

Notes on Pests, Diseases and Disorders session with Audrey Litterick

What are Pests and Diseases?

Pests

Animals which attack your crops, they might be:

- mammals (e.g. moles, deer, rabbits)
- birds (e.g. pigeons, crows)
- insects (e.g. caterpillars, root flies, mealy bugs, aphids)
- microscopic worms (nematodes)
- mites (e.g. red spider mites, gall mites)

Diseases

Illnesses caused by pathogens, usually micro-organisms which attack your crops, they might be caused by:

- fungi (e.g. potato blight, clubroot, mildew)
- bacteria (e.g. apple canker, fireblight, spear rot)
- viruses, viroids, etc (e.g. tobacco mosaic virus, potato ringspot, beet western yellows)

What are Disorders?

Illnesses in plants which are not caused by pests / pathogens but by environmental conditions e.g.

- a lack or a damaging excess of one or more major, minor or secondary nutrient (usually linked to soil pH)
- too high / too low / too variable temperatures
- too much / too little water
- insufficient light
- excessive draughts / exposure to wind

What is Crop Protection?

Our attempts to keep crops

- Healthy and high yielding
- Free from nutrient deficiencies and toxicities
- Free from attack by weeds, pests & diseases

Sustainable crop protection

- emphasis is on prevention rather than cure
- try to avoid pesticides where possible
- Organic growers rely on a wide range of partial solutions to preventing and controlling pests, weeds, and diseases.
- Cultural methods to prevent and control problems

Pesticides are prohibited or restricted and are regarded as a last resort.



Companion planting with flowers and protective mesh

Key points for success 1

Happy crops growing in the right place (for them) and properly fed, rarely succumb to pests, diseases and nutrient disorders

Learn how to provide the right environmental conditions for the crops you want to grow, and the right nutrition and you are more than half way to preventing pests and diseases.

Key points for success 2

You've got an advantage: environmentally friendly pest and disease control works best in gardens and small holdings. Diseases love mono-culture, so our gardens with their greater diversity are at an advantage.

Non-nutritional disorders

Lots of different types caused by, for example

- lack of light
- too much light
- draughts
- exposure to excessive wind
- unsuitable temperatures
- drought / over-watering

Nutrient deficiencies and toxicities

- Greatly influenced by soil pH (degree of acidity). If the pH is too high or too low, the nutrients are inaccessible to the plant.

Also depends on:

- concentrations of major, secondary and minor nutrients in soil or growing media
- soil conditions (mainly soil temperature and moisture)
- crop covers (used and not used)
- weather conditions

A very big subject- too large and complex to cover in detail here. Seek advice from an expert if in doubt about diagnosis of a crop problem.

Examples of nutrient disorders

- Calcium deficiency in lettuce – dry brown edge of leaves, which then goes slimy
- Calcium deficiency in tomatoes - sunken, dry decaying areas at the blossom end of the fruit. This is common in tomatoes grown in grow bags, not because of an actual lack of calcium in the growing medium, but because the roots get too wet.
- Boron deficiency in cauliflower – little holes appear within stem
- Magnesium deficiency in tomatoes – yellowy-orange bands between the veins, which may later turn brown if the deficiency isn't treated soon enough. This is common at the end of the season and on older leaves. It can happen as a result of calcium uptake.

Pests in horticultural cropping

Pests can cause a lot of damage. The main pest problems you are likely to encounter will probably include:

- aphids
- slugs and snails
- vine weevil
- carrot fly
- cabbage root flies
- wireworm
- red spider mite (indoors)
- caterpillars
- moles
- rabbits and deer
- Potato Cyst Nematodes (PCN)

Nematodes are not such a problem here, because of soil temperature. In fact it is for this reason that many seed potato growers are based in this area.

Aphids, nematodes, mealy bugs and scale insects can be vectors for disease. Commercial growers that spray against these pests are often spraying because of the viruses rather than the pests themselves.

Diseases in horticultural crops

Main disease worries will be:

- Potato blight and black leg
- potato skin diseases
- botrytis
- mildews (downy and powdery)
- rust
- white rot (alliums)
- vascular wilts
- damping off, root rots and wirestem (seedlings and transplants)
- sclerotinia root and stem rots

How to prevent / control pests and diseases?

