PRINCIPLES AND PRACTICES OF INTEGRATED PEST AND DISEASE MANAGEMENT

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Strategic levy investment

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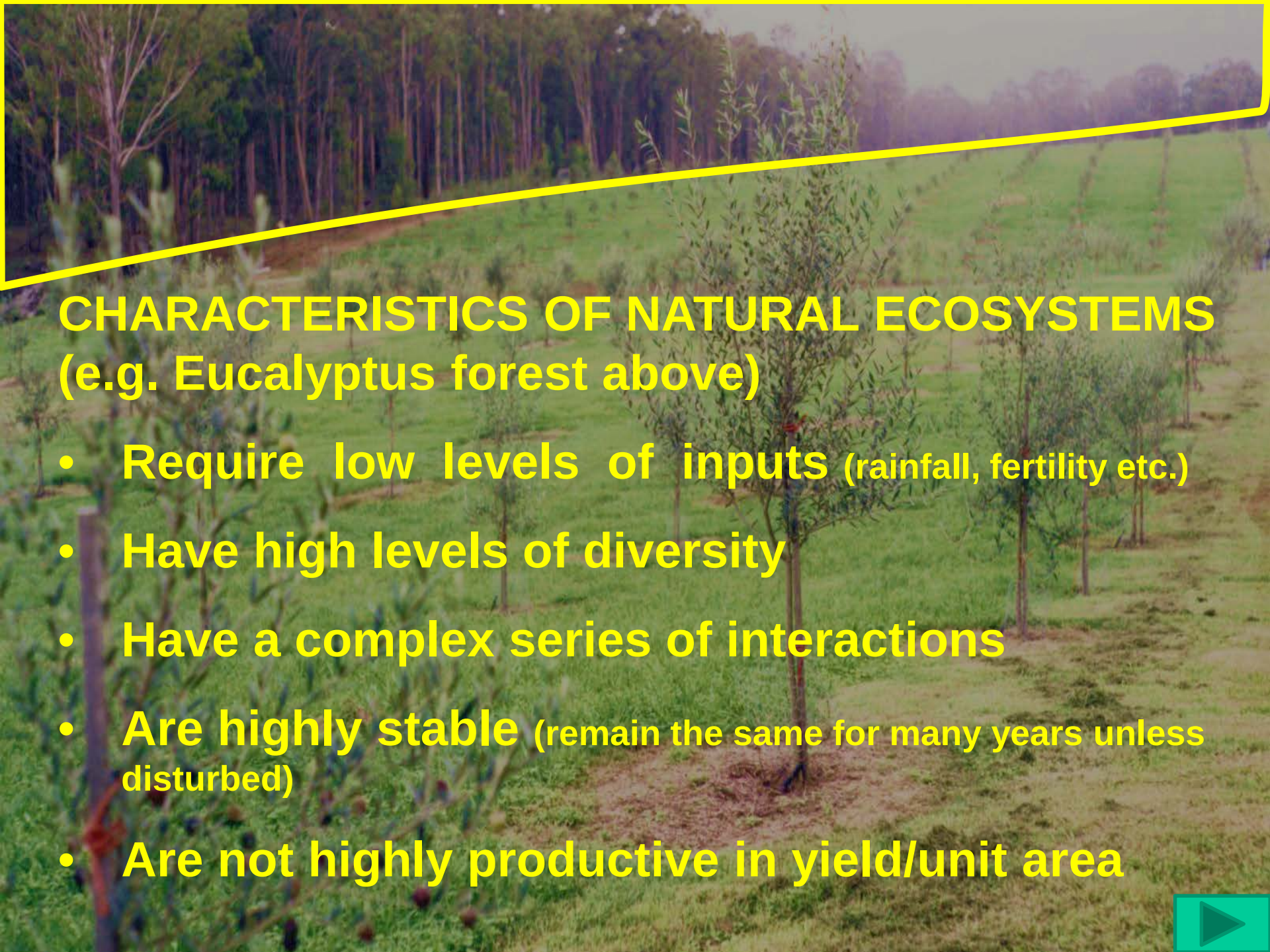
This is No. 1 in a series of 9 tutorials on IPDM in olives

