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#5 Crop monitoring

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3. Rainfall/irrigation volume and frequency
Measure using a professionally calibrated rain gauge. A free standing, mobile, model can be positioned in amongst your crop to catch irrigation. Know exactly how much volume you are applying over what run time. Dry or over- wet zones, can be identified by repositioning the rain gauge once base data has been collected in the original location. Be aware that significant changes to your potting mix; i.e. altering the percentages of peat, bark or pumice will require alteration to your irrigation management.
Irrigate your container crop at or before the mix is 60% moisture depleted. Replenish to Container Capacity + 10%. Over–drain can be measured by putting the container into an over sized poly bag and clipping or taping the outer bag to the rim of the growing container. Any irrigation over and above that required to restore Container Capacity will be found trapped between the two.

4. Growing media Ec. (conductivity) and pH Measure using Eutech Ec. and pH meters and a simple sample preparation technique and testing protocol. The results are virtually instantaneous and inexpensive.
Monitoring the Ec. of in-situ container crops gives a valuable insight into nutrient availability and especially excess which might injure roots. Tracking media pH can show the effects of an acidifying fertiliser or hard water irrigation. Ec. can be used as a predictive tool to determine remaining coated type fertiliser longevity. Establish a bench-mark by grinding up a 100ml sample of fresh mix and testing the Ec. produced. Compare this result with a recovered 100 ml sample from an in use mix. The fresh mix result is the 100% potential nutrient yield expressed in Ec. A simple calculation will identify how much remains in the in use mix.

5. Crop growth rate and sale ability
Measure using a photographic record. Make up a background board, white with some bold target markings for reference points. Select the same plant for monthly photos throughout production of the crop. Shoot the plant in 'Birds eye' and profile views using a marker pole to show height gain. Place a natural green colour swatch between the subject's leaves and the white background to monitor leaf colour. The monthly progress of your target plant will be obvious and recorded in a fast and durable way. Continue the system and build up a photographic and data "Blue print" of crop production for the future. Collect leaf analysis results of your best ever crop to reinforce this data.

6. Insect identification and population
Measure using Sticky card traps, yellow or blue, installed 150cm above your crop. Use 1 card / 4sq. m in propagation and 1/ 15-20 sq m in growing on houses.
Check the cards every 3-4 days and mark trapped insects with a dot from a bold marker pen. Use a magnifying glass to identify the stuck insects. Population fluctuations can be read in conjunction with the pesticide application record to confirm effectiveness.

Correlation and interpretation:
Gather your data diligently, read records in conjunction with one another and you will build a more detailed picture of the production environment and your management effect on it.

McHort can assist by supplying monitoring equipment and designing a monitoring strategy especially for you.
Call Donald today to discuss your requirements.

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They say 'information is power' and I'm in no doubt that quality data collection and correlation can advance our knowledge of plant production management.
Given this I'm concerned by the apparent lack of interest and activity in this vital area and wonder why. Is it too complicated or expensive or are growers unsure as to how to start?

Below, I suggest strategies and systems by which you can gather useful crop and environmental data in a relevant form which will empower your management and result in making better crop production decisions.

My approach is simple so that you will understand, sustain and administer the system with ease. Delegation of certain tasks is envisaged and indeed involvement of your staff is often highly beneficial. Harness their skills and enthusiasm and through their greater understanding of production challenges, you will reap big rewards from more motivated, satisfied workers, better crops and reduced costs.

I shall start with basics, keep the technical jargon to the minimum and allow you to develop the concept to whatever level suits you. It is intended as a foundation upon which you should build.
Let me introduce the concept that 5 main factors in the production mix really influence plant growth. These are, in the simplest terms, the ***BIG 5:***

LIGHT, HEAT, WATER, NUTRIENT and AIR

My maxim in developing this strategy is:

'If you can't measure it, you can't manage it'

So, with that in mind, we rationalise which factors we can control or influence before we start trying to measure them. For example, if you grow outdoor crops the value in measuring light levels is limited, simply because it would be unrealistic to supplement light. Yes, it would be, and is, different if you grow annual seedlings under glass when extra lighting in Spring may be considered beneficial, even essential.

So the message is, measure what is relevant to your particular cropping regime and environment. For now, I shall focus on the four remaining factors and then apply 6 fundamentals of measuring and monitoring.

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These are: **Air temperature**

Root zone temperature

Rainfall/irrigation volume and frequency

Growing media Ec (conductivity) and pH

Crop growth rate and sales appeal

Insect identification and population

All are highly relevant to production success, all link back to the **BIG 5.**
Avoid the mistake of setting unrealistic data collection goals. Too much data can confuse. Start modestly and build progressively.
Remember the information gathered is supplementary to your daily observations and existing knowledge.
At best it will highlight trends and confirm, or otherwise, the effectiveness of your management inputs.

Let's then review the 6 fundamentals in turn.

1.Air temperature. Measure using a Quick set max.-min. thermometer. Establish monitoring sites in protected cropping areas, under shade and outdoors. Read the thermometers daily, ideally at the same time each day, and remember to reset them.
The data collected will help you understand the specific micro climates in which you grow, see the contrast between environments and map the progression of the seasons.

2. Root zone temperature. Measure using special soil thermometers. Insert them so that the tip is in the centre of the host root zone. Use in the same site, in the selected production environment, even if and when the crop changes. Mark the monitoring station with a white painted stake for ease of identification. This will give consistency and continuity of data. Protect the soil thermometer with an oversized plastic pipe sleeve. This will shield the indicator, red, spirit and preventing it from being bleached colourless. Plant species' response to root zone temperature varies. Some plants will not actively grow at less than 15° C; others lose roots at just 26° C. Irrigation is a valuable tool for cooling roots, but the effect is double edged and chilling may also slow growth rate.

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NURSERY 'KNOW HOW' :

#1 IRRIGATION

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One of the hardest container crop management facets to teach is how to irrigate effectively and economically. Those of you who are adept in the skill have usually developed the talent, almost sub-consciously, over many years.
You draw on a vast experience of reading the weather signs, empathising with the specific needs of a vast range of plant types, adjusting inputs relative to crop maturity and a plethora of other influencing factors.

In short, a massive calculation involving a sizeable amount of information, followed by some highly subjective judgment.
So, who decides when to water, how much and how often for your crop?
Are they provided with information to enable them to make quality judgments consistently?

Let's review the issues and develop an action plan.

The function of irrigation

1. To replace moisture loss in the root zone through utilisation (transpiration) and evaporation.

2. To cool the root zone.

3. To maintain safe soluble salts' levels (conductivity) in the root zone.

In addition, water is required to dissolve fertilisers so that roots can absorb them.

Key influencing factors for irrigation requirement

1. Atmosphere and climatic. Light intensity, day length, relative humidity, wind velocity and ambient temperature.

2. Cultural practice. Potting media, pot size, plant subject and stage of maturity.

Irrigation techniques

Overhead, in pot dripper and capillary systems are all popular but require different management. Know your potting mix. Mixes in New Zealand have evolved along the lines of being more free draining, more aerated and less moisture retentive. They are tuned to overhead irrigation systems Their current physical characteristics are designed to shed excess rainfall and allow irrigation management to err on the side of more. Over supply, being easier to gauge and allowing for a root zone cooling strategy, running freely to waste rather than risk water logging .

The compromises and consequences are:

High relative water use, nutrient leaching, more temperature volatility in the root zone temperature.

How much is enough?

Irrigate to restore container capacity plus at least 10% more run to waste.

