Use decorative pots as ornaments in their own right, or use plain containers for growing plants.

Small pots can be grouped together for greater impact – preferably at varied heights (on steps, benches, pedestals, pot stands, low walls, or even empty upturned pots). As a general rule, position the pots in a triangle, with the tallest pot and plant at the back of the group.

Large pots are best viewed with plenty of space around them. For a formal look, use the same style of pot and plantings, positioned at regular intervals along a wall, on steps or along a balcony.

**Gates and Arches**
The addition of an arch or gate to a garden adds charm to the garden. They may be constructed out of wood, wrought iron, galvanised pipe and in the case of arches out of crimped wire.

**Sundials and Birdbaths**
These can be both decorative and useful. They were usually fixed to a short column or baluster constructed of brick, stone or cast iron. Remember that sundials are reversed in the southern hemisphere in comparison to those of the northern hemisphere. Pre- made sundials and birdbaths can be purchased which can then be set in to a base or pedestal of your choice.

**Garden Furniture**
Furniture in the old style gardens varied from rustic through to the more formal. Woods such as teak and oak were popular for construction in England, while Red Gum and Stringy-bark were popular in Australia. Cast iron furniture was also popular in England and the United States. Interlaced patterns of branches, leaves, fern fronds and flowers were all translated into cast iron.
Work out why you want the furniture. What is important to you – appearance, practicality or both? Do you want furniture that you can move around the garden? Do you want furniture that blends into the background or furniture that makes a bold statement?

We put outdoor furniture into our gardens for two reasons:
1. To be used and to embellish or enhance the aesthetics of the garden.
The right piece of furniture put in the right place will do for a garden what a well chosen sauce does for French cuisine (i.e. Change the whole impression).
2. To be used. Outdoor furniture adds to the way you can use a garden in the same way that furniture adds to the way you can use a house.

*The Choices:*
*Furniture can be permanently fixed in position (eg. seating built around a tree or into an embankment), or moveable.
*The style can be formal or informal.
*It can be hardy to weather, remaining outside all of the time, or require storing under cover when not in use.
*It can be made from metal, timber, fibre-glass or plastics.

*Where is it going to be used?*
- On the lawn
- On the patio
- On the veranda or the deck
- Inside a gazebo or outdoor pavilion
- Under a tree
- By the pool

*What is it to be used for?*
- A seat for one person
- A place where two or more people can sit and talk
- A table where people can share meals
- A place with an umbrella to protect you from the sun
- A place for garden ornaments or pot plants

**What Materials?**
The type of materials you select for your furniture will depend upon your budget, where you place the furniture, the style of your garden and house, and of course your personal taste.

*Plastic*
Plastic furniture is light, easy to manoeuvre and can be easily dried when it gets wet – all of which make it ideal for poolside settings. Its disadvantages are that it can be easily knocked over and if left outside for long periods, it will deteriorate under the effects of UV light even if treated.

*Timber*
Timber furniture has a pleasing, natural appearance that blends well with all garden settings. Timber benches and tables are especially popular for use on decks and in barbeque areas.
It is more expensive than plastic and is heavier to move, but good quality timbers will last many years. Left out in the open, the natural colours will fade – an annual coat of wood preservative will revive its appearance and protect it from further deterioration. The most durable outdoor furniture timbers are Jarrah, Western Red Cedar, Californian Redwood and treated pine**.**

*Metal*
Metal furniture is light weight and compact, making it ideal for areas with restricted space such as courtyards, small balconies and beside pools.

The traditional designs, based on 19$^{th}$ century Victorian wrought iron furniture, are ornate and are best suited to formal gardens. Newer designs are simpler and are increasingly favoured in modern inner-city courtyard gardens.

In full sun, metal furniture can become uncomfortably hot, in which case use vinyl cushions to cover seats and umbrellas to shade tables.

Metal needs to be checked for rust and that bolts are not loose. Rust can be treated by applying anti-rust paint coats or by purchasing powder-coated furniture.

*Stone*
Stone furniture is chosen for its strong visual impact, rather than for comfort. Rough stone benches are ideal for bush gardens. Dressed stone furniture is more commonly used in formal settings, and looks particularly good in paved courtyards.

