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MEMORANDUM

FOR : The Regional Directors
Regions 2, 3, 4A, 5, 6, 9, 12, 13, NCR and NIR

FROM : The Director

SUBJECT : **FMB TECHNICAL BULLETIN NO. 22-F, INTEGRATED PEST MANAGEMENT**

DATE : JUN 20 2016

I. This Technical Bulletin

This Technical Bulletin is to introduce integrated pest management as the most effective approach to manage diseases. Integrated pest management (IPM) is a strategy that prevents pest damage with minimum adverse impact on human health, the environment and non-target organisms. This strategy focuses on preventing the introduction of disease causing microorganisms (pathogens), managing the environment to promote healthy plant growth, monitoring for early signs of disease, practicing good housekeeping and sanitation, diseases must be properly identified, and efficient use of pesticides.

II. Users of the Technical Bulletin

The users of the Technical Bulletin are the Nursery Managers, Growers, Assistant Growers and readers who plan to start and operate a nursery for native plants as well as exotic plants in the tropics.

III. Introduction

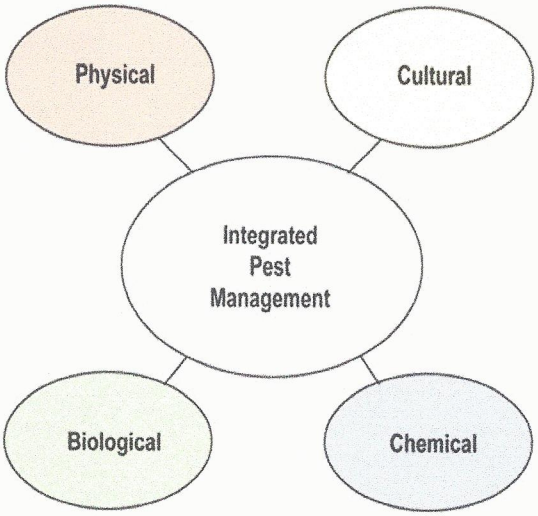
There are three requirements for a plant disease to occur. First, the pathogen must be present. Second, the environmental conditions must be favourable for disease development. Third, the plant must be susceptible due to age or genetic make-up. If a single requirement is lacking, the disease will not develop.

In IPM programs, growers use their knowledge of crop and pest biology to take actions that reduce the environment's suitability for pest establishment and increases in pest populations. IPM employs careful monitoring techniques and combinations of

biological, cultural, mechanical, chemical and environmental or physical control. Pesticides are used only if monitoring indicates that they are needed. If pesticides are necessary, they are chosen and applied in a way that avoids disrupting other IPM practices.

Successful IPM relies on a combination of techniques and methods for managing pest populations that includes the following elements:

a. planning and managing ecosystems to prevent organisms from becoming pests (*prevention*);
b. identifying pest problems and potential pest problems (*pest identification);*
c. monitoring populations of pest and beneficial organisms, damage caused by pests and environmental conditions (*monitoring*);
d. using injury thresholds in making treatment decisions (*injury thresholds);*
e. suppressing pest populations to acceptable levels using strategies on considerations of physical controls, cultural controls, biological controls and chemical controls (*treatment methods*);
f. evaluating the effectiveness of pest management treatments (*evaluation*). It is not always practical or possible to use all these methods in every situation, but each case needs to be analysed to determine the best management program.



One of the many advantages of using the IPM pest management approach is *maintaining a balanced ecosystem.* Ecosystems comprised of living and non-living components that are linked from one species to the other species within the system either positively or negatively due to the reliance at different biotrophic levels. For example, using chemical controls can reduce pests, but may also reduce species of organisms that reduce pest species themselves within the ecosystem. By using an IPM approach, we aid in maintaining ecosystem stability while controlling pest problems.

IV. Different Methods of Pest Control

There are four different methods of pest control used under IPM approach.

1. Cultural Control

The cultural methods focus more on watering, fertility, sanitation and hygiene practices that will affect pest and diseases populations. By implementing strategies such watering regimes, managing salts and cleanliness reduce the risk pest and disease infestations.

a. Sanitation is the first step in any pest control program. If the source of pest and diseases is constantly present due to poor sanitation, pest control programs will be expensive and frustrating. Proper greenhouse sanitation is a continuous and year-round activity.

b. Overwatering plants can increase the number of insects such as fungus gnats and shore flies. High moisture levels would keep the surface of medium moist, resulting in the growth of algae that will provide breeding sites for fungus gnats and shore flies. Overwatering also stresses the plants that would increase their susceptibility to other plant-feeding insects and mites.

c. High or low fertility can increase crop susceptibility to pest and diseases. High fertility level can increase soluble salts in the growing medium, which stress plants and increase their susceptibility to insects and mites. The soft, succulent tissue resulting from excess nitrogen fertilization would make it easier for insect and mites to penetrate with their mouthparts and can increase the reproductive ability of the insects.

d. Control of weeds inside the nursery site is an important part of a pest management program. Weeds can provide a refuge for insects and act as reservoir for diseases. Herbicide application, cultivation and hand weeding are the most practical methods of controlling weeds in the nursery.