How often?

Irrigate when the moisture content in the root zone falls to 60% of that at container capacity.

When?

The time of day you irrigate will influence root zone temperature, so, in principle, water soon after dawn in Spring and early Summer to minimize the chilling effect. In high Summer irrigate later in the day to cool the roots and limit the terminal temperature in the root zone.
I realize that overhead irrigation later in the day in Summer will result in loss to evaporation even before it reaches the crop. This loss is, however, offset by the savings you have made through accurately assessing and applying just the right amount of water and reduces root stress.

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Application methods

1. Overhead
2. In pot dripper
3. Capillary

Use a professionally calibrated rain gauge to check both the rate and uniformity of overhead applied irrigation. Either alter the sprinkler type or number to adjust the delivery pattern or, at the least, note dry or wet zones for the future placement of plant species best suited to those conditions. Measure and record the volume applied by the system for a given run time.

In pot dripper systems are accurate and efficient. They are expensive to set up and maintain. Choose the drip nozzles care fully. The type that can be independently shut off are best. These can be shut off if a plant is taken out of line and will avoid water waste. Be aware that some require more pressure to operate, successfully, (low level spray types) than others. Those that do drip may need to be used in multiples in larger pots to achieve uniform wetting of the whole container.

A useful trick to prevent water tracking straight through the pot without wetting all the mix is to put a handful of sand under the dripper. The water is spread out over the sand before going down into the root zone. Moisture conservation can be achieved by applying a mulch, organic or synthetic, to the top of the pots.

Capillary systems are the most efficient and effective of all. However, provision should always also be made to enable you to apply water overhead on to a capillary irrigated crop. This overhead application is used to leach away damaging salts build-up, which occurs in prolonged rain free spells. The cost to set up these systems is high.
Crops do, however, respond very well to this irrigation method. It is very water efficient, does not rely on constant management inputs, is fertiliser efficient and discourages weed growth on the top of the pot.
Make sure that your water delivery to a capillary mat system is able to respond quickly enough. Any drying back or out completely tends to negate the benefits of the concept. Often the matting material used is thin and holds little moisture in reserve. Use top quality matting.
A capillary sand bed is superior to a capillary mat in so much as the sand bed can be used to pull out water from rain soaked pots. It is likely to last longer too!
Potting mix physical make up should be tuned to the special requirements of a capillary system. Special pots are also used which will give a capillary connection through their base.
Still not sure how to use your Irrigation
Call me. We can discuss your specifics, help you with the various measurements and supply you with the best tools to monitor your irrigation and management strategies.

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NURSERY 'KNOW HOW' :
#2 TESTING INPUTS

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This article is limited in scope to containerized production of ornamentals using controlled release fertiliser in soil-less potting mix.
I make no excuse for this as this is the custom and practice of ornamentals' production, in the main, in New Zealand today.
Measuring crop inputs is a fundamental management function which enables you to produce efficiently, consistently and safely.

The 3 main reasons for testing:
Problem solving
Quality optimization and maintenance
Establishing bench mark data

As you all know, the symptoms of over watering a crop can be easily confused with those associated with under watering. Nutrient deficiency or toxicity symptoms similarly are easily confused. Testing enables us to more accurately differentiate.
A simple and quick salinity test of the potting mix will soon identify the difference.

Fine tuning the fertiliser inputs and modifying them during culture in consideration of the growing conditions is both practical and desirable.
Of great significance is deciding when the original charge of incorporated fertiliser is exhausted.
All too often this is only acted upon when the plant loses colour and vigour. A simple test with comparison and an interpretation method is a powerful tool for production optimization.
Correct timing of the supplementary nutrient charge, usually top dressed, is vital for quality continuity, maintenance and economic production. Measuring the pH of a potting mix will allow us to monitor any pH drift. This can and does occur much more frequently that most growers acknowledge. pH drift can result in nutrient lock-up and consequent deficiencies.
By measuring the nutrient content of a potting mix or plant tissue of the ideal crop, we can establish bench mark data by which to compare any subsequent crop/s grown under the same production regime.

As I understand it, most growers currently test, especially plant tissue, entirely for the purpose of problem diagnosis. This is often frustrated by the fact that so little data exists for so called normal plants of the same type.
The answer lies in building up a data base for the plants that are important to your business and being grown in the production system used . In New Zealand we have no Government funded research or extension service devoted to this aim, so you are on your own.

Who should do the testing?
Testing can be conducted at two levels:
1. By a specialist commercial laboratory.
2. By testing yourself, on site.
Tests conducted in the lab. are more wide ranging and offer greater accuracy, but at the cost of time and money.
On site testing, whilst limited in scope and accuracy, can produce useful results quickly and very economically. Ec and pH meters are essential. We sell them!

What should you test?
Potting mix, irrigation water and plant tissue.
In practical terms, on site testing is limited to Ec. (conductivity) and pH of potting mix, fertigation solutions and irrigation water. The value of this information , however, should not be under estimated as it forms the very foundation for consistently producing quality plants.
A specialist laboratory should be used to confirm your own results periodically and to extend the depth of findings for diagnostics and bench marking purposes.
The irrigation supply if from a bore should be tested every six months as it has been known for quality to vary with the season and to deteriorate over time.

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A lab test will
relate hardness as well as pH.
This detail will be essential if correction is required. Tissue analysis of stock plants, those you propagate from, can be especially useful. Some species e.g. Lavender and Pittosporum have been known to be Calcium deficient. If you can manage the nutrition of your stock plants then periodically testing will help you produce the best propagation material.

Frequency of testing
Test every batch of potting mix, home made or bought in, using your own test kit for Ec. and pH. If an abnormal result pops up, a lab. test may be justified. Stored potting mix containing controlled release fertiliser should be tested to ensure safe salinity levels are not exceeded.
To establish good bench marking data and to predict how long the fertiliser in the mix will last may involve testing monthly.
I recommend that your irrigation water is tested annually by a lab. and 3-4 times a year using your own on site test kit.

Sampling techniques.
When collecting material to be tested it is vital to have a consistent technique. Potting mix from a bulk heap should be collected as at least 20 sub-samples, handfuls, which are then gently mixed in a clean bucket. From this volume either draw off the 100ml required for on site testing or 1ltr to send on to the lab.
Sampling from a container crop in situ requires a different approach.
If possible take off the pot and take a small amount of mix from the root ball about half way down the pot. Avoid sampling pots on the outer edge of the bed.

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At least 20 such samples should be gathered and mixed together before submitting for testing. Do not gather samples immediately after rainfall or irrigation unless you wish to confirm an Ec. reduction after having remedied a salts accumulation problem by leaching.
When sampling leaf tissue choose the most recently expanded, mature leaves. You will need at least 70 leaves, from a species with medium sized leaves. Avoid sampling recently fungicide treated leaves or if this is unavoidable make a diary note as to which spray had been used and when.
Commercial laboratories such as R.J. Hill in Hamilton will provide sampling kits and guidance to assist you.

How to use the results
Interpretation of your results is the least understood factor in the equation. Most commercial labs. are not equipped to offer interpretations simply because they only see the samples submitted and not the circumstances of production. Their skills and expertise is almost always limited to the accurate production of results consistently. Interpretation needs a vast practical experience and excellent reference data derived from the same climate and cultural system being employed by you.
McHort specialize in providing this type of help, but need you to provide the data.
Equip your business with the basic testing tools and invest in some tuition on how to use them.
Start to collect base data from crops currently in production , make observations and record the specifics of potting mix inputs, production and potting dates, etc. along with your test results.
Need help? Call me, I shall be in your area soon.

