Taking the Soft Approach to Pest and Disease Management – Does It Work?©

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INTRODUCTION

There is a growing problem in horticulture – inability to control some pests and diseases. Mites, thrips, and white fly are now resistant to a wide range of chemicals. Even some easy-to-control insects like aphids are now developing resistance to previously effective chemicals. New chemistry is now more difficult and slower to discover and develop – with costs blowing out to millions of dollars for each molecule. In addition our range of chemicals is actually decreasing in many cases due to increasing number of old style chemicals being banned. And finally, consumers and farm workers are increasingly demanding chemical-free plants and working conditions.

We are in an in-between phase where we still rely on chemicals but increasingly we need to employ other more natural methods to assist in good pest control. What does the future hold? Currently chemicals are still essential to our mass-production systems and chemical companies are increasingly developing more environmentally friendly selective chemicals. Such chemicals enable the successful management of biological beneficials with the safety net of chemical intervention when needed. More and more natural methods are being discovered which due to new mass rearing techniques can be very effective against pests and disease. The key is in learning how to best manage each new tool. A time may come in the future when chemicals will be replaced by a wide range of natural methods but at present the two systems need to work together. This is indeed integrated pest management (IPM).

SOFT VERSUS HARD TECHNIQUES

Harsh broad spectrum chemicals were the only choice for many years but resistance soon developed to these once powerful weapons. "Soft" does not mean "weak" for good soft techniques properly employed can be more powerful than harsh chemicals. Using the power of nature is an amazing thing, e.g., seeing a population of the predator mite, *Phytoseiulus persimilis*, multiply rapidly sweeping through a crop to decimate a huge population of chemical resistant two spotted mite (*Tetranychus urticae*) is an awesome thing; especially when numerous sprays with the best miticides in the world have already been applied unsuccessfully. This is the evidence that convinces the most sceptical of farmers.

This does not mean biological control works in every situation – but this is only because we have not yet discovered how to do it! Excellent examples of powerful biological control on a commercial scale abound. Superb control of mealy bugs by *Cryptolaemus* sp. lady beetles and lacewings; excellent control of aphids by a combination of *Aphidius* sp. wasps + lady beetles + lacewings + hover flies; strong control of thrips by *Neoseiulus cucumeris* and *Typhlodromips montdorensis*; great control of white fly with *Encarsia* sp. and *Eretmocerus* sp., etc. All these are commercially practiced in real world IPM programmes. Nature is very powerful – the more we learn how to manage and adapt it natural solutions will be found to control many difficult pests.

Disease control is much less advanced in terms of commercial biological control but some fine examples are currently working, e.g., *Trichoderma* sp. controlling *Sclerotinia* in onions and *Phytophthora* sp. in avocados. *Bacillus subtilus* is also showing some promising results. Currently most fungicides are relatively safe to most beneficial insects so IPM programmes employing both are relatively commonly practiced today. However the same fungicides are very damaging to many beneficial microbes like *Trichoderma* sp. It is for this reason that most current systems include beneficial insects used alongside

fungicides rather than beneficial microbes.

PEST MONITORING

Accurate monitoring of pests is an essential part of any IPM programme. Is the pest increasing, decreasing, or static? This is the critical information which is necessary for good decision making. If increasing, are the levels not causing damage yet or has damage started to occur? In the former case releasing more biologicals may be able to control the pest, e.g., lacewings released onto hotspots of aphids or mealy bugs can clean them up rapidly. In the latter case some chemical assistance will almost certainly be needed as damage must be stopped quickly. Selective chemicals are preferred as many beneficials survive these sprays, but in some cases the biological programme must be temporarily forgotten and a harsh broad spectrum chemical applied just to save the crop. It is easy to reintroduce new biologicals but to lose a crop is devastating and unacceptable. Again there is an important choice to be made prior to spraying harsh chemicals, e.g., some like Lannate® have a much shorter residual than Mesurol®. So the shorter residual ones should always be chosen if possible as beneficials may be reintroduced again more quickly.

Useful Monitoring Techniques Include:

1) Simple counts of numbers per unit area or per leaf – adults, nymphs, eggs, alive, dead – need to be recorded to indicate population increase or decrease.
2) Sticky traps are very useful but need to be replaced weekly so fresh numbers are always being counted. Yellow is best for white flies and fungus gnat while blue is best for thrips and shorefly.
3) Sampling buckets are very useful for sampling faster moving insects or those that drop easily from the plant.
4) Potato chunks can be very useful for monitoring fungus gnat and shore fly larvae.
5) Sick plants can be destructively sampled to really see what's going on in the root zone.