Stone tables are bulky and heavy – choose a position with plenty of space so it doesn't overwhelm its surrounds.

Like metal, stone furniture heats up in full sun, and is best positioned where it receives shade in summer. Stone rarely needs maintenance due to its strength and solidness. However if grime occurs, wash it off. If stains occur, contact the manufacturer or seller as some items may be treated prior to selling.
If cracks occur, most gardeners will show off the crack as it appears as though it is an aged stone feature.

TABLE:
A general comparison between the main materials used in furniture.

| PLASTICS | TIMBER | METAL |
|---|---|---|
| Can get sweaty to sit on in hot weather. | Softer to sit on than other materials. | A very hard surface to sit on. |
| | | |
| Heats up at an average rate. | Slow to heat up. | Gets hot quickly on a warm day. |
| | | |
| Low maintenance -doesn't need painting. | Needs treatment with paint or preservative every few years | Corrosive metals need painting or other treatments. |
| | | |
| Some cheaper types will crack if exposed to U.V. light for extended periods. | Sun can cause splits and cracks in some timbers. | Sun does not cause deterioration. |
| | | |
| Aesthetics more suited to a modern garden. | Aesthetics suit natural or period garden styles well. | Most metal furniture is designed for period (i.e. old world) gardens. |
| | | |
| Looks shabby if it becomes dusty. Needs wiping over regularly. | Can still look good when it becomes a little dirty. | Looks shabby if not kept clean, and if paint work not in top condition. |

TIMBER
There are many different types of timber used for furniture. The characteristics of the material vary according to the type being used.

PINE - Radiata pine is both inexpensive to buy and very easy to work with (being a softwood it can be cut and worked with easily). The cheapest garden furniture available is usually made from pine. If unpainted and not treated with preservative, pine will not last beyond one season.
Furniture built with treated pine will last 10 years or more.
Untreated pine furniture must be painted with several coats of a timber preservative/wood stain if going to be left in the weather. It will require repainting every 1-2 years, and even then, it will not last as long as other timbers.

HARDWOOD - Furniture made from hardwoods is more expensive, but if painted with appropriate wood stains or preservatives, will last a great deal longer.

**LIGHTING**
Lighting allows a garden to be used and viewed at night. Thoughtful use of lighting can offer a wide range of possibilities in the garden that just aren't available during the day. Dark, hidden or forbidding spots can be turned into delightful new features.

Daylight penetrates every corner of the garden, illuminating both those things you want to see as well as those you don't want, however night lighting can be controlled. It is possible to direct light in a narrow or wide stream, to block its flow, to control its reflection and even to change the colour.

Night lighting may be derived from a fire (e.g. a BBQ, bonfire or lamp), moonlight, solar or electric lights. Often it comes from a combination of sources. Depending on its source the light can throw different shadows and create different effects. Think carefully about the purpose of outdoor lighting, where you want the light and where you don't want it, and develop the garden to achieve your aims.

If you plan to do a lot of outdoor entertaining at night, you may choose to use "Fijian style lamps" on bamboo stakes and burning citronella oil. This will not only provide a light source, but will also repel insects. However, this type of light is uneven and unreliable in windy conditions. If you want a stronger or more reliable light source you may choose to install some form of electric light as well.

If you want to make full use of natural moon light, think carefully about where you plant trees and build pergolas and other structures. What might be a desirable feature in the day time may throw shadows at night making lighting more difficult and expensive; and perhaps creating security problems. Lighting for security purposes has become increasingly important during recent years.

Lights should be located to achieve their intended function, for example, so you can see when walking or sitting outside at night, or for visual affect, or perhaps so you can see the garden when sitting inside.

**Main Types of Lighting**

- Sensor lights are used to light areas or spots when in use or triggered by someone passing or entering the scanned area.
- Spotlights -for illuminating a specific feature (eg. a statue, fountain or street sign)
- Grazing lighting -to illuminate objects (but not features) which it is close to such as a wall or section of water on a pond.
- Spread lighting - to primarily illuminate a circular patch of low plants.
- Silhouette -placing lights behind objects such as a wall or shrubbery to create an illuminated background while leaving the foreground in darkness.
- Flood Lighting -attempting to create a daylight type affect in one whole section of the garden (eg. an outdoor living area).
- Layered or selective lighting -where parts of a garden are lit and other parts remain shaded.