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NURSERY 'KNOW HOW' :

#3 Quality Potting Mix

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Quality Potting mix is, put simply, the inter-relationship of three key factors, chemical, physical and biological, precisely defining a potting mix. Quality results when the correct balance of suitable stable components and ingredients are used.
Quality is compromised even when superior components are selected if the critical blend and balance is not correctly engineered.
Not all potting mixes are equal and not all potting mixes are capable of growing quality plants. You should specify to your supplier exactly what you require and be prepared to check the accuracy attained regularly.
Mix specification and consistent adherence to the specification is critical.

A more detailed look at each key factor will illustrate quality issues.

Chemical properties are expressed and measurable as pH, conductivity, Nitrogen stability, toxicity, nutrient balance, amount and longevity.

pH
Most ornamentals are happy in a mix pH 6 - 6.5 (5 - 5.5 for acid lovers). Adjustment of mix pH is achieved by adding calculated amounts of liming materials; e.g. Ag. Lime and Dolomite lime. Each variant in base mix components; i.e. bark to pumice ratio, has the potential to change the liming requirement to achieve the same pH point. Low levels of lime input may require additions of Calcium as Gypsum and/or Magnesium as Kieserite to ensure adequate supply of these elements to your crop. Small particle sized liming materials will alter mix pH faster but may not hold it in the desired range for long enough. Use liming agents with fine particle size for short term crops and a mixture for longer term crops.

Conductivity or soluble salts level in your mix should not exceed Ec. 2.0 when potting pot grown G.O.L.'s, Ec. 1.2 if potting up cuttings or seedlings.
Ec. is quantified using a 1:1.5 water extract method. Fertiliser type and rate has a bearing on the salinity generated. Soluble types are very fast acting with poor longevity and a high salinity risk. Slow release and coated types are longer lasting and produce less salinity. Blending different fertiliser types may be advantageous but must be used on an informed, thoroughly trialled basis.

Nitrogen stability, especially in relation to composted mix ingredients, is laboratory tested and reported as N.D.I. Look for a result 0.7 - 1.0 N.D.I., but always read in conjunction with Ec. The result can be fudged by high soluble Nitrogen fertiliser additions. A high salinity reading may indicate this.

Toxicity is assessed by sowing fast germinating seeds and counting emergence and survival. The most common causes of toxicity are by-products from incomplete composting, too much soluble fertiliser or contaminations. Woody, more mature plants are more tolerant than young tender seedlings. Ammonium toxicity is a problem in cool Spring conditions for a number of annual seedling crops. The toxicity is often as a result of using either Urea or ammonium fertilisers at too high a rate. A laboratory test will identify Ammonium toxicity. Levels of Ammonium greater than 50 ppm are of concern.

Nutrient balance, amount and longevity relates specifically to your crop, vigour, stage of growth, cultural practice and, ultimately, how much you want to spend. Significant savings can be made with careful and informed selection.
Crop performance can be seriously depressed by getting the equation wrong, by either too much or too little!

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Physical properties to consider are Water Holding Capacity, Air Fill Porosity and component stability. These factors describe the precise relationship of air to water to solid matter in a given mix. The W.H.C. is an expression of total water held in a mix after draining. Selected components in the mix should remain stable for the entire production cycle of the crop and not be prone to excessive breakdown or shrinkage. Most crops will be happy with 45-55 WHC and 18-25 AFP. Container shape and size should be considered when engineering the growing media. Shallow containers with a large relative surface area can accommodate a lower AFP and higher WHC especially when growing annual seedlings at a high density; e.g. annuals in punnets or cell trays.

Irrigation management has a powerful effect on crop performance, so your management capabilities and how they relate to the potting mix are equally critical. Re-wettability of a mix is a serious issue. Many consider re-wetting agents as essential but test first! Add one with your fertiliser inputs only if necessary. The rate applied will determine how long it remains effective. Use a rate of 0.5kg/m3 for short term crops and 1kg/m3 for longer term woody crops. Higher rates offer little tangible benefit. Granular formulations are preferred to liquid forms. Liquid forms require repeated applications and increase the risk of crop injury due to toxicity. Ultimately, plant roots fill the air spaces that would potentially fill with water. No amount of wetting agent helps!

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Heat in a fresh mix is a healthy sign
Temperatures above 35—40 C, however, will need careful management.
Spread out a hot heap to dissipate the heat. Apply cooling water, if necessary. Avoid building any potting mix into a heap higher than 1.5m.
A bark based mix that is delivered and remains cold is of far greater concern! The lack of heat might indicate very little microbial activity and a consequent lack of disease suppression.

Microbial issues
A good mix will be rich in diversity and amount of beneficial organisms, fungi and bacteria. The composting process not only enriches beneficials, but also usually reduces the pathogen population. This is a significant and real bonus not usually associated with peat mixes. Composted materials are probably less likely to contain either pests or weed seeds. The pasteurising effect during composting usually takes care of that. Additional beneficials can be added to any potting mix. *Trichoderma* is one such organism, more are becoming available. These include bacteria, amino acids, brassinosteriods and glycosides.
McHort are developing uses for a number of commercial products in this area including Seamac PCT, Numax, Terra-Sorb and VitaZyme.
Bark and wood waste composted mixes will support larger and more viable populations than peat based mixes.

Impartial, quality, advice is available from McHort. We don't make or sell potting mix, so you can be sure that we will only recommend a potting mix specification for your exact needs.
Call today for a free consultation; our knowledge and experience in this field is simply unrivalled.

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NURSERY 'KNOW HOW' :

#4 FERTILISERS IN POTTING MIXES

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The challenge.

Feeding plants in a container using a soil-less potting mix is a precise task. The plant must have all it needs within the contained root run and it must ideally remain available for at least the duration of the production phase.

Fertiliser types described.

'Controlled release' fertilisers have revolutionized container culture. Many fertilisers justifiably claim to be 'controlled release' and yet the range of formulation chemistry across the various brands is significantly different. Essentially we tend to describe this whole group as being slow release fertilisers.

The release mechanisms.

Will involve utilizing one or more, or all of the following properties:

Low solubility, biological degradation or encapsulation of soluble fertilisers.

Not all are suited to container production.

Low solubility fertilisers

Are perhaps the least favoured due to the large volumes of irrigation and rainfall associated with outdoor crops. Much of this type of fertiliser will wash through and out of the container before the plant can use it.

Biologically degradated fertilisers

Are less than perfect in this context of use. Essentially the only chemical nutrient element which can claim to provide a slow release through biodegradation is Nitrogen.

Soil microbes and bacteria convert either organic or inorganic Nitrogen to either, or both, Ammonium or Nitrate Nitrogen which plants can then utilize. The limitation is that first there must be substantial microbe populations present and maintained in the potting mix to perform this function.

This requires a delicate balance of moisture, salinity, pH, and temperature. Such fertiliser has limited appeal in our container culture.

Encapsulated soluble fertilisers

The encapsulation material may be an organic or synthetic polymer. Prills of soluble fertiliser are coated with a layer/s of the polymer. Water can be drawn into the coated fertiliser prill due to the permeable nature of the coating.

Release occurs through microscopic cracks or pores in the coating which itself expands or contracts in response to temperature. Higher temperatures and expansion create larger openings from which the fertiliser inside is pushed out. This effect is described as an Osmotic pump. Lower temperatures cause contraction and limit release. A thicker coating or multiple layers extend the term over which release occurs.

