

Integrated Pest Management

Holistic Nursery Pest Management

An expanded version of this article has just been published in the Proceedings from the IUFRO-Diseases and Insects in Forest Nurseries meeting in Finland (see #98 in New Nursery Literature).

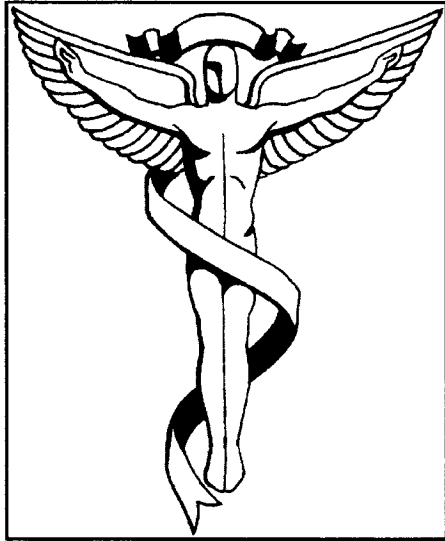


Figure 1 - Holistic medicine views the patient as a whole person and considers the importance of the environment.

Holistic medicine is a relatively recent movement that emphasizes the need to perceive patients as whole persons. It developed as a response to the increasing specialization in medical education that was producing physicians who treated organs rather than the body as a whole. Searching for a cure, patients were referred from doctor to doctor but each was a

specialist in one narrow field. None could see the "big picture" or provide the patient with a comprehensive diagnosis. Another concern was the increasing dependence on drugs in the treatment of disease. Many patients felt that doctors were merely prescribing drugs to treat symptoms, rather than trying to find out the real cause of the disease. Holistic medicine developed as a response to these concerns.

Many of the principles of holistic medicine can be applied to nursery pest management:

Give as much attention to the environment as the pest.

One of the basic tenets of holistic medicine is to recognize how much environment contributes to disease. Everyone is aware of the "disease triangle" concept which emphasizes that a pest, a host, and a conducive environment are all necessary to cause disease. However, the environment often gets overlooked. Nursery workers, and especially pest specialists, tend to focus on specific pest organisms and fail to appreciate the critical importance of the environment in the nursery management. Following holistic principles, we should always consider environmental stresses instead of just working to control pest organisms.

For example, consider the greenhouse environment. The principal reason for raising seedlings in containers in a greenhouse is that all potentially growth-limiting factors can be controlled (Table 1). Seedlings are sown at regular spacing in an artificial soil mix that is formulated for ideal pH and porosity. The atmospheric environment is automated to maintain ideal temperature and relative humidity both day and night.

The ideal propagation environment of a greenhouse has both advantages and disadvantages

	<u>Advantages</u>	<u>Disadvantages</u>	
	No growth-limiting factors in physical environment	Ideal conditions for some pests	No beneficial organisms
Edaphic Factors	1) Water 2) Mineral nutrients	Fungus gnats, <i>Bradysia spp.</i>	Mycorrhizal fungi
Atmospheric Factors	3) Light 4) Humidity 5) Carbon dioxide 6) Temperature	Botrytis blight, <i>Botrytis cinerea</i>	Insect parasites

Table 1

Even carbon dioxide is supplied to accelerate photosynthesis. Unfortunately, what is ideal for seedling growth is also ideal for nursery pests such as fungus gnats (*Bradysia* spp.) and Botrytis blight (*Botrytis cinerea*). The sterile greenhouse environment also excludes many beneficial organisms including mycorrhizal fungi and insect parasites that can keep pest populations in check (Table 1). The ideal growing environment also produces seedlings that are not as hardy as those grown under natural conditions. In particular, high fertilization rates designed to accelerate seedling growth rates also make them susceptible to abiotic stresses.

?? **Are we spending too much time looking for an organism with a "smoking gun"?**

To borrow an analogy from detective novels, we should not become obsessed with trying to identify a "suspect" pest. Most common nursery pests, such as the fungi *Pythium* and *Fusarium*, are not aggressive pathogens but pest specialists have spent a considerable amount of time trying to implicate a particular fungal species or ecotype for a specific disease. These fungi are commonly found in both bareroot and container nurseries and the diseases they cause are usually triggered by environmental stresses. As an example, fungal damping-off is usually not a problem unless soils and growing media become compacted or waterlogged (Figure 2).

