Plant Health and Pest Management
What is wrong with this fruits, vegetables and nuts?
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Plant Health and Defense

All living organisms must have a way to defend themselves from other organisms which might attack them or cause disease, such as predators and microbes. Plants are no exception to this rule. Plants are at the very bottom of the food chain, which means that many other organisms eat plants to survive.
Plant Health and Defense

In order to ward off pests and pathogens, plants have evolved complex immune systems which deter or kill microbes and even herbivores such as caterpillars. This presentation will outline the ways in which we help our crops to defend themselves against pests, focusing on integrated pest management.
Crops, Pests, and Pesticides

Humans grow crop plants in order to harvest the fruit, vegetable, or other plant products to eat or use in making products.

Corn and tomatoes are two important crops.

Can you think of any other plants that are important for agriculture?
Crops, Pests, and Pesticides

One major type of pest is insects. Insects chew, suck, or burrow into the plant, causing physical damage to the plant, and making the plant vulnerable to infections. The other organisms that eat the crops can be detrimental to crop health and decrease crop yield.

Caterpillars are one of the many organisms that feed on plants. The caterpillar to the right is a tobacco hornworm.

Do you know some more examples of other insects that eat plants?
Crops, Pests, and Pesticides

Scientists have developed pesticides which kill all of the insects on a plant when sprayed onto the plant. Pesticides are extremely useful for getting rid of large insect infestations, and have been extremely important in the development of large-scale farming.
Pesticides can be extremely useful tools for getting rid of insects, but they should be used carefully. Insects grow resistant to pesticides, which means that the pesticide will eventually not work anymore, because all of the insects can survive it.
Spraying with pesticides does not differentiate between the insects which are pests, and the insects which are harmless or even essential to agriculture, such as honey bees and other pollinators.
Aphids steal nutrients from crop plants

Aphids (below) are a type of insect which suck the sugary sap out of plants, which steals the nutrients that the plant needs. Aphids affect corn, also called maize, which is a very important crop.

When aphids infest the reproductive parts of maize (right), it can stop the plant from being able to produce corn, which is the part we eat.
Aphids transmit diseases to crops

In order to feed, the aphid must stick its mouthparts into the plant like a needle, which creates a wound where microbes can get into the plant. In this way, aphids help spread many plant diseases.

One of these diseases is Maize Mosaic Virus, pictured on the right. This virus affects the growth and survival of the plant.
Strawberry and Gray Mold Rot

- Gray Mold Rot is a disease that is caused by a fungus (a special mushroom) that can affect strawberries.
- We lose every 4th strawberry because of this disease.
- The fungus is very difficult to detect in greenhouses, because strawberries mostly show symptoms after they have been harvested.
Potatoes and Potato Mop Top Virus

- A virus in potatoes that causes brown rings and stunted growth
- Economically important to farmers
- No cure for viruses, only preventative methods

[https://cropscience.bayer.co.uk/threats/diseases/potato-diseases/spraing-mop-top/](https://cropscience.bayer.co.uk/threats/diseases/potato-diseases/spraing-mop-top/)
[https://alchetron.com/Potato-mop-top-virus](https://alchetron.com/Potato-mop-top-virus)
Root knot nematode in peanut

- Small worms present in the soil
- Affect several major crops globally, including peanut.
- Nematode infection is characterized by the formation of galls or “knots” in the peanut roots and pots

http://nwdistrict.ifas.ufl.edu/phag/files/2012/10/Root-Knot-Pods.jpg
Root knot nematode in peanut

Susceptible plant

Resistance plant


Alternative Methods to Control Plant Diseases
Intercropping

➔ What is intercropping?
- Two or more crops are grown in one field
- This can be done by randomly mixing plants, by different rows (as the image shows), after each other, closely next to each other but with a small amount of space

➔ What are the benefits?
- Potential increased crop yields
- Improved soil fertility and reduced soil erosion
- Reduced amount of weeds and pests

➔ Are there some drawbacks?
- It’s not ideal for mechanical farming systems
  - Harvesting crops with machines
- It needs more time and good management

D. Dobill; www.masters-sms.agron.iastate.edu
The light that we (humans) can see is called *visible light*, it consists of the colours of the rainbow.