Encapsulated fertiliser is your best option . But which one and why?

The selection criteria.

Consider in turn the following 7 criteria:

1. Nutrient analysis
2. Release pattern
3. Longevity
4. Rate of use
5. Safety
6. Availability
7 Cost

Nutrient analysis

The ratio of the N, P& K are relative to :

A. The potting mix composition

B. The plant species being grown

Nitrogen is the key driver as far as plant size is concerned. Put simply, low N will result in smaller slower growing plants. Excessively high N may produce soft, weak and stretched growth. In New Zealand fertiliser analysis is expressed in the elemental form; e.g. 21+2.1+9.9. Overseas the same analysis is reported in the oxide form; e.g. 21+5+12.

The ratios of N:P:K for woody stock production may range from 4:0.5:2 - 5:1:3 If you use a Bark based potting mix, pot all year round and grow mostly vigorous species, the best choice would be close to a 4:1:3 ratio. Use a higher N ratio in bark than peat.

European products are tuned to peat mixes, deciduous species and a short production season from Spring potting .

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New Zealand conditions and practice require a different approach.
Trace element content is also important.
New Zealand potting mixes and the mainly evergreen species we cultivate call for more Iron, particularly, than that contained in the European source fertilisers. Phenols in bark disrupt Iron availability . To overcome this we should have extra Iron in our fertiliser compared to those used in peat. Plant species sensitive to Phosphorous need a special low P formula and extra Iron. Plants in this group include many South African and Australian natives and Citrus.

Release pattern.

Deciduous plants require plenty of fertiliser delivery immediately after breaking dormancy. Failure to supply this will compromise growth potential. These plants grow strongly through Spring and early Summer but should have all the Nitrogen supply exhausted by early Autumn to allow for Winter conditioning.
The best release pattern for these plants is therefore more early and less later.
Conversely evergreen species put on most growth in late Summer and early Autumn. Too much fertiliser delivery in Spring is undesirable. Field grown wrenched and containerized stock responds best to a low initial fertiliser delivery whilst it recovers from wrenching with more later for optimum growth.

Longevity.

Select product longevity in consideration of the anticipated time required to produce a saleable plant plus a few months extra to give some "shelf life". It is rare to market a whole production batch in one month and retailers do appreciate plants that hold condition.

Rate of use.

Longevity influences the rate of use.

In general terms the industry uses 0.5kg/ cubic metre of mix for each month in the longevity selected; e.g. 9 month longevity is used at 4.5 kg/cubic metre.
Fine tuning can produce even better results and, of course, lower rates will cost less. Carefully weigh-up the cost of a high input rate versus topdressing later after using a lower base input. You might find the later course is better value!

Safety.

Simply follow the manufacturers' guidelines on use. Encapsulated fertilisers have an excellent safety record. Beware of formulations with lots of soluble or starter feed. These are sometimes called 'Fast start'. The quick release of fertiliser can burn roots. You must not 'Dibble' apply this fertiliser format.

Availability.

Some manufacturers and suppliers boast very large ranges of fertilisers. In a market the size of New Zealand it is impractical, costly and unnecessary to offer much more than 15 variants. The inevitable consequence is 'stock outs' and/or passing on the extra cost of slow moving stock to you .

Cost.

Some brands carry a premium price but not necessarily any performance benefit. You may just be paying for multiple middle men taking their cut, funding flash company vehicles, expense accounts and frivolous advertising . Trial an alternative less expensive brand, you might be pleasantly surprised!
Check out not only the cost per bag but the cost of use per cu.m. of mix.

Are you paying too much?

If you are currently paying more than $ 30 / cubic metre for the fertiliser in your mix to produce a nine month crop you could be paying too much!
Free advice is available from McHort, just call us!

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NURSERY 'KNOW HOW' :

#6 Root zone temperature

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Critical to optimum growth and health of a container crop is the root zone temperature.
Too cool and growth will be restricted; too hot and the roots can be damaged.
It is then surprising that many growers do not routinely monitor root zone temperature (RZT). Even fewer attempt to manage it.
The key to any management strategy is collecting and collating information.
Use a soil thermometer to measure RZT.

Thermometer location is critical.
A metal sleeved soil thermometer should be pushed into the containerized root ball of the target crop so that the tip is in the very centre, top to bottom, left to right, of the root zone.
Shield the red spirit indicator from direct sunlight using a piece of plastic pipe as a sleeve. Exposure to direct sunlight bleaches the spirit colourless and therefore impossible to read.

Site selection.
Select a permanent monitoring site in each growing environment.
A thermometer will be required in the propagation area, in the growing on area, where liner plants (GOL's) are produced and in the final production beds.
Mark that position clearly, so the thermometer is easily found. Use a white painted stake, or a striped surveyor's pole. Avoid a position at the edge of the area, or near a door in an enclosed environment. These locations will not give readings typical of the whole area. We seek uniform and typical data which represents an average for that area.

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Recording frequency.
Record temperatures at the same time each day. Mid morning, or just before lunch are satisfactory, but be consistent.
You could simply put each reading onto a wall calendar day by day and extract the required data at a later date for analysis.

Data loggers for the computer literate.
Those of you who are computer literate may prefer to install data loggers. These are now widely available at modest cost.
They are completely weather proofed and can be left in situ for 6 months or more.
Multi channel loggers will record RTZ in several location at the same time.
A soft ware package, available with the data logger, allows you to down load the information onto your PC. From your PC you can produce graphs which illustrate RTZ fluctuations over time, season by season and even hour by hour, if you wish.

What influences root zone temperature?
Firstly, never pot young tender stock into hot potting mix. Potting mix can heat up in storage due to microbial activity associated with decomposition. Potting mix temperatures in excess of 50°C have been noted. Cool it before use by either spreading it out to air cool, or damp it down with water, or both. Quality potting mix should not be this hot! Once potted, radiant heat from the sun raises RZT.

The effect of irrigation.
Irrigation will cool or even chill the root zone. It is then critical to understand this influence if optimum RTZ is to be Maintained, especially in early Spring when radiant heat gain is at a premium.
As a general rule, in Winter and early Spring irrigate as near to dawn as practical to maximize radiant gain during the day.

NURSERY 'KNOW HOW' :

#6 Root zone temperature

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In Summer and early Autumn irrigate from about 2pm to avoid a heat spike. Remember water holds heat more efficiently than does air. If you irrigate early in the day on a really hot day, the RTZ will be higher for longer than had you watered later in the day. This is due to the accumulative heat retention.
The result could be par boiled roots!

Managing RTZ is secondary to irrigation.
Having pointed all that out, do not compromise plant health or growth performance by withholding or delaying irrigation simply to manage RTZ. Always irrigate well and to waste, but in consideration of the plants' needs and the RTZ. Try to avoid overhead irrigation in very bright sunlight, or so late in the day that the leaves are not dry by night fall.

Optimum root zone temperature is species specific.
As a guide, most crops will perform best with a root zone temperature in the range 18—24°C. Tropical and sub tropical species require an RTZ at the high end of this range, plant species indigenous to extreme Northern or Southern latitudes, or altitude are typically happiest at the lower end of the RTZ range.

Fertiliser behaviour is affected by potting mix temperature.
Coated, controlled release, fertilisers popularly used for container production, are significantly affected by RZT. If potting mix temperatures are too high, fertiliser delivery may become dangerously high. Root burn may result due to salinity.

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If potting mix temperature is too low, fertiliser delivery may not be enough resulting in poor growth.

