

Tropical Horticulture
Lecture 16
IPM & Weed Control in the Tropics



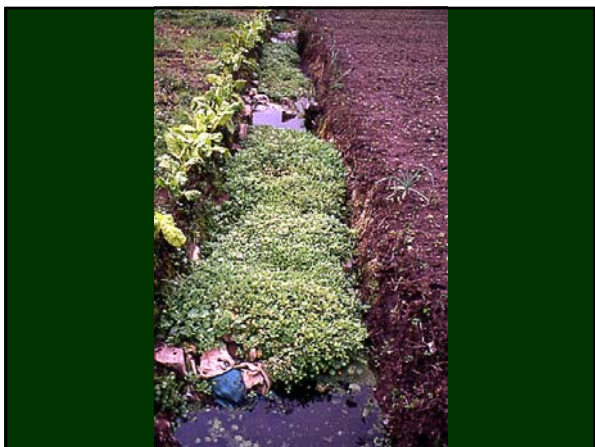
IPM is a system in which a combination of methods is used to maintain pest populations at levels that allow profitable crop production with minimal adverse effects on the environment.

















**Also called informed decision making:
The decision maker gathers as much
information as is necessary to make
the best decision on pest control for
the particular situation.
To make these decisions the farmer must
understand the crop, production
practices, pests, and available tools.**

The Underlying Premise of IPM

**It is a scientifically proven fact that when
current production technologies are properly
integrated and precisely managed, the
production goals of immediate economic gain
and long-term sustainability are mutually
reinforcing.**





Nonchemical Pest Management Techniques

- Cultural
- Biological control
- Resistant cultivars
- Mechanical
- Quarantines





Cultural

- Tillage
- Rotation
- Crop residue destruction
- Irrigation
- Intercropping/strip
- Planting date (timing)
- Fertility
- Cultivar selection
- Mulches
- Spacing
- Row orientation
- Cover crops
- Burning residues
- No till





Biological (most useful for insects)

- Conservation of natural enemies
- Importing natural enemies
- Mass culture and release of natural enemies
- Biopesticides (insects, diseases, weeds)
- Allelopathy

Host Plant Resistance

- Tolerance
- Nonpreference
- Physical resistance
- Chemical resistance

Quarantines

- Exclusion
- Sanitation
- Restrictions
- APHIS - exports

Steps in Successful Pest Management

1. Correct identification

- Insects- Pest ID services
- Weeds - ID resources manuals, keys, video
- Diseases - Farmer knowledge
- Nematodes - Symptoms
- Vertebrates

2. Understanding of pest and crop dynamics

- Life cycle/mode of attack
- Key pests - direct vs. indirect
- Beneficials - predators, pathogens, parasites
- Seasonality
- Pest environment interactions

3. Monitoring - methods to determine pest presence

- Visual - Forecasting
- Scouting - Plant damage assessment
- Field mapping
- Traps, pheromones, light, sticky, pitfall, sweeps, spore traps, indicator plants

4. Economic thresholds

Don't apply control action unless you expect loss from pest to exceed cost of control action.
Economic threshold is pest density at which you need to implement some control measure to avoid economic loss.

5. Choice of optimum pest control options

Management decision to control pest
Based on: ID of pest, biology of pest,
number present - economic threshold

Strategy

Ask these questions

- What will I lose if I do nothing?
- What will I gain?
- How well will this action control the pest?
- Is this action legal?
- Will this action impact either positively or negatively other pests?

Answer them to your satisfaction before implementing a control

Available Tactics

- Cultural
- Biological
- Mechanical
- Quarantines
- Chemical
- Biorational
- Combinations

Chemical

Types:

- Insecticides
- Herbicides
- Fungicides
- Nematicides
- Rodenticides

Classification:

- Efficacy
- Longevity

Mode of Action

Chemical

Product Label:

- Environmental aspects
- Storage
- Fate/carryover
- Breakdown
- Mixtures
- Adjuvants
- Environmental influences (rain, humidity, wind, soil, temperature)
- Resistance/tolerance
- Timing of application
- Equipment
- Safety

Biorational (Integration of Control Measures)

IPM = integrated pest management;
ICM = integrated crop management

Insects:

- Pheromones, mating disruption, insect growth regulators
- Sterile release
- Weather
- Irrigation

Weeds:

- Flaming
- Hot water
- Cultural

Diseases:

- Weather
- Resistance
- Environment

Combinations:

- Multiple IPM approaches for all pests

None

Mechanical

- Row covers
- Physical pest deterrents







6. Assess effectiveness of treatment and plan for future

- Assess why it worked or did not work
- Plan for future based on assessment
- Keep good records
- Consult with pest advisors and discuss future options
- Long range program inputs and objectives necessary for an effective pest control program

Implication of IPM to the Tropics

Principles are the same for temperate agriculture but control is more difficult due to lack of winter, warmer temperatures, high moisture all of which are conducive to pest proliferation.