The others are:

2. Monitoring for pests, diseases and beneficial species, including symptoms and possible causes, identification/diagnostic services, biosecurity
3. Biosecurity, including pests and diseases not present in Australia
4. Black scale: biology, damage and management
5. Olive lace bug: biology, damage and management
6. Apple weevil: biology, damage and management
7. Anthracnose: life cycle, conditions conducive, symptomatology and damage, and management
8. Peacock spot: life cycle, conditions conducive, symptomatology and damage, and management
9. Cercospora leaf mould: life cycle, conditions conducive, symptomatology and damage, and management

It is an output from the Hort Innovation project OL17001 An Integrated Pest and Disease Management Extension program for the Olive Industry

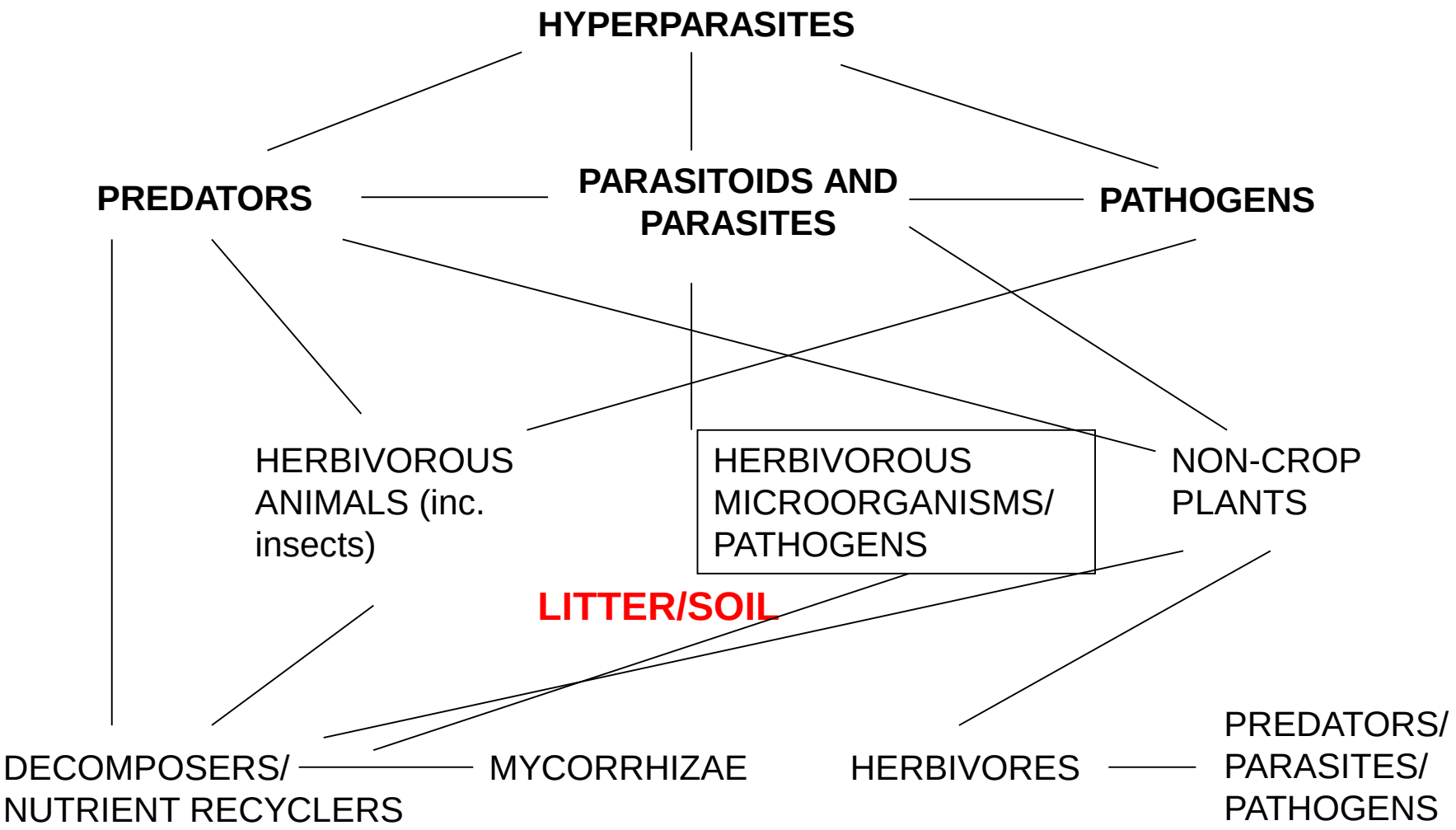


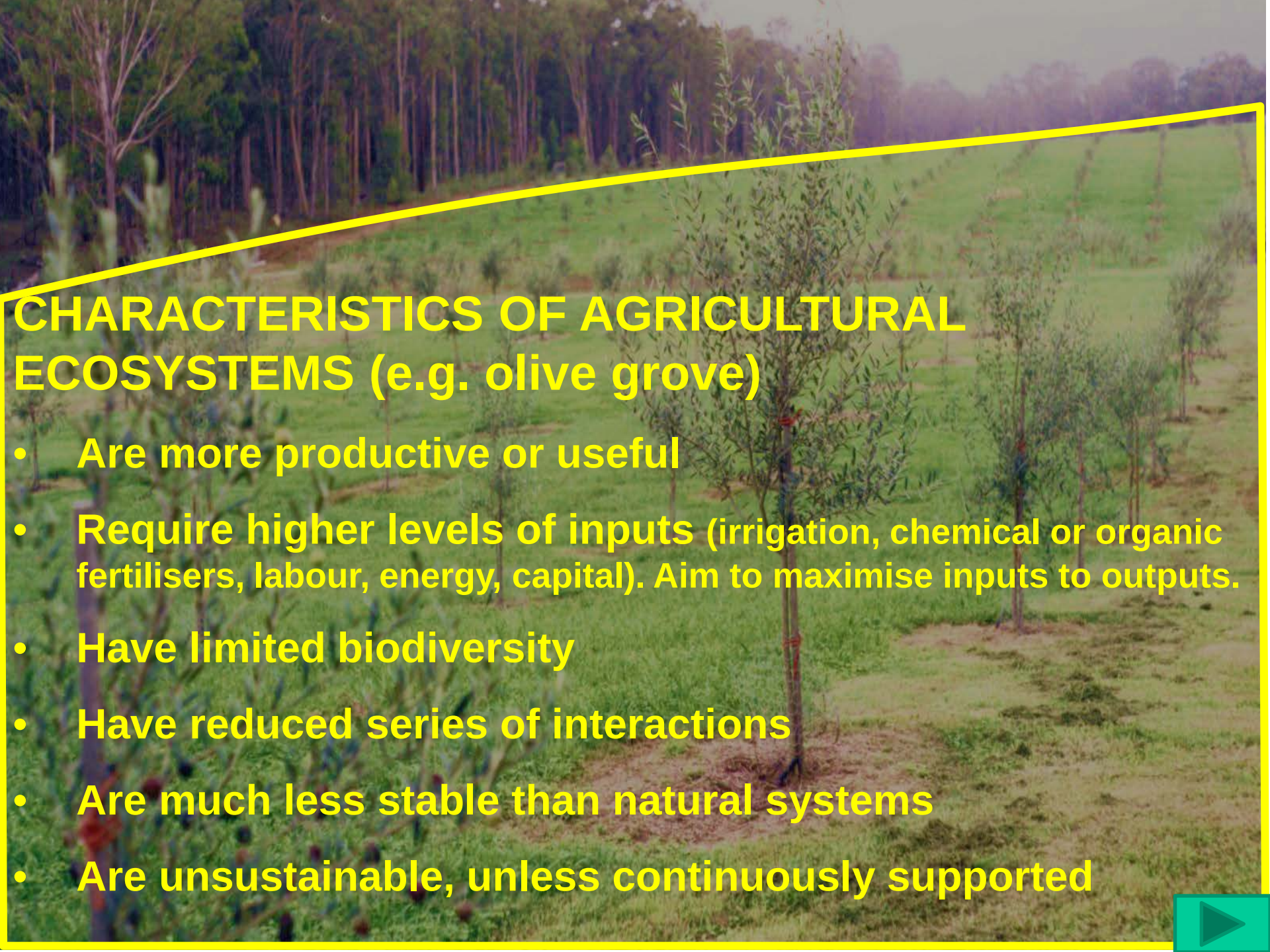
CHARACTERISTICS OF NATURAL ECOSYSTEMS (e.g. Eucalyptus forest above)