Managing root zone temperature.
In most cases, management is limited to maximizing radiant gain from the sun in the cooler months and minimizing it during the hotter months. Making sure glass or poly tunnel covers are clean and restricting air flow through the growing house will maximize heat gain. Heat reduction is achieved by shading, increasing air flow and by irrigating to cool the root zone.

What we know about New Zealand conditions.
Research conducted by myself in co-operation with seven Polytechnic sites throughout NZ established the following:
The highest RZT occurs between 4pm & 6pm in high Summer. Black pots attain a 2-3°C higher RZT than white pots. Containers irrigated mid-morning on hot days rose to a higher terminal temperature than those irrigated early to mid afternoon**.** Free draining, bark based potting mix warmed up faster than peat mix, but did not reach as high a terminal temperature. Irrigating significantly cools the root zone. Irrigating mid morning in Winter will result in a loss of valuable heat gain for the day compared to irrigating close to dawn. Air temperature was different to root zone temperature and was not a reliable indication of likely root zone temperature. Root zone temperature needs to be managed in order to optimise crop performance. Optimum fertiliser selection for release pattern, longevity, performance and economy can only be achieved with access to, and an interpretation of, the specific RTZ data for your crop. This data will of course be specific to your cultural practices, geographical location and season of production.

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NURSERY 'KNOW HOW' :

#7 Stock plant management

KNOW HOW McHort
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NURSERY 'KNOW HOW' SERIES : #7 STOCK PLANT MANAGEMENT

.Do you manage your stock plants?

Whether you propagate from seed or cuttings, from stock plants in the soil or in a container, there can be no doubt that healthy vigorous stock plants produce the best propagation material. So, do you have a dedicated stock plant management programme in place? If not, why not?

Seed or cuttings

Most seed will be gathered from the native landscape, but careful selection is critical to future success. Avoid plants that are subject to stress. A plant laden with seed is an attractive proposition, but sometimes the reason is that the plant is under significant stress. Seed volume is often highest in drought conditions for example. That plant near the path or Highway, whilst easy to collect from, may be challenged by traffic pressure and/or pollution. Sometimes, in the very struggle for survival, plants will set a huge seed volume. Be wary, germination percentages may be very low; the parent plant being in poor condition.
Pittosporum seed may vary, within the same species, in size and colour.
P. eugenoides with plump shiny black seed often has a high germination and vigour compared to small dull brown seed of the same species.
Cutting material taken from container grown stock may be significantly inferior to that from a plant growing in the soil. The restricted root run in the container limits nutrient and water supply. In the soil a plant's root system can range freely to find what it needs!
Be especially wary of cutting material taken as a windfall of second and subsequent formative trimming and training. It may lack the optimum complement of essential nutrients.
This is very common practice in New Zealand when producing Lavender. Our growth rates are exceptional, especially when compared to Northern Europe, and call for more frequent regulatory trimming.
If provision is not made for this, results can be poor. A progressive degeneration of Lavender, for example, is very common. Although not immediately apparent, this degeneration can lead to poor plant habit, form and disease resistance. The nutrient thought to be implicated in this syndrome is Calcium. Growers often overlook the continuity of supply of Calcium and, sometimes, Magnesium when topdressing container stock. Depleted Calcium may lead to poor cell wall structure resulting in reduced disease resistance and, in some species, poor structure and habit.
This 'weeping' habit effect has been recorded in Pittosporum and may also be accompanied by some stem splitting. Calcium cannot be re-distributed within the plant to make good temporary Shortfalls, as it can with, for example, Nitrogen. Calcium uptake is continuous and is diverted to the growing point. If Calcium is short in supply, the thickness of each new cell wall may be reduced to make what Calcium there is go further. Eventually the plant itself will regulate growth under depleted Calcium supply situations by limiting, or even ceasing, root development. As a consequence stem and leaf expansion ceases and plant growth stalls.

Best practice

Establish your own stock garden from which to collect propagation material. If you have to forage in the 'bush', get off the beaten track and select carefully. Treat your stock plants with the reverence and respect they deserve. They are, after all, your raw material, the very foundation of each and every crop.

NURSERY 'KNOW HOW' :

#7 Stock plant management

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Stock grown in the soil should enjoy intensive management, every bit as much as your container crops.
Regular applications of fertilisers, including lime, should be in accordance with soil analysis interpretations at least every second year.

Mulch, mulch and more mulch

Mulch the stock garden to suppress weeds, preserve moisture, replenish the organic matter and encourage beneficial microbes.
The establishment of a good mulch layer will encourage and maintain adventitious roots, which will further sustain plant health and vigour.

Try restoring the micro-biological balance

Inoculate with Trichoprotection® products to boost natural disease suppression.
An application of either TrichoDry™ to the mulching material or to the soil before applying a mulch is a viable proposition.

'Benchmark' plant performance

For key species 'bench-mark' health and vitality by recording leaf analysis data. Reliance solely on a visual check of stock plant health and vigour may not be very reliable. Collecting hard data is a better option. Choose the best example of the species you can find and sample the most recently fully expanded leaves.

"Benchmark" against this sample of your stock plant each year at the same time. Hopefully any deficiencies in nutrient uptake will, with careful monitoring, become apparent. Use this information to balance the feeding regime.

Container stock plants

Replace stock frequently and don't use out-grades from your production.
Always choose the best for stock plants, never the worst. Topdress fertiliser more frequently than you would the production crop.
Every cutting you detach removes nutrients. You must replenish nutrients regularly with supplementary feeding. Plants held in containers for more than six months may benefit from extra Calcium and Magnesium as well as the regular N,P,K + Te top dress. Gypsum and Kieserite are useful for this purpose and will not raise the pH as would Dolomite or Ground Limestone.

Pest and disease management

Don't forget to keep your stock plants free from pests and disease by including them in your routine spray programme. Implement a regular monitoring programme for all stock plants. Growers sometimes overlook spraying of the stock garden when they spray the production crop. Don't fall into this elementary trap.

Manage for success, don't leave it to chance.

If you would like help or advice, please call me.

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NURSERY 'KNOW HOW' SERIES : #7 STOCK PLANT MANAGEMENT

NURSERY 'KNOW HOW' :

#8 Weed suppression

McHort KNOW HOW
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Weed control in the container nursery is a keystone to profitability.
By design, we create the very best conditions in which to grow plants. It should not then surprise us when weeds grow so prolifically amongst our crops, if we are careless enough to let them.

The definition of a weed
A weed, by definition, is simply a plant growing where we don't want it. Tackle the problem of weeds as a whole; the emphasis being on prevention with strategic eradication and ongoing suppression.
The challenge is how to selectively remove the weeds effectively and economically without harming our crop.
Don't dismiss hand weeding from the equation, but acknowledge that it is unreliable, unpopular and proven to be uneconomical.
The whole approach requires that we look and act beyond the actual crop in containers. We must keep the production area and surrounds as weed free as possible. To do this, economically, requires an integration of a number of control and suppression strategies.

These are **1. Physical methods**

2. Chemical methods

We can further divide these methods into two areas:

A. Outside and beyond the growing container

B. In, or on, the surface of the growing container

Physical methods outside the container
Use weed mat, black is best, on top of a prepared production area. Ensure a stable consolidated foundation for the bed. Create a crown, so that excess water can be shed.

Sweep the mat and wash down using a biocide between crops to prevent any build up of spilt potting mix which might provide a foot hold for invasive weeds, moss and algae.
If your weed mat does not extend to the pathways, these must be kept weed free too. Garden and stock beds will benefit from mulching every couple of years. This will conserve moisture, stimulate healthy roots and suppress weed growth.