**Urns, Pots and Tubs**

These were usually very ornate and resting on a pedestal and base. They were constructed mainly of terra-cotta, stone or wood, and were often very heavy. Such containers were often placed on top of balustrades or walls or were formally arranged on patios, verandas or in gazebos.

**Statues**

The more elaborate old style gardens displayed statues representing allegorical or historical figures on columns, piers and pedestals at various points in the garden such as in grottos or secluded areas surrounded by shrubbery.
These are excellent garden features but they need to be chosen and positioned carefully.
First look at the style – does it complement the garden?
Second, look at its scale. If you have a small garden space, use a small statue.
Third, position it so that it fits in comfortably with its surrounds – maybe with shrubs behind it or low plants around the base to soften its impact.

**Sculpture**

When selecting a sculpture you need to make sure it suits the style of the garden. A brightly coloured abstract sculpture will usually look out of place in a traditional or bush garden. Unless you are looking for a dramatic contrast, a sculpture such as this should be positioned in a modern-style garden surrounded by bright colours.

**Water**

Water can be a terrific way to add an artistic touch to your garden. Water itself can be used for artistic fountains, or it can be used to flow over and around artworks. Think of those big, ceramic spheres with water flowing over them – it is the water that adds the fluid motion to these artworks.

**SOFT LANDSCAPING MATERIALS (I.e. plant stock and associated material)**

Soft landscaping materials include the following:
Trees
Shrubs
Groundcovers
Climbers
Scramblers

Water plants
Grasses
Ferns
Perennials
Annuals
Potting media –Propagating Media –Pots
Hormone treatments
Fertiliser
Pesticides
Herbicides
Soil ameliorants i.e. lime and gypsum

**CONSERVATION ISSUES ASSOCIATED WITH SOME SOFT LANDSCAPING MATERIALS**

*Peat Moss*

Extraction of peat, which is a rapidly diminishing resource, from peatbogs or Peat lands has over the past few years become a world-wide environmental concern. Peat bogs support wildlife that is often rare, within a fragile environment. The horticulture industry relies on peat resources (the cost of which is gradually increasing as supplies diminish and extraction methods become more and more costly) as additives to potting mix and propagation media. Coco-peat a renewable resource made from coconut fibre is becoming more established as an alternative to peat moss in some instances.

*Creosote*

Of the three types of creosote available, coal-tar creosote (made by treating coal at high temperatures) is the most commonly used to treat timber for use in railway tracks, electricity poles as well as fences, posts and retaining walls. It is a thick black oily substance made up of around 300 chemicals. The treated timber oozes a black tar which can leach into ground-water as well as streams (when used to treat bridging timbers or when used on bank stabilising timber) and persists in ground water and soil for many years. Small amounts can be toxic to animals and humans. Residues can be found in fatty tissue of humans that have come into prolonged skin contact with creosote. PAHs (Polycyclic Aromatic Hydrocarbons) in creosote are known carcinogens.

**Biocide resistance**

*Biocide* - A substance or product that kills or controls micro-organisms such as bacteria, yeast, mould and selective fungus.

Herbicides and pesticides have been used to control weds and insect pests for many decades, by 1960, soil borne insect pests were controlled before planting crops, by fumigating the soil with a broad spectrum pesticides. Although these insecticides have been used world-wide as an effective and reliable method of control, insects do eventually develop resistance. Similarly some weeds have also developed resistance to particular herbicides. An integrated pest management program is important to lessen the effects of insect and weed resistance to biocides generally.

**Safety**

*Labels*

The label offers a wealth of information concerning safety precautions, application rate and modes, directions, storage conditions, first aid and safety instructions, batch numbers and container disposal instructions.

Registration safeguards of chemicals assess:

* Residues in foods
* The safety of persons using the chemicals
* Environmental safety
* Safety to the plants or animals being treated
* Trade issues.