Specific types of monitoring should be adapted to each crop, e.g., white fly in poinsettias is best monitored by (A) using yellow sticky traps and (B) disturbing the foliage and observing how the insects fly – white flies have a characteristic erratic pattern of flying, and (C) counting larva numbers on the leaves. Fungus gnat may be monitored by (A) counting fast moving adults over the medium surface and (B) assessing roots of damaged plants or potato chunks for larvae.

The vital aim of good monitoring is knowing what's happening – no nasty surprises is! Then timely preventative or emergency controls may be implemented.

Biological Control in Propagation Nurseries

Due to propagation plants being so small and vulnerable bio-control is a high risk venture! However most bio-control products are very plant friendly so there is a lower risk of phytotoxicity compared with many chemicals. Initially, prior to releasing any biological organisms ensure toxicities from previous sprays have degraded. Check lists of chemical residuals. Also trial releases of small numbers of beneficials may be needed to check this.

The key with all bio-control methods is getting the programme going early when the pest is present in very low numbers. When a pest population has momentum it is very hard to stop so beneficial releases at this stage are usually insufficient to control the pest alone.

Multiple or weekly releases of a beneficial organism may be necessary in some cases due to the tiny margin for error with seedlings. On larger plants where a canopy develops often only one to two releases of *P. persimilis* may be necessary as they breed so well. Also releasing multiple types of organisms can really increase the power of the control programme by mimicking natural complexity. A good example is with fungus gnats. Using eco-nematodes (*Steinernema feltiae*), *Hypoaspis* predator mites (*Hypoaspis miles*), or VectoBac® (*Bacillus thuringiensis* var. *israelensis*) alone will only give partial or temporary fungus gnat control but when all three are combined in a weekly programme

excellent control may be achieved without resorting to chemicals at all. Similarly excellent aphid control in lettuce and brassica seedlings has been achieved using combinations of *Aphidius* sp. wasp and lacewing larvae released weekly or fortnightly. Superior spider mite control is achieved by combining *P. persimilis* and *Neoseiulus californicus.* Both can work well together simultaneously but under humid conditions the former works best but under dryer conditions the latter works better. Either way they make a good partnership.

GOOD AGRONOMY – THE ESSENTIAL PARTNER FOR BIOLOGICAL CONTROL

Giving the new plant a good start is essential for a good crop. Healthy plants are more tolerant of insect and disease attack. Important practices include:

1) Ideal water balance especially not overwetting is crucial. Good quality media with proven levels of air filled porosity are essential for good root health.
2) Ideal fertilizer levels are so important. Don't "burn" the roots with too much but ensure there is adequate nutrition available for strong early growth.
3) Minimal chemical use early on is important as some chemicals affect plant rooting and general growth.
4) Natural products are often very valuable at this early stage; e.g., trichodermas for disease control, eco-nematodes, etc., for fungus gnat control; seaweeds for strong root development.

NATURAL CHEMICALS AND PHYSICAL RETARDANTS

Some useful partners to biological control are some natural products with low toxicity to many beneficials. Oils such as Biopest®, Ecooil®, and soaps provide good physical control (dessication) of many pests including mites and white fly. They are relatively soft on many beneficial insects and aren't susceptible to insects developing resistance. Neem products, especially Azamax®, have been very useful at enhancing chemicals which are failing to give previous levels of pest control due to the onset of resistance, e.g., Vertimec® efficacy on mites can be boosted by 20-30% with the addition of Azamax®. Similarly a number of whitefly chemicals may be boosted by the addition of this neem product.

Ecocarb® or sodium bicarbonate has been very useful at controlling powdery mildew without hurting beneficial insects at all. Also there is growing evidence that seaweed products, e.g., Seasol® or Acadian® enhance plant health and plant defence mechanisms enabling them to tolerate or overcome significant pest or disease attack. Used in combination with a range of techniques already mentioned these products can be the difference between an IPM programme working or not.

SUMMARY AND CONCLUSIONS

Using "soft" or biological controls in commercial horticulture is very much a current and very valuable practice. Such techniques do not work alone but must be combined with a range of techniques including good agronomy, natural products like neem and soaps, selective chemicals, and at times harsh chemicals. Good monitoring is essential to track pest levels and to know when various tactics should be employed. Starting all biological controls early, before the pest develops is the key tactic leading to success. *Trichoderma* sp. and seaweed products are very useful at reducing disease pressure but fungicides are still an important part of most IPM programmes. It is important that we don't just stop using harsh methods without a plan. For every technique that is removed from an old harsh chemical system – one or two new "biological" techniques must be substituted. With diligence, trial work, good observation, and some risk taking the soft approach to horticultural pest control is well positioned to keep growing.