Using chemicals
Chemical methods may be necessary, but should perhaps form a second line of defence. Chemicals cost money and always carry the inherent risk of damaging your crop. The most cost effective chemical herbicide group to use in the non-cropped situations on the nursery are the non-selective contact herbicides.

Non selective herbicides for non- cropped areas

Glyphosate - inexpensive and effective
Buster® – useful if clover is a problem
Preeglone™– a dangerous poison, but very effective at killing fibrous rooted grasses
20% Vinegar (acetic acid) is used overseas as an alternative to glyphosate; McHort import a proven, branded, product form the USA.

Selective biocide/herbicides for liverwort, moss and algae
Surrender® or Yield– are effective on new growth, less so on older established infestations
Don't forget to treat the nursery margins and your plant casualty dump to prevent wind blown seed from re-infesting your clean crops.
Baking soda (sodium bicarbonate) may be a useful alternative in some circumstances. Work needs to be done on rate of use and checking for any long term problems resulting from frequent use. Trial first!

Physical methods in the growing container
A mulching technique using either organic (bark) or synthetic (geotextile) mats is viable. A mulch of landscape bark, non-graded, raw and inexpensive, in a layer 3-5 cm deep can be accommodated by under-filling the container when potting or bagging. It does slow up the potting process, but, when production is on a small to medium scale, it is realistic and economic.
This method especially appeals to those who are a little anti-herbicide and who appreciate the aesthetics of the finished and weed free product. McHort commend this practice.

NURSERY 'KNOW HOW' :

#8 Weed suppression

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Synthetic geotextile mats installed wet and the correct side up are effective and reusable. You may find application slow and there is a question mark over hygiene if re-used.
Like bark, water and nutrients applied as topdressing will get down through the mulch mats.

Cut discs of weed mat may also be of use, but will need to be anchored to the top of the container to prevent loss.

Hand weeding is, of course, widely practiced, though usually as a spot treatment only.

Chemical methods in the growing container
Pre-emergence herbicides can be applied to the container surface up to a couple of weeks post potting; the time limitation being that application should be made before any weed germination. None of the pre emergence herbicides are good at knocking down germinated weeds.
Available in both liquid and granular formats, pre-emergence herbicides are non selective. They are best suited to use on woody ornamentals.
The principle of forming a chemical herbicide seal across the potting mix surface applies to all formulations.
It is critical to success that the surface to which they are applied is level, lump free and reasonably firm.
Application should take place when the containers are positioned on the growing bed and, ideally, only after a couple of applications of overhead irrigation which helps level and consolidate the potting mix surface.

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Foresite®– a liquid formulation which is inexpensive and safe on a wide range of species. Foliage should be washed off immediately after application.
It is difficult to see if a complete coverage has been achieved and is therefore less popular than the granular formulations.

Ronstar®– a granular formulation applied from a pepper pot type applicator at the rate of 20g/m2.
Contains Simazine (NZ formulation only) for improved control of annual grasses.
Does not control Pearlwort or Mouse Ear Chickweed.
Ronstar is due to be replaced in the NZ market, so check out the replacement. Pay special attention to the active ingredients and formulation of any replacement offered.

Rout®– a granular formulation applied at 32 granules/10cm2 (About half the Ronstar rate).

A good practice is to ring the changes between the granular types. They should remain effective for 2-3 months by which time the crop leaf canopy tends to suppress weed growth.

Always trial any change to your current methods on a small scale first.

McHort are currently trialing an organic pre-emergence herbicide for use in ornamentals' production in containers. If you would like to participate in this Programme, please contact Donald on 021 782250

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NURSERY 'KNOW HOW' :

#9 Sciarid fly (Fungus gnat)

McHort KNOW HOW
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Sciarid fly (fungus gnat) has become widespread throughout nurseries in New Zealand. I have rarely, in the last decade, visited a property without identifying the presence of this potentially serious pest.
For too long, growers have been complacent about Sciarid fly, overlooking the significance of the potential damage it causes.
The damage is not always apparent or clearly attributed to the seemingly innocent adult fly stage. Often growers tolerate the presence of significant populations, even 'clouds' of the small bodied adult flies, which are most commonly found under benches and on the surface of algae covered potting mix.

Attracted by moss and algae
Sciarid fly can be found wherever green algae or moss grows. Unseen, but creating havoc below surface, are the Sciarid fly maggots, feasting in the root zone of the crop you are growing. Most vulnerable are young seedlings and rooting cuttings. Sciarid weaken your plant stock, reduce vigour and the injury they cause can invite serious root rot problems later, most notably ***Pyhtophthora*** and ***Pythium.***

Your propagation facilities provide a warm and moist environment, capable of sustaining large and very attractive moss and algae growth. It is this growth that attracts the Sciarid. Organic matter, your potting mix, sustains Sciarid if we allow it to become infested. The mist or over-head irrigation, when combined with shade and plant nutrient supply, efficiently spreads and promotes the growth of the attractant moss and algae. So, how should we deal with this pest?

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Using chemicals
Synthetic pyrethroid fly sprays may knock down the adult fly although some growers report suspected resistance.
It may be necessary to use even more toxic insecticides such as Karate or Confidor. The Sciarid has a relatively short life cycle and new adults emerge in just days. Hitting the adult is not enough!
Frequency of application and cost means that the use of insecticides is best limited to reducing 'out of control' infestations before adopting other strategies.
Adding a poisonous organo-phosphorous compound to the potting mix is expensive and creates a hazard to those who must handle the potting mix.

Integrated methods
A more astute approach would be to integrate a package of measures.
The strategy should include monitoring pest populations, removing moss and algae and instigating an on-going biological control programme.
It is unrealistic to expect eradication. Sciarid flies are a part of the natural order and will soon re-infect unprotected host material.

An integrated strategy
Clean up production areas targeting any green moss or algae growth. Employ a zero tolerance to it.
Try Yield or Surrender®, these contact biocides will selectively and safely remove viable spores and existing growths. They work best on the newly germinated spores less so on established liverwort. Just keep them away from ferns and other valuable plant material propagated from spores.
McHort Vinagreen vinegar herbicide diluted 1:2 in water is effective against liverwort, moss and algae but be sure to avoid contact with valuable green plant material as it is non selective.
Great for under benches though!

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NURSERY 'KNOW HOW' SERIES : #9 SCIARID FLY (FUNGUS GNAT)

NURSERY 'KNOW HOW' :

#9 Sciarid fly (Fungus gnat)

McHort KNOW HOW
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Avoid accumulation of old potting mix under benches or on capillary mats. Sciarid fly will make a home here. Try to quarantine very slow germinating seed. The mix they are in will attract Sciarid.

Using yellow sticky traps
Hang sticky traps 150cm above your indoor crops. Use 1 trap/sq m in the propagation house and 1trap/15-20 sq m in the growing on areas. Check them every 3-4 days marking trapped insects with a bold marker pen dot so as to monitor population fluctuations.