Weed Control in Tropical Horticulture

Characteristics of Weeds

- Ability to reproduce via large number of seeds and/or rapid vegetative regeneration.
- The ability to persist. Seeds can survive in the soil for long periods.
- A broad genetic base allows weeds to adapt to varying environments.
- Compared to most pests weeds have relatively low mobility.
- Weeds generally lack host specificity.

What is a weed?



Cost of Weeds

- Weeds reduce yields by competition for light, water and nutrients.
- Weed removal results in high production costs.
- Weeds reduce the quality of crop and livestock products.
- Weeds can poison humans and livestock.
- Weeds harbor pests which attack crops.
- Weeds increase the cost of harvesting.
- Aquatic weeds hinder water flow and increase irrigation costs.
- Social costs of weeds in less developed countries are high since many people spend their entire life weeding.

In the tropics, it is important to keep weeds out of fields for as long as possible since weed growth is rapid and early season weed competition is most damaging to crop growth.

Example: Maize and beans grown in Mexico had maximum yields if kept weed free for first 30 days of season.

Garlic grown in Brazil had maximum yields if purple nutsedge was eliminated for first 13 weeks of season.

Yield losses due to weeds in tropics if weeds are not removed:

Country	Crop	
Sudan	Cotton	64-75%
	Peanut	61-80%
	Sorghum	35-46%
	Wheat	28%
	Rice	69%
	Cassava	75-94%
India	Yams	22-91%
	Maize	40%
Brazil	Okra	62%
	Garlic	89% (purple nutsedge)
	Tomato	53%

Effects of Weed Densities on Crops

- Very low weed densities can cause severe crop losses.
- Crop losses usually increase with increasing weed density; loss per weed decreases.
- In any one crop, each species of weed will result in a different crop loss at equal density.
- Other factors to consider:
 - Crop cultivar
 - Method of propagation
 - Time of planting
 - Crop density
 - Soil moisture
 - Soil fertility

Factors Affecting Weed Control in Tropics

- Long growing season
- Continual source of new seed
- Dense foliage and rapid growth
- Annuals often act as perennials
- Many species - crops and weeds
- Weed growth is rapid
- Many different rainfall patterns
- Many soil types

Methods of Controlling Weeds

Prevention - do not allow weeds to invade a field or a country.

- National quarantine
- Use of clean seed
- Avoid transfer of weed in nursery stock
- Clean equipment
- Avoid manure, mulch, etc. from other farms
- Keep irrigation ditches free of weeds

Categories of Weed Control

- Physical tillage by humans, animals, machinery
- Cultural crop rotation, mulches, burning, crop competition
- Biological - weed control with insects, diseases
- Genetic - breeding for crop resistance to herbicides (e.g. glyphosate resistance)
- Chemical - use of herbicides

Categories of Weed Control

Cultural



Categories of Weed Control

Chemical



Categories of Weed Control

Genetic



Some Considerations for Use of Herbicides in the Tropics

Weeds

- Tolerant weed species
- Rapid shifts in weed population
- Different weed species at different elevations

Crop

- Limited screening for crop tolerance
- Environment affects herbicide activity

Costs

- High for chemicals and equipment
- Shortage of water for spraying (Africa)
- Lack of precision in applying herbicides
- Traditions of intercropping and hand removal

Solutions

- New low cost equipment - rope wicks, wipers, (Herbi)
- Integration of old methods with new

Types of Farms

- Plantations
 - Most sophisticated agricultural practices
- Private Farms
 - Less sophisticated, more hand labor
- Subsistence Farmers
 - Mostly hand labor, human intensive

Problem Weeds in Tropics and Subtropics

Purple nutsedge – *Cyperus*
Common bermudagrass - *Cynodan*
Barnyardgrass - *Echinochloa*
Jungle rice
Goosegrass
Johnsongrass
Guineagrass
Water hyacinth
Cogongrass
Lantana

Eight of 10 weeds are grasses or sedges,
5 are perennial grasses, all are found in the
United States.

Parasitic weeds

Striga (witchweed) - tropical Africa and Asia
causes severe losses in sorghum, millet, maize,
upland rice and sugar cane.

Orobanche spp. - Mediterranean area; causes
loss in broad bean and tomato

Problem Weeds

VT Weed Identification Guide



Purple nutsedge - The world's worst weed

Problem Weeds

Parasitic Weeds
Broomrape - Orobanche



Problem Weeds

Parasitic Weeds
Striga - witchweed



Problem Weeds

Virginia Tech Weed ID Guide



Parasitic weeds
Dodder

Problem Weeds

Johnsongrass



Common bermudagrass



Problem Weeds



Barnyardgrass



Jungle rice



Problem Weeds



Yellow nutsedge



Goosegrass

Problem Weeds



Lantana



Galinsoga

Problem Weeds



Nightshade



Lambsquarters



Pigweeds

Future

- > level of Development
- Greater involvement of technology
- Globalization
 - New standards
 - New practices
 - Improved IPM