?? **Are we treating secondary conditions instead of the real problem?**

Continuing with our root disease example, a great deal of research has been aimed at identifying root pathogens when it might make more sense to work towards creating a better root environment. For instance, we should attempt to create and

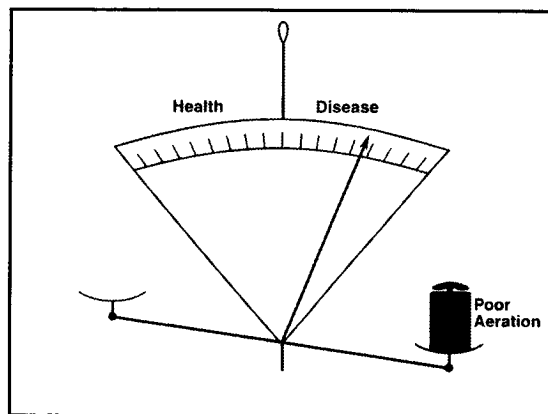


Figure 2 - Most root diseases are triggered by environmental stresses in the soil, especially poor aeration.

maintain soils and growing media with the proper amount of aeration porosity. Air exchange only occurs in the relatively large macropores because the smaller micropores are typically filled with water. Excessive compaction during seedbed formation or when filling containers can destroy these macropores. During the growing season, aeration porosity fluctuates due to irrigation and rainfall when macropores become filled with water. Maintaining adequate porosity in containers is even more difficult because macropores are lost as roots grow. Aeration porosity is gradually reduced as roots expand throughout the container and, by the end of the growing season, is reduced to almost zero because roots have occupied every macropore. This may explain why root diseases often develop late in the growing season when opportunistic fungi attack the weakened roots. Returning to our holistic theme, the real problem behind these root diseases is poor aeration and not merely the presence of pathogenic fungi.

?? **Conclusions and Recommendations**

The basic concepts of holistic medicine can be applied to forest and conservation nurseries in several different ways:

1. Get training in seedling physiology and horticulture - Most people only see what they know. The mystical poet William Blake said it well:

"A fool sees not the same tree that a wise man sees"

All nursery workers, and especially pest specialists, need a basic understanding of seedling physiology and horticultural practices so that they can better diagnose the true cause of seedling problems and design holistic control measures.

2. Put greater emphasis on prevention - Instead of just looking for diseases or insects, pest specialists should work with nursery managers to stress seedling health and modify propagation environments to discourage pests. Consider the example of fungus gnats in a greenhouse. These ubiquitous pests can never be completely eliminated in this wet, moist environment but their populations can be kept to manageable levels by employing holistic practices, especially careful water management.

3. Use pesticides only when necessary - This philosophy should be the cornerstone of nursery pest management: pesticides should be used only after all other environmental and cultural controls have been considered. In applying this concept, the Forest Research Nursery at the University of Idaho reduced the amount of pesticide solution they applied by 80% while still maintaining the same level of seedling production.

This dramatic example was achieved by employing a full range of holistic practices: vigorous sanitation to keep pests from entering the propagation environment, growing regimes that promote hardy seedlings, careful water management, and good ventilation to lower humidity.

4. Promote practical use of beneficial microorganisms -For example, mycorrhizal fungi have been a popular topic for many years and there seems to be a variety of opinions as to their value in forest and conservation nurseries. Some "true believers" feel that mycorrhizae are essential for all phases of nursery culture as well as outplanting, whereas many nursery managers are more skeptical. The holistic approach stresses that mycorrhizal inoculation can be worthwhile, but that the timing of inoculation and the species of fungus should be matched to nursery objectives. In particular, the fungal species should be selected for either the nursery or the

outplanting site. There is no "all-purpose" fungus that will perform well under both conditions. Fungal species that are adapted to withstand outplanting conditions will not survive under the high moisture/high nutrient nursery environment and vice versa. Therefore, nursery pest specialists must work with the nursery personnel and seedling customers to explain that the species of fungus, the type of inoculum, and the timing of the inoculation will vary with the objectives of the treatment.

So, I think that you can see that taking a holistic approach to nursery management can create a better cultural environment and reduce the use of pesticides. It will be necessary to take small risks in order to test holistic principles but I think that you will be pleasantly surprised by what you learn.

Sources:

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