Chemical versus biological
Consider a knock-down spray of Natural Pyrethrum for the initial control of large infestations. Repeat at 3-4 day intervals 3 or 4 times in succession. Use either Dimilin® 25W and or the natural predator Hypoaspis sp. in your mix. Dimilin® acts by preventing the adult Sciarid fly from emerging from the pupal stage.
Hypoaspis is a predator mite which will be sustained in your mix for several months by feeding on ever present mould mites or Sciarid fly maggots and other pests if present .Both methods are slow to take effect, so be patient and continue to reduce moss and algae and spray any adult fly. Hypoaspis sp. is produced in a medium of peat and vermiculite. This is applied on top of the growing media. It is unaffected by many aerial pesticide applications except synthetic pyrethroids (e.g.Karate), and will be harmed by drenches or incorporated insecticides e.g. Diazinon etc.

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Insecticides such as Suscon® Green, Baricade or Confidor® have been added to potting mix to eliminate Sciarid fly with only limited success. They seem to work best only after several months of building up release into the growing media. Wearing gloves when handling such mix is strongly recommended.

Chemical insecticides in potting mix
Not everyone is happy to handle potting mix with chemical pesticides in them. Biological pest control is not only viable, it is eminently practical and safer too.

The economics of using Hypoaspis
Hypoaspis is a viable control method once allowed to establish, but is most economical when used in propagation and tube stock rather than in final containers.
An exception might be when valuable stock or display plants are held over in the same container for several years. Hypoaspis can be applied to the top of the container. See www.mchort.co.nz
The Hypoaspis mites will quickly go down into the root zone. Check with us about compatible chemicals and withholding periods before introducing Hypoaspis.

Have patience
Although gratifying, a quick chemical solution to an ever present pest problem like Sciarid, is rarely successful, or sustainable. In general, the more toxic chemicals are potentially harder on your plants and certainly indiscriminate towards other beneficials within the growing system. I recommend you persevere with the biologicals and cultural technique fine tuning.
Call Donald if you would like to establish a bio-control system at your place.

NURSERY 'KNOW HOW' SERIES : #9 SCIARID FLY (FUNGUS GNAT)

NURSERY 'KNOW HOW' :

#10 Biological pest & disease suppression

McHort KNOW HOW
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I have long been a champion of developing and promoting better ways of growing healthy plants. I believe in a future less reliant on chemicals as being the future direction for our industry.

The strategy I believe in is a composite of three component parts :

Cultural , Biological and Chemical
Their integration is, in my experience, both tenable and viable. The challenge is to develop techniques which produce acceptable results in a practical production environment.

These are the tactics used to execute the strategy.
You should note the order in which I have arranged my components. My philosophy encompasses the use of chemicals, as I'm a realist, but only after due consideration of all other options.

An example is how the industry today deals with the once very significant disease problem, Botrytis. Twenty years ago *Botrytis cinerea (Grey mould)* may well have been disease # 1 in protected cropping systems. Today it rarely rates a mention. Why? The practice of the day was to protect plants and eradicate Botrytis using the very successful chemical Benlate. This high performance chemical was legendary .
Exclusive and repeated usage in many spray programmes has resulted in the build-up of Benlate resistant strains of the fungi.
A period of bad publicity on another issue further damaged its reputation.
With the effectiveness gone and no immediate replacement available, we had to find out how to work without it. We did.
Practice changed and today Botrytis is largely controlled by better use of ventilation and humidity control, not chemicals. The lesson being, use of a chemical may be easy and available, but is it necessary?.

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Sometimes there is another, better, way.
1.Cultural technique
Consider these tactics when you next review your plant protection policy.

Ask yourself these questions:
Do I accurately know with which disease/s I am dealing?
Seek professional help with identification.

What do I know about the conditions that favour and promote the incidence of this disease?
Research the disease or seek help.

Which of my crops are vulnerable to this disease?
It may be a problem limited to an insignificant part of your crop and easily fixed by ceasing production of those plants.

Common areas of the cultural practice that will come under review will be:
Irrigation regime
Potting mix physical and chemical make-up
Hygiene
Pest control
Crop handling, etc.

Another common nursery practice which can cause disease problems is root pruning.
Ask yourself, is root pruning necessary?
Is it perhaps only because stock has been held too long before potting-on?
Avoid root pruning if at all possible.
The injury you inflict upon your plants simply invites a host of root rot problems.
When unavoidable, treat stock in advance with a foliar spray of Aliette® or Fostonic and repeat the application a month later. These chemicals will help prepare the stock to deal with the increased disease threat.

Avoid putting stock under severe moisture stress. This can occur when tube stock is held over to long, has become root bound, and is under less than ideal irrigation conditions.
I often see tube stock being held in the car park or under trees supposedly as a temporary measure. They are still there months later!

NURSERY 'KNOW HOW' SERIES : #10 BIOLOGICAL P&D SUPPRESSION

NURSERY 'KNOW HOW' :

#10 Biological pest & disease suppression

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Keep hygiene as a priority
Remember to spray your tube stock, especially that bought in, along with the rest of the nursery. It is easily overlooked if you have parked it, temporarily, away from the main production area.
Contamination from Willow or Poplar leaves in Autumn may result in an increased incidence of rust diseases. Contact with the soil or sitting in a puddle may result in root rot attack.

2. Biological
Potting mix type can contribute significantly to the promotion of healthy plants if it will support and foster a diversity of beneficial organisms. Many bacteria and fungi are antagonistic or even predatory on plant pathogens.
You can boost these with strategic additions of *Trichoderma*, mycorrhizae and bacteria to your mix.
A number of proprietary products exist.
The resultant symbiotic relationships can be immensely useful, very cost effective and, in some cases, still compatible with chemical use.

3. Chemicals
Selective and considered use of chemicals is realistic and need not be expensive or have harmful side effects. Review the options carefully. Focus on the active ingredients rather than brand names. The same active ingredient is often available at the same concentration under different brand names at lower prices.
Develop a plan that involves alternate products for each task. Ring the changes to avoid disease resistance.

Read the labels carefully and follow instructions.
Do not attempt to eradicate disease with protectant formulas. This could result in resistance.
Seek advice about compatibility with the beneficials in your growing media.

Anticipate disease problems

Most common are:
Pythtophthora
Pythium
Fusarium
Rhizoctonia
Downy mildew
Powdery mildew
Rusts
and Leaf spots

Prepare an action plan. Research carefully the options. Focus on prevention rather than eradication. Apply sprays in consideration of plant growth rate rather than simply 14 day intervals. You may need to spray more frequently in Summer for example.

Choosing the least toxic chemical formula for a given task will be gentler on you, the environment, the plant, beneficial bacteria and fungi whilst still suppressing disease.

Remember to consider the integration of all the methods of control at your disposal; cultural, biological and chemical.

McHort have unrivalled expertise in the development of practical pest and disease suppression using biologicals. We also supply many excellent products to support your efforts to manage this ever present threat. Please do call use for any further information or a detailed programme for your growing business.

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NURSERY 'KNOW HOW' :

#11 Phytophthora sp. 'Root rot'

McHort KNOW HOW
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November to March is the season for *Phytophthora sp*. to attack your container grown crops. Aerial symptoms include stunting, wilting, often only on one side of the plant, yellowing, then foliage browning and, ultimately, collapse and death.
The disease is infectious and readily spread by water movement of the zoospores and in potting mix, soil and dust in the persistent zoospore stage.
Although described as a weak pathogen, *Phytophthora* is a ruthlessly efficient exploiter of any injury site to gain entry to your valuable plant stock. Attack can occur from the soil damaging roots and stem bases, but the pathogen then causes a collar rot that extends well up the stem.