After reading the labels always adhere to:

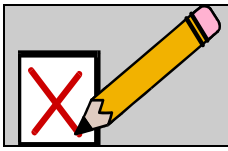
* do not exceed label dose/application rates
* do not apply chemicals more frequently than label instructions
* do not use chemicals contrary to a specific label prohibition
* observe withholding periods stated on the label.

NB. Permits may be granted by some states to use chemicals outside these restrictions.

You should be aware of the regulations in your country as well as those for your state /region

Material Safety Data Sheets (MSDS) or Pesticide Information Sheets are available for all manufactured chemicals. You should ensure that you have a copy of each sheet for every chemical that you have in use or storage.

**Rain Forest Timbers a Conservation Issue**
Careful consideration should be given before using timber that has been sourced from the world's rapidly shrinking rainforests. Rainforests world-wide (some are estimated to be between 60 to 150 million years old and still evolving) contain over 30 million species of plants and animals as well as support many indigenous people for food, shelter, and medicine. The result of extensive deforestation has been the destruction of plant and animal life, soil erosion, dwindling or contaminated water on a local level and changes in world climate i.e. more intense droughts during normal dry seasons and increased flooding in the wet seasons**.**



**SELF ASSESSMENT**
Perform the self assessment test titled ' test 1.8'
If you answer incorrectly, review the notes and try the test again.

**HORTICULTURAL PLANNING**

Work planning and project management is an important aspect of the type of work that would be generally carried out by the professional horticulturist. It may be in diverse areas within the horticulture industry i.e. a planting program, plant sales program, landscape project, revegetation project, sports or turf management, irrigation and drainage systems implementation, production planning (crops and nursery), conservation of natural resource areas, conserve a heritage area and so on. Project management may be under the broad direction of superiors in certain situations however self directed application of knowledge that has substantial depth is expected at this level.

As an example, to plan and manage a project, a manager would include following considerations:

**Example of Planning: Conserving a Heritage Garden**
1. Assess the area
*Identify original planting and consider and evaluate the factors that may encroach on the restoration of the planting i.e. changed aspect or environmental conditions on the site
*Identify the original overall design including if possible the planting design and note any changes that have occurred that differs from the original.
*Write an assessment report on your findings

2. Develop a restoration management plan
*Identify resources required and devise a work plan that takes into consideration:

a. Onsite organisation of tools equipment and materials as needed for each day and organises labour accordingly
b. Replanting taking into further consideration suitable planting times i.e. ensure that planting material is planted in the correct season and has been sourced accordingly and organises propagation of plants from original plantings where possible;
c. Soil tests are undertaken;
d. Hard surfaces and structures and features are restored according to assessment report or new materials are sourced consistent with the original style but taking into consideration contemporary health and safety issues (i.e. non slip pavers are used).
e. Considers environmental practices;
f. Management plan is consistent with the assessment plan.

g. Considers the occupational health and safety issues of employees and the public that may enter the site during restoration.

h. Work schedules are in the correct sequence according the requirements of the contract and to ensure that it is cost, asset and resource effective. Work programs should be monitored and where necessary varied i.e. materials don't arrive on time etc.

i. Final site inspection

**ASSIGNMENT**
Download and do the assignment called 'Lesson 1 assignment'.

# SPECIAL PROJECT

This is what is often referred to in universities as a PBL Assignment (Problem Based Learning)
Read the lesson thoroughly before starting.
You should aim to complete this project within two weeks of commencing it.

**WHAT IS PBL?**
Traditionally, students learn by listening to lectures and reading. They are assessed on their ability to recall and communicate what they have learned.

Another way of learning is **problem-based learning**. Students are given problems to solve, and learn much more in the process.

Many successful and progressive universities around the world use problem based learning (PBL), and ACS courses have always incorporated a PBL approach.

**WHY PBL?**
Research shows that PBL gives the learner **greater long-term benefits** than traditional learning. Graduates of PBL courses advance faster and further in their careers.

Other benefits of PBL:

- Develops critical and creative thinking;
- Creates effective problem-solvers;
- Increases motivation;
- Encourages lateral thinking;
- Improves communication and networking skills;
- Is based on real-life situations.