- Require low levels of inputs (rainfall, fertility etc.)
- Have high levels of diversity
- Have a complex series of interactions
- Are highly stable (remain the same for many years unless disturbed)
- Are not highly productive in yield/unit area

SIMPLIFIED PICTURE OF BIODIVERSITY OF ORGANISMS AND RELATIONSHIPS IN AN ECOSYSTEM

CROP PLANTS/FARM





CHARACTERISTICS OF AGRICULTURAL ECOSYSTEMS (e.g. olive grove)

- Are more productive or useful
- Require higher levels of inputs (irrigation, chemical or organic fertilisers, labour, energy, capital). Aim to maximise inputs to outputs.
- Have limited biodiversity
- Have reduced series of interactions
- Are much less stable than natural systems
- Are unsustainable, unless continuously supported


The aim of IPDM is to incorporate the best features of natural ecosystems into agricultural systems to make them stable, as well as environmentally and economically sustainable

A PEST or PATHOGEN MAY BE

- **A new species or strain (including a more virulent or resistant strain)**
- **A native (indigenous) species attacking new crops (e.g. olive lace bug, Queensland fruit fly)**
- **A naturalised (exotic but well established) species attacking a new crop (e.g. black scale, anthracnose)**
- **An exotic species incursion (e.g. olive fly, Xylella)**
- **An induced species responding to changed environmental conditions (e.g. monoculture, irrigation and fertilisers, “improved” crop varieties, pesticide use and other pest control measures, climate change)**

PLANT HEALTH is complex, involving a series of natural and management factors

INTEGRATED PEST AND DISEASE MANAGEMENT (IPDM)

A commonsense approach where all methods of control: resistant varieties, planting and harvest time, conservation and manipulation of natural enemies and biological control are all brought into operation in a systemic way to keep pest/pathogen populations and related damage at low levels, with pesticides applied only where absolutely necessary, and in such a way as to interfere least with non-chemical methods

NB. Intervention with pesticides (organic or synthetic) can be part of an IPDM strategy. Sometimes, limited but strategic use of pesticides (and not as the last resort), can be highly effective.

IPDM HAS THE FOLLOWING CHARACTERISTICS

- **Based on ecological principles**
- **Requires correct identification of damage & causal agents (diagnosis may require more than observing symptoms)**
- **Continuous monitoring of crop health, weather, potential pests/diseases and their damage, as well as their natural enemies, including after application of any treatments (chemical, biological or ecological). SEE TUTORIAL 2 FOR MORE INFORMATION ON MONITORING**
- **Setting thresholds of pests/disease and/or damage at which action is to take place (this can be difficult)**
- **Integrating a number of strategies in a systemic way**
- **Intervening with selected chemicals only when appropriate, and then with appropriate timing and coverage**

STRATEGY 1. CULTURAL MANAGEMENT

- **Maintain good plant health (irrigation, nutrition)**
- **Hygiene, plant sanitation, biosecurity**
- **Control alternative hosts pests and diseases**
- **Change environment to favour pests and pathogens (e.g. improved tree training systems, open canopy for air/sunlight and spray coverage, selected cover crops)**
- **Change management practices (harvest times, varieties, pruning practices) to minimise pests and diseases and their spread**