2. Physical Control

It is difficult to control insects from going to the nursery because it is an open area. The most effective physical means of pest detection would be trapping. In many cases physical controls can be implemented at the point where the pests will harbour and breed and if a breeding site can be eliminated, often a pest problem can be solved. Physical controls can sometimes be a more effective and appropriate method in gaining long term control over a particular pest infestation

3. Biological Control

Biological control may not be available yet in the Philippines but it is worth mentioning here as a future consideration when this method becomes available. Biological control methods involve using living organisms (natural enemies)

such things as the introduction of parasites, predators or pathogens to eradicate a particular pest. Although biological control may not be available yet in the Philippines, this area of pest management is becoming increasingly important in IPM programs.

4. Chemical Control

Chemical control methods involve the application of pesticides as part of the IPM program. While pesticides may be part of the IPM program, chemical control of pests should be undertaken judiciously using the appropriate pesticide and means of application to minimize risk to human, animals and plants. Insecticides are classified as conventional, bio-rational and systemic.

a. ***Conventional*** insecticides include most of the major chemical classes that have broad spectrum of pest activity and killing a wide range of insects and pests.

b. ***Bio-rational*** insecticides include insect growth regulators, insecticidal soap, horticultural oils and bacteria. They have broad mode of action in the way they kill pests and they are less harmful to natural enemies or biological control agents.

c. ***Systemic*** insecticides have translaminar properties that penetrate or absorbed by plant tissues such as leaves, stems and roots and form a reservoir of active within that tissue. Systemic insecticides should be applied when the plants have roots and actively growing so the plant can absorb the insecticide through the transpirational stream.

V. Managing Diseases

Diseases are inevitable part of growing planting stock in a forest nursery. Most growers in the past relied on pesticides to prevent and combat diseases without regard to other control measures or understanding the cause of the disease such as environmental conditions.

There are three components required for disease to develop: a susceptible host plant, the pathogen and environmental conditions favorable for disease development. These three components comprise the three sides of the "disease triangle." Aim disease management practices at reducing one or more sides of the triangle to reduce the amount of disease.

1. Monitoring

Monitoring, also called scouting, is the regular, systematic inspection of crops and growing areas. Monitoring is the process of determining the potential for pest populations to reach an economic threshold (i.e. depletes the value of the crop below an established bottom line) or an intolerable level.

A regular monitoring program is the basis of IPM decision making, regardless of the control strategies used. By regular monitoring, a scout is able to gather current information on the identity and location of pest problems and to evaluate treatment effectiveness. Keeping records from previous years can be used as a reference. Watching the weather pattern and historical data can give a good idea when and if a pest problem may occur. A nursery employee who is knowledgeable with computer can be trained as an IPM scout.

Passive scouting using yellow sticky cards

Scouting techniques can be categorized as passive and active.

a. *Passive scouting* involves the use of devices such as traps and sticky cards that attract or lure insects. Sticky cards are effective for monitoring the adult stages of insects. Place the sticky cards just above the canopy and attached them to a bamboo or stake with clothespin so that they can be adjusted as the crop increase in height. Only one side of the sticky cards should be used at one time for 2 weeks. Scout at least once per week and record the insect found on the sticky cards on data sheets. Place one sticky card for every 500 sq. m.

b. *Active scouting* **is a**nother important monitoring technique is crop inspection. Adopt a regular sampling pattern that provides good coverage of the whole production area. Records are necessary.

The following information must be recorded so Nursery Managers and Growers can use it in the future.

1) Date
2) Pest/Disease Identification
3) Location in the nursery
4) Number of insects trapped
5) Stage of development (eggs, adult, pupae)
6) Crop species or cultivar
7) Control Action (pesticide used, rate, area treated, etc.)

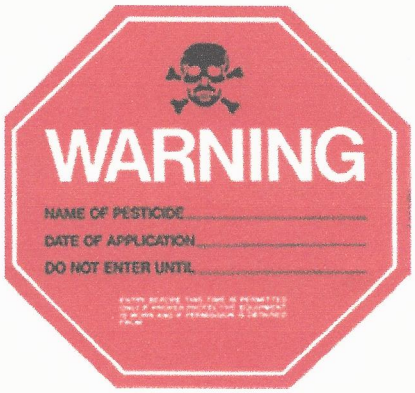
2. Prevention

Plant diseases can be caused by bacteria, viruses, nematodes, and fungi. Many crop problems can be anticipated and avoided. Prevention is often least expensive and most effective, and sometimes the only control option available. By the time plants begin to appear unhealthy, many problems cannot be cured, and the crops may have already been seriously damaged. Some key pest prevention techniques include:

a. Using good hygiene and sanitation
b. Planning your crop production and IPM program in advance
c. Properly managing the environment
d. Cultural practices.