**WHAT KIND OF PROBLEMS?**
The problems that you will solve in your course will relate to what you are learning.

They are problems that you might encounter when working that field, but they will be **adapted to your level of study**.

Sample problems:
- Plan pest and disease control for a tropical vegetable garden (horticulture);
- Design a library display on human respiration suitable for all ages (science);
- Create a 4 page lift-out section on a topic for a magazine (publishing or writing).

**WHAT IS INVOLVED?**
Every PBL project is carefully designed by experts to expose you to the information and skills that we want you to learn.

When assigned a project, you are given:
- A statement of the problem (eg. diseased animal; failing business; anorexia case study);
- Questions to consider when solving the problem;
- A framework for the time and effort you should spend on the project;
- Support from the school.

**PLEASE NOTE:**

Students who are accustomed to traditional education might think that PBL is not what they need. However, research backs PBL in all areas of learning. After you have complete a PBL project, you will see why.

**PBL Project:** Horticultural Equipment, Materials and Sundries

**Project Aim**
Select a range of horticultural tools, materials and sundries and plan their use within a specified project.

**Learning Outcomes**
1. Identify a range of tools and equipment required by the professional horticulturist
2. Select the appropriate tools required to complete specific tasks
3. Plan and manage the use of appropriate materials, tools and equipment before commencing a task
4. Implement alternative solutions when problems arise or tools are unavailable
5. Identify conservation issues considered during the planning process.

**Problem Definition**
You are (hypothetically) a horticultural consultant who runs a small horticulture business specialising in garden maintenance. Services you offer include:
Mowing, tree and hedge pruning, lawn renovation, dividing perennials, creating new garden beds and planting, applying fertiliser and other soil ameliorants as required, mulching, pest and disease management.
A client has contacted you in relation to a garden renovation project that they wish to undertake on their large 100 year old country garden. The garden includes:
*Hedges
*Large deciduous trees (some quite old)
*Conifers now shading out some areas of the garden that hold sun loving plants
*Stone walls (some in disrepair)
*Large circular driveway (in need of renovation)

*Perennial beds and roses in need of care i.e. pruning, fertilising, dividing and pest and disease management, mulching.
*Annual display beds needing rejuvenation and planting

Your initial role as a consultant is to:
*Determine and outline the work required to complete the project
*Determine the materials, tools and equipment that will be required to complete the renovation, the list must be broken down into several lists; one for each task.
*Devise an action plan that includes a work schedule and timetable and prioritises tasks so that the project progresses from one task to the next, in a logical order, and with a minimum of delay.
*Report these requirements (in detail) to your client for assessment and so they can make an informed decision as to whether they will go ahead with the project.

**Team Structure & Mode of Interaction**
Being a relatively short project, the quantity of interaction with others needs to be limited.

Your team will consist of yourself, your tutor, and a friend or relative who you will use as a hypothetical client.

You are in the hypothetical role of a horticultural consultant.

Your tutor is in the hypothetical role of a garden maintenance specialist who you refer to for specialist advice on the project. You should approach your tutor in the same way that you would approach a consultant in a real life situation.

You need to enlist the assistance of someone as a client (hypothetical or real: it is your choice). This client will need to talk to you at least once, and perhaps more, about what they would like to have you plan for their garden.

*You must interview the client (once or more) and determine their requirements.

*You must contact your tutor two times via phone, fax or email during the project, before attempting to commence the final submission. At each point of contact, you should be mindful that the hypothetical consultant (tutor) is both an expert but also one that charges by the hour; so questions you put should be meaningful, designed to contribute toward achieving the stated project aim, and above all, should not be repetitive. Contact should be concise and time efficient.

*You must also seek support from your tutor and any other interested parties within the school, by submitting relevant questions to a student room forum, seeking meaningful feedback, on at least two occasions during the project, before attempting to commence the final submission. You must also check for responses and if useful, incorporate the responses into your final report.
You may ask for guidance, assistance or simply report on your progress. You may request more frequent assistance if necessary, within reason. It is not your tutor's role to solve the problem.