Many popular plant species in cultivation are especially vulnerable notably: Astelia, Azalea, Boronia, Brachyglottis, Erica, Dracaena, Grevillea, Griselinia, Knightia, Leucospermum, Lophomyrtus, Malus, Olearia, Protea, Rhododendron and the conifers species Chamaecyparis and Taxus.
Phytophthora sp. will, in favourable conditions, however, attack most plants.
Do not rely on aerial symptoms as evidence of attack exclusively. Your plants may well already be infected.
Inspect the root systems regularly.
Conditions that favour *Phytophthora* include:

Warm moist weather/environment.

Poor potting mix drainage or poor standing area drainage.

High soluble salts (Ec.) causing root burn.

Root damage by insect attack e.g. Sciarid fly.

Physical root injury during handling or potting operations. 'Sun strike' cooking roots on the outer edge of the root ball in planter bags.

Low levels of antagonistic 'Good guy' beneficial fungi e.g. *Trichoderma*.

The key areas of crop management that will limit risk from and losses to *Phytophthora* are:

Potting mix design.

Crop shading.

Boosting beneficial biological soil organisms.

Scrupulous crop hygiene.

Adequate standing area drainage.

Careful crop handling.

Proactive chemical fungicide applications.

The following ***10 point plan works*** well and is currently employed by **McHort** clients throughout New Zealand.

1.Select a well aerated free draining potting mix.
Aim for an AFP of 25-28 and a WHC of 50-55 .Ensure standing areas for container production do not puddle. Stand plants on either weed mat or metal but never on bare dirt.

2.Choose a potting mix based on composted and aged pine bark because it has far greater inherent disease suppression qualities than peat. Bark supports a more diverse range of beneficial organisms than peat appears to do.

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NURSERY 'KNOW HOW' :
#11Phytophthora sp. 'Root rot'

McHort KNOW HOW
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3. Do not over fertilise your crop. Be especially careful with fast acting, top dress, applied fertilisers in Spring or early Summer. Select products that are of mainly coated or encapsulated fertiliser types. These carry the lowest salinity threat. Avoid products which claim a very fast effect or have only short longevity unless you are prepared to re-apply these little and often.
Never allow the salinity (Ec) to build up in the potting mix. Monitor potting mix Ec. regularly with an Ec. meter using the 1:1.5 water extract method.

Maintain the Ec in the range 0.7—1.2.
Keeping the crop too dry can lead to high Ec. The relationship to fertiliser rate and diluting water volume in the root zone is a critical balance. Capillary irrigated crops should be leached through every two weeks in Summer with overhead irrigation.

4.Avoid damaging the root system of your stock when potting up or potting off. Even bruising can allow disease entry!

5.Frequently fine tune your irrigation practice. Know exactly how much irrigation is being applied and do not over water or apply more frequently than is necessary. Be especially careful with hairy, silver or small thick leaved species as these generally require less irrigation than other species.

6. Provide shade on the sun-struck side of the growing container. Try a skirt of white polythene, pot high, along the outer edge of each bed. Roots exposed to 35 C will be severely damaged even killed.

7. Boost the beneficial fungi in your potting mix by adding Trichodry™ Nursery and following up monthly until March with Trichoflow™ Nursery.
A regular and routine programme of re-application will be necessary to maintain a viable defense mechanism in the root zone. Control all pests that might cause injury to plant roots through which disease may then enter. Target Sciarid fly, Root mealy bug and Black Vine Weevil especially.

8. Maintain scrupulous crop hygiene, rogue out and remove from the nursery any suspect plants immediately.

9. Regularly clean all propagation equipment, benches and rooting containers with a strong biocide.

10. Routinely spray foliar applications of Aliette® WG or Fostonic two weeks before any plant handling that may result in root disturbance or injury.
Use an Aliette® WG drench as a spot treatment to clean up any disease hot spots. Maintain a monthly precautionary Aliette® WG or Fostonic foliar spray regime from November to March on all 'at risk' plants. These chemicals stimulate the plant's own immune system rather than eradicating pathogens.

If you need help managing the *Phytophthora* threat to your crop, call Donald today.

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NURSERY 'KNOW HOW' :

#12 PITTOSPORUM SUDDEN LEAF DROP

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The sudden catastrophic leaf drop from established container grown pittosporum is not uncommon in mid-late Spring. The affected plants are rendered unsaleable and recovery whilst possible is not economically viable.
The key areas of crop management that limit risk of Pittosporum leaf drop are:

Potting mix design.

Irrigation management.

Boosting beneficial biological soil organisms.

Scrupulous crop hygiene.

Adequate standing area drainage.

Careful crop handling.

Proactive chemical fungicide applications.

The following ***10 point plan works*** well and is currently employed by **McHort** clients throughout New Zealand.

1.Select a well aerated free draining potting mix.
Aim for an AFP of 25-28 and a WHC of 50-55 .Ensure standing areas for container production do not puddle. Stand plants on either weed mat or metal but never on bare dirt.

2.Choose a potting mix based on composted and aged pine bark because it has far greater inherent disease suppression qualities than peat. Bark supports a more diverse range of beneficial organisms than peat appears to do.

3. Do not over fertilise your crop. Be especially careful with fast acting, fertilisers in Autumn potting and late season top dress applications

Select products that are of mainly coated or encapsulated fertiliser types. These carry the lowest salinity threat. Avoid products which claim a very fast effect or have only short longevity unless you are prepared to re-apply these little and often. Do not heap top dress fertiliser up against the plant stem. Never allow the salinity (Ec) to build up in the potting mix. Monitor potting mix regularly with an Ec. meter using the 1:1.5 water extract method.

Maintain the Ec in the range 0.7—1.2.
Keeping the crop too dry can lead to high Ec. The relationship to fertiliser rate and diluting water volume in the root zone is a critical balance. Capillary irrigated crops should be leached through every two weeks in Summer with overhead irrigation.

4.Avoid damaging the root system of your stock when potting up or potting off. Even bruising especially at the base of the stem can allow disease entry. Shifting mature plants that may have rooted through the bottom of the container may also cause damage

NURSERY 'KNOW HOW' SERIES :#12 PITTOSPORUM

NURSERY 'KNOW HOW' :

#12 PITTOSPORUM SUDDEN LEAF DROP

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5.Frequently fine tune your irrigation practice. Know exactly how much irrigation is being applied and do not overwater or apply more frequently than is necessary.

6. Provide shade on the sun-struck side of the growing container. Try a skirt of white polythene 'pot high' along the outer edge of each bed. Roots exposed to 35 C will be severely damaged even killed.

7. Boost the beneficial fungi in your potting mix by adding Trichodry™ Nursery and following up monthly until March with Trichoflow™ Nursery. A regular and routine programme of re-application will be necessary to maintain a viable defense mechanism in the root zone.
Control all pests that might cause injury to plant roots through which disease may then enter. Target Sciarid fly, Root mealy bug and Black Vine Weevil especially. Try Hypermites as a control of these pest. Call us for details of use.

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8. Maintain scrupulous crop hygiene, inspect the root zone and stem base of your plants often. Rogue out and remove from the nursery any suspect plants immediately.

9. Avoid applying Top dress fertiliser too soon after any pruning operations.
Aim to have an interval of 4 weeks between pruning and topdressing

10. Routinely spray foliar applications of Aliette® WG or Fostonic two weeks before any plant handling that may result in root disturbance or injury.
Use an Aliette® WG drench as a spot treatment to clean up any disease hot spots. Maintain a monthly precautionary Aliette® WG or Fostonic foliar spray regime on all at risk plants. These chemicals stimulate the plant's own immune system rather than eradicating pathogens.

If you need help managing these threats to your crop, call Donald today.
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