Mummified fruit, source of anthracnose pathogen (Sergeeva, Spooner-Hart & Nair 2008)

STRATEGY 2. BIOLOGICAL CONTROL

Use of natural enemies of pests and diseases such as predators, parasitoids and pathogens, competitors

Biological control can be undertaken by

www.goodbugs.org.au

- **Introducing natural enemies of exotic pests (Classical B.C)**
- **Releasing/applying mass-produced natural enemies (for further information see www.goodbugs.com.au)** and
- **Implementing strategies to conserve and support natural enemies**



STRATEGY 3. PHYSICAL AND MECHANICAL CONTROL

Examples include:

Mechanical devices and barriers (e.g. birds, roos, weevils)

and

Traps

such as coloured sticky traps for monitoring or mass trapping (although not commonly used in olives in Australia)

Tree barrier to prevent apple weevil movement up olive tree

STRATEGY 4. SELECTED PESTICIDES

- **Natural or organic pesticides are not always the least environmentally disruptive choice (many are broad spectrum)**

- **Narrow spectrum (selective) pesticides target a limited range of pests or diseases. However, many are more prone to resistance build-up by the target species.**

- **Some better options are pesticides which disrupt pest's development or behaviour, such as pheromones (communication chemicals), insect growth regulators and oil sprays (in addition to suffocation, may also reduce feeding, settling and oviposition)**

DISRUPTION OF THE ECOSYSTEM IS A CONSEQUENCE OF:

- **The spectrum of activity of the pesticide** (broad-spectrum are generally more disruptive)
- **Residual activity of pesticides** (residual pesticides are more disruptive)
- **Spot/selective vs broad applications** (spot or target spraying is less disruptive)
- **Timing and frequency of applications** (ensuring optimum timing for pest or disease; the more applications the more disruption)

GROWERS CAN IMPLEMENT IPDM TO VARIOUS STAGES OR LEVELS.

1. **Improved cultural and hygiene practices**

   Monitoring of pests/diseases to better time pesticide applications

2. **Monitoring of beneficial species, predicting pest and disease populations**

   Selection of “softer” pesticides where possible

   Spot and target applications of pesticides

STAGES OF IPDM

3. **Environmental modifications to encourage beneficials, and discourage pests**

   Releases of mass-reared beneficials/ entomopathogens/ competitors/ antagonists

4. **Better design of production systems to minimise pest problems**

SOME ISSUES TO CONSIDER WITH ORGANIC OLIVE PEST AND DISEASE CONTROL

• Organic pest and disease management should have a strong scientific base, where monitoring plays a key role

• Some acceptable organic inputs may not be permitted for commercial use in olives by APVMA. Check on APVMA website https://apvma.gov.au/ for registrations or permits

• Copper is a fungicide under threat of removal, with problems with soil microorganisms, copper toxicity

• Some organic pesticides may be environmentally disruptive (broad spectrum, e.g. pyrethrum, copper)

REVIEW QUESTIONS

- Q1: Can pesticides be used as part of an IPDM program?
- Q2: What types of organisms can be used for biological control?
- Q3: What is the first step in implementing an IPDM program?

ANSWERS

- Q1: Yes they can. However, they should be used judiciously and strategically, and so as to least interfere with other management strategies (especially biological control)

- Q2: Arthropods (insects and arachnids), other animals such as birds, insect pathogens, competitive/ antagonistic/ microorganisms (for disease management)

- Q3: A good monitoring program, which should include monitoring for pests, pathogens and beneficial species

QUESTIONS TO CONSIDER AFTER READING THIS TUTORIAL

- Where is your farm in the IPDM spectrum? Could more IPDM strategies be implemented, or existing ones more effectively?

- Can you recognise common beneficial species in your grove? How could you encourage them in your grove?

- Should you review your current pesticide use, in light of IPDM and legal use of conventional and/or organic pesticides?

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