- Aim to prevent as many pests, diseases and disorders as possible through good horticultural practice.
- Aim to learn what pests and diseases you are likely to suffer from and learn as much as you can from books and knowledgeable friends.
- Learn about the life cycles and needs of your garden enemies in some detail, and learn what specific things you can do to help to prevent them and control them if they do occur.

General environment-friendly strategies for pest/ disease control

- Grow only what will be happy in your garden (e.g. tomatoes, kiwi fruit and maize can be difficult outdoors in Scotland).
- Effective crop rotations
- Enhance numbers of predators / Parasites / Antagonists
- Optimised soil pH and crop nutrition
- Use resistant species and varieties
- Use crop and variety mixtures
- Agronomic measures (e.g. time of sowing / harvest, irrigation regime)
- Use barriers (e.g. polythene, fleece, mesh cages)
- Try bio fumigation (if pest / pathogen is soil-borne)
- Use safe pesticides as a last resort.

Appropriate Crop rotation

- The biggest single measure that can help minimise the incidence and severity of disease and pest damage.
- Most effective against soil-borne diseases (e.g. clubroot, white rot, sclerotinia) and relatively immobile soil pests (e.g. nematodes)
- Most effective against diseases / pests with narrow host range
- Less effective against air-borne diseases (e.g. mildew, potato blight) air born pests (e.g. aphids) and where the pest or pathogen has a wide host range
- Organic commercial growers will grow potatoes or carrots in a field one year in six.

Vegetable Plant Families

Pea / Bean Family (Leguminosae)

French bean
Runner bean
Broad bean
Pea
Clover
Lucerne
Lupin
Trefoil
Vetch / tares

Potato Family (Solanaceae)

Potato
Tomato
Aubergine
Pepper

Beetroot Family (Chenopodiaceae)

Beetroot
Spinach
Swiss chard
Spinach beet

Lettuce family (Asteraceae)

Chicory
Endive
Lettuce
Salsify

Grass Family (Gramineae)

Sweet corn
Grazing rye
All cereals / grasses

Cucumber Family (Cucurbitaceae)

Cucumber
Squash
Courgette
Marrow
Gourd
Pumpkin

Carrot Family (Umbelliferae)

Carrot
Celery
Parsnip
Celeriac
Fennel

Onion Family ([Amaryllidaceae](#))

Onion
Leek
Garlic
Shallot

Cabbage Family (Brassicaceae)

Cabbage
Broccoli
Brussels sprouts
Kale
Swede
Kohl Rabi
Cauliflowers
Radish
Oriental brassicas
Turnip
Mustard

Audrey moves soil in and out of her glass house to achieve rotation as tomatoes, aubergine and peppers are all grown in there, and are all in the same family.

Crop rotation

Ideally only grow vegetables in each botanical family for 1 year in 5.

Some diseases require longer, therefore control relies on much more than the rotation alone

E.g. white rot – 15 years

E.g. clubroot – 20 years

Producers of organic fruit (e.g. strawberries) for supermarkets grow their plants for 1 year only. This does give low yields, but is the most cost effective way to produce organic fruit. This is done on a fifteen year rotation. The plants are taken out and burned at the end of the year.

Predators, parasites and antagonists

Encourage biodiversity and in particular, beneficial organisms from the large to the small.

Large species (e.g. birds, frogs and hedgehogs)

Smaller species (e.g. ladybirds, lacewings and predatory mites)

Microscopic species (e.g. parasitic and antagonistic fungi)

Encourage Biodiversity – how?

- Diverse rotations (not as easy in tunnels, as there are cost implications)
- Encourage a rich natural flora in and around the garden
 - Destroy damaging weeds
 - Establish beetle banks
 - Collect seed from wild flowers locally and encourage beneficial species
- Add plenty of bulky organic mater, especially composts to soils

Predators, parasites and antagonists

- You can use licensed, naturally occurring biological control agents
- Not generally effective outdoors, but they often give excellent results indoors

Examples include:

- For vine weevil and slugs (parasitic nematodes)
- For aphids, parasitic wasp (*Encarsia formosa*)
- For aphids, predatory mite (*Phytoseilus persimilus*)

Optimise soil pH and crop nutrition

Susceptibility to pest / disease attack will be minimised if crops are grown in soil with appropriate:

- pH
- fertility

Crops and soils differ: It is important to know your soils and choose crops to suit, e.g. Do not lime potatoes (makes common scab worse)

Clubroot – add lime to reduce effects

Do not add too much Nitrogen – it can make (probably most!) pests and diseases worse.