There is also light that we can’t see like *infrared light (heat)* or *UV light*

**UV light** is responsible for sunburn but also skin cancer, but it also has an effect on plants.
UV - light

Scientists found out that UV light can make a plant stronger and more resistant against certain pests and diseases.

UV light works like a vaccine in plants: it can strengthen their immune system against diseases. Scientists are even developing a UV-robot, that drives through your plants to give them UV-light.
Trapcropping: Marigolds

Trapcropping is the practice of planting a plant species which attracts a specific pest away from a crop plant.

Marigolds, pictured on the right, are a common trap-crop, and are used to draw away root nematodes. Marigolds are also toxic to the nematodes, which help keep nematode populations low.
Biological Control

Ladybugs and whitefly larvae are natural predators of aphids. These insects can be introduced to the plant, to feed on the aphids and control their populations!

Aphids pictured with whitefly larvae, a predator of aphids.

A ladybug surrounded by a feast of aphids, on a maize leaf.
Enemy enhancement

Enemy enhancement is the practice of planting other plants near the crop to provide food and shelter for predator insects.

The picture on the left shows a ‘hedgerow’ next to tomato fields. The hedgerow gives hiding spots and food to the animals and other insects which feed on the tomato pests. Ultimately, this is better for the survival of the tomatoes!
Mating disruption

Mating disruption is the process of tricking insects into trying to mate with decoys instead of a member of their species. This is done by releasing pheromones and attracting males. This wastes their time and prevents successful mating with females. Overall, this helps reduce the number of pests present.

Mating Disruption Dispenser
Use of wild species in peanut to fight nematodes

Backcrossing approach: Is like combining strawberry and vanilla ice cream

Resistant plant = Strawberry ice cream

Susceptible plant = Vanilla ice cream

How to move resistances against pest/diseases from wild species?
Let see the ice cream example
Resistant plant = Strawberry ice cream

Combine the two flavors 2 spoon each

Susceptible plant = Vanilla ice cream

Combine again 2 spoon each

Remaining pink color represent the resistance incorporated from wild species
Integrated Pest Management (IPM)

➡️ **What is IPM?**

In IPM, natural predators or parasites are used to control pests. Pesticides are only used as a backup plan if natural prevention fails.

It’s not the same as organic practices: It does not discourage spraying chemicals; it promotes spraying with selective pesticides only when the crop needs it, which generally means that less pesticide is used.
Integrated Pest Management: the Pyramid

- **Chemical Control**: Using selective pesticides
- **Biological Control**: Beneficial bugs are used to control harmful pests
- **Physical/Mechanical Control**: Includes hand-picking, traps, barriers, vacuuming etc.
- **Cultural/Sanitation Control**: Selecting varieties, which are best for the local growing conditions
- **Prevention**: Preventing pests by good practices e.g. intercropping, resistant cultivars, clean environment
IPM model of continual improvement

STEP 1 - KNOWLEDGE
- Key pests
- Pest lifecycles
- Natural enemies
- Growing area

STEP 2 - PREVENTION
- Site selection
- Variety
- Time of planting & rotations
- Water & nutrition management
- Farm hygiene
- Pest host management

STEP 3 - OBSERVATION
- Crop monitoring
- Pest prediction models
- Pheromone traps
- Yellow sticky traps

STEP 4 - INTERVENTION
- Mechanical controls
- Biological controls
- Chemical controls

STEP 5 - EVALUATION & PLANNING
- Review monitoring records, talking, listening, reading, thinking
- Consult & adapt
Do we need pesticides?

What do you think?