**Discussion Questions**
- What criteria does the client want met by your recommendations for example:
  *Which tasks are considered high priority?
  *Is low maintenance a high priority or not so important?
  *Are they looking for change or do they want to preserve as much as possible?
  *What are their preferences for hard landscaping should it closely match existing features and surfaces or create a contrast? What are the alternative preferences if existing features and surfaces can't be matched?
- What are the site characteristics that are relevant to this project? The site characteristics will determine the type of machinery used on the project (i.e. steep/flat/narrow/tight/open areas) and will also vary throughout the garden.
- What site characteristics might affect growth of the plants detrimentally? i.e. large trees shading out garden areas, do they want to remove the trees or change the under-planting to suit the situation?
- What resources are available, and what limitations exist that may affect what can be achieved? e.g. finances, manpower, time-frame etc

- What are reasonable goals in this situation?
- How can you ensure that plant survival and ongoing health is maximised?
- What potential conservation issues could you encounter whilst undertaking the renovation? What are the ways to overcome them?

*These are examples of issues or questions that you may address in your solution, whether or not you can find answers.*

**Resources**

**Human resources** (optional) **–** You may draw on the skills, knowledge and assistance of others – other students, experts whom you consult, friends. All assistance must be formally acknowledged.

**Other resources** (compulsory)– You are expected to use some resources, but the choice of which ones are yours. You may gather the information required to solve this problem from course readings, books, journals, news programs, the internet, etc. All sources must be acknowledged.

Internet Resources may include:

http://www.acs.edu.au/links
http://www.allsun.com.au/

**Guidelines**

*Duration:*

This project should take up to 8 hours (including communications with a tutor or others). When between 6 hours of work has been completed, you should be moving onto the final report; and when 8 hours is completed, submit what you have, no matter what stage it is in. You may be penalised for exceeding this time limit.

*Assessment:*

You will be assessed on your capacity to work through the problem to a logical conclusion
You are not being assessed on the report.
The report will be part of what shows the school that you have worked through the problem in an appropriate way. Your interaction with a tutor and use of a forum in the student room are also indicators that you have worked through the problem appropriately

**Final Report**

You may use any if a variety of means to present your project but should not spend more than a quarter of the total time involved in the project, on preparing the presentation.
Most students are likely to submit a written presentation, possibly with illustrations
If you have the equipment at hand, and appropriate skills, it is acceptable for you to submit a presentation any other way (e.g. Multi media presentation with Power point or Flash, Video, CD, DVD).

**Your presentation must include:**

1. A summary of the site conditions on the property (hypothetical or real)
2. A summary of the work required to complete the renovation (including hard and soft landscaping)
3. A list of plant selection criteria you used to choose plants for each of the garden areas.
4. A list of issues that arose during the project that you either could not deal with or that were not essential to the project. Plus some conservation issues that you needed to deal with throughout the project and their solutions.
5. A list of resources used i.e. equipment, tools and materials required for the project including human resources.
6. A list of plants you selected for the garden
7. A description of the way you would plant and establish the plants and finish the planted areas.

8. A summarised work schedule that also prioritises tasks and lists materials, equipment and tools used against each task. This should include such things as pruning, dividing, feeding, pest control, watering, plant inspections, planting, mulching, paving, maintenance and repair of structures and features and any other tasks undertaken.

| ***Presentation Component*** | ***Minimum Required*** | ***Maximum Allowed*** |
|---|---|---|
| Site conditions | Half a page or 1 minute presentation or equivalent | One page or 3 minute presentation or equivalent |
| A summary of the work | Half page or 1 minute presentation | One page or 2 minute presentation or equivalent |
| Plant selection criteria | List of four points or 20 second presentation, or equivalent | Half page or 1 minute presentation or equivalent |
| list of issues | A few words for each point bulleted or equivalent | Half page or equivalent |
| list of resources | A few words for each point bulleted or equivalent | Half page or equivalent |
| List of plants | List of 12 (scientific names) | List of 25 (scientific names) |
| How to establish the plants | 150 words or 30 second presentation or equivalent | Full page or 90 second presentation, or equivalent |
| Work schedule | Full page or 90 second presentation or equivalent | One and a half pages or 2 minute presentation or equivalent |