Use Resistant species and varieties

- Choose crop species that you know will grow or test on a small space the first time around
- Choose the best available varieties (sometimes old, sometimes new)
- Never forget the taste – be very wary of new highly disease resistant varieties, e.g. Potato “Lady Balfour”.

Use crop and variety mixtures

Possibilities include strip cropping or inter-cropping (e.g. alliums in rows between carrots / parsnips.)

Cultural measures for disease / pest control

Endless options and permutations! For Example:

- Time of sowing / harvesting
- Depth of sowing / planting
- Nature of cultivation regime

- Pruning / trimming time / method (perennial crops)
- Irrigation regime
- Nutrient application regime
- Harvesting method
- Storage and transportation methods
- To a large extent, experience will show you what works best for your soil, climate and expertise.

For example, to hopefully crop before potato blight may hit, start chitting and get the tubers into the ground as early as your frosts will probably allow, use protection like fleece if you can to bring forward cropping. Some varieties are much more blight resistant than others e.g. Sarpo Mira, Sarpo Axona, Setanta, Orla.

Barriers and traps

- Electric / wire mesh fences
- Glasshouses, polytunnels, cloches and mini-tunnels covered with fleece or polythene are all potentially barriers if set up in order to exclude specific pests.
- Vertical barriers
- Slug traps
- Sticky traps
- Pheromone traps

Look out for enviro-mesh: this lets the rain get in better than with fleece. Make sure that there are no gaps at the bottom, and no holes. Keep the cover on for as much as possible – take off for weeding, and quickly replace.

Biofumigation

The basic definition is to harness the natural chemical agents of plants to suppress weeds, fungal pathogens and insects. It is an agronomic technique that makes use of some plants' defensive systems. With this system, tissues of these plants can be used as a soft, eco compatible alternative to chemical fumigants and sterilants. Many plants in the brassica family contain glucosinolates which makes them taste spicy.

Glucosinolates also deliver a deadly punch to many soil borne pathogens, nematodes and weeds, making them an effective, all-natural alternative to chemical insecticides and herbicides.

- Relatively new technique used against nematode pests
- *Tagetes patula* “single gold” and sorghum sudan grass are commonly used in the Netherlands and in warmer climates.
- Mustard is also often used in the UK (grown to flowering, then chopped and dug in).
- Growers in the Netherlands aren't allowed to use some of the nastier chemicals, so instead use this marigold. The plants are grown, then cut down and dug into the soil.

Pesticides

- “Pesticides” is the general term for products intended to kill weeds, pests and pathogens.
- Most are best avoided by those wanting to grow their own produce.
- Synthetic pesticides and several natural and semi-natural products are prohibited in certified organic farming systems.
- Products approved under the organic standards are not necessarily the safest for non-target organisms though.
- Be aware of the safety implications of using any pesticide.

Insecticides and fungicides that you might use

- Sulphur products
- Copper products
- Conazole fungicides
- Strobilurin fungicides
- Tar acids
- Phenolic compounds
- Insecticidal soap
- Neem oil
- Pyrethrins
- Synthetic pyrethroids
- Imidacloprid
- Metaldehyde

Conclusions

- When trying to prevent and control pests and diseases, gardens and small horticultural units have the advantages
- Diversify rather than specialise; use a wide range of different techniques to prevent pest and disease attack
- You should have few serious problems (apart from growing under protection).

More information

- The Encyclopaedia of Organic Gardening, HDRA (Ed. Pauline Pears)
- Pests and Diseases (RHS) Pippa Greenwood and Andre Halstead
- National Sustainable Agriculture Information Service (an excellent USA website aimed at crofting style agriculture – <http://attra.ncat.org/horticultural.html>)
- Garden Organic Website <http://www.gardenorganic.org.uk/>
- Using pesticides in the garden http://www.pesticides.gov.uk/garden_home.asp
- Grow Organic Food website - <http://organicgarden.org.uk/gardening/pests-diseases/sprays-organic-for-pest-control>