3. Action

One also needs to determine the action needed in order to address the pest problem. If pests reach an economic threshold or intolerable levels, action must be taken. When no other strategy will bring the pest population under a tolerance threshold, then the use of chemical pesticides is probably justified – and should be applied properly according to label standards. When applying pesticides, upcoming storm events, wind speed, and proximity to water and the floodplain zone should be considered. Always use appropriate safety materials such as goggles, gloves, suits, rubber boots, etc. and application rates and methods listed on the label and Material Safety Data Sheet (MSDS).



e.

A Simplified Disease Diagnostic Key (symptoms and possible causes)

PLANT	**Stem rot**
Decay of seed/seedlings	• *Botrytis, Sclerotinia*
• damping-off (pre- and post-emergence)	• *Erwinia spp*
• low temperatures	• viruses
• insect feeding on roots	**Necrotic stem lesions**
• high salts and/or improper pH	• virus

• poor water management (too much or too little)	• chlorine damage
• viruses	**Girdling of stem at crown**
Stunting of plants	• *Fusarium, Rhizoctonia*
• root rot	• damping-off caused by *Pythium or Phytophthora*
• poor water management (too much or too little	**LEAVES**
• viruses	**Chlorosis (yellowing)**
• insects or nematodes feeding on roots	• poor root growth (check for root rot)
• low fertility	• poorly drained medium
• high salts and/or improper pH	• low pH; nutrient deficiency
Poor rooting of seedlings or cuttings	**Leaf reddening**
• *Pythium* rot	• poor root growth (check for root rot)
• low rooting temperature	• low nutrition levels
• desiccation of leaves	**Raised corky spots**
Wilting, dieback	• oedema caused by a saturated media & high RH
• *Xanthomonas* blight	**Leaf spots**
• *root rot caused by Fusarium, Pythium, Phytophthora, Rhizoctonia*	• *Botrytis, Alternaria, Ramularia, Septoria, Xanthomonas or Pseudomonas*
• *Fusarium, Ralstonia, Verticillium*	• viruses
• poor root growth (check for root rot)	• miscellaneous fungi
• viruses	**White, powdery growth**
• poor water management	• powdery mildew (don"t confuse with spray residue)
STEMS	**Corky pustules that are not the same colour as the leaf**
• Cankers, branch dieback	• rust (can be red, brown, yellow, white or black)
• *Phytophthora*	

VI. Checklist: Integrated Pest Management

a. Before introducing or growing a crop, clear the greenhouse of plant debris, weeds, algae, etc. Wash and disinfect floors, pallets, trolley carts, tools and equipment. After the greenhouse has been sanitized, avoid recontamination with pathogens.
b. Purchase seeds from reliable sources. Seeds should be disinfected by chemical and/or heat treatment (by the seed center).
c. Inspect incoming seeds or cuttings as soon as possible upon arrival for the presence of insects, diseases, or cultural problems.
d. Repair any drainage problems that may contribute to recurring arthropod pest outbreaks. Provide a hook to keep hose nozzles off the floor.
e. Do not reuse growing media.
f. Use ambient air to minimize condensation or high humidity inside the greenhouse.
g. Inspect stock plants for disease and do not take cuttings from infected plants. Dip cutting tools in a disinfectant before moving from one stock plant to another.

h. Use yellow sticky cards to monitor flying pests. Correctly identify pests on sticky cards and plants. Record pest numbers, location within the greenhouse, and the number of plants inspected.
i. Scout propagation areas at least every 3 to 4 days. Properly identify the pest or disease.
j. Review scouting records and previous pest problems to determine which pests were problems and which pest management strategies worked.
k. Monitor roots for damping-off or root rot symptoms.
l. To prevent root rot diseases, select a well-drained medium, test for soluble salts periodically, and apply water for optimum growth of the crop.
m. Space plants for good air movement and sunlight. This results in rapid drying of foliage and better spray coverage.
n. Irrigate early enough in the day to allow foliage to remain dry overnight. Water sparingly during periods of cloudy and rainy weather.
o. Wash hands thoroughly or wear disposable gloves and discard them after handling any plants suspected of being diseased as poor sanitation can spread pathogens.
p. Change the cards weekly, and place new cards in the same areas of the greenhouse to track pest trends.
q. Use indicator plants to determine the efficacy of pest management tactics and to monitor susceptible crops for the viruses (tospoviruses) such as impatiens necrotic spot virus (INSV) and tomato spotted wilt virus (TSWV).
r. Biofungicides are fungicides that contain living organisms such as fungi and bacteria. They must be used preventatively as they will not cure diseased plants
s. To prevent the development of resistance, alternate applications among different modes of action (MoA) groups, or mix or rotate systemic/protectant fungicides.

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