OLAM DE FOUNDATION KUIT CONSULTANCY

Pest and Disease Management

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1. Why pest and disease management

- In a natural ecosystem undisturbed by agriculture, pest, diseases and their hosts are in balance
- In agricultural systems this balance is often missing. Intensive cultivation of coffee means a large concentration of food for coffee pests and diseases in one place
- Natural organisms can be beneficial:
  - Decomposition of organic matter → supply of nutrients;
  - Natural predators that attack coffee pests
- But, some natural organisms can also attack the crop that we try to grow

Can you name more predators than the ones shown above?

2. Basic principles of plant protection

- A strong and healthy tree will have less pest and disease problems. Insufficient nutrition makes a plant more vulnerable
- Some coffee varieties are more susceptible to disease than others that are more resistant
- Damage done by pests and diseases can never be completely avoided. Aiming for complete control, especially with chemicals can:
  - Also damage natural enemies of the pest or disease;
  - Cost more money than you get from extra yield;
  - Pollute the environment;
  - Damage human health; and
  - create resistance of the pest or disease against the chemical used
- Therefore we should try to:
  - Frequently check the health of our trees;
  - Use resistant varieties when planting new trees
  - Ensure sufficient nutrition to create strong and healthy trees
  - Control pests and disease from the start when their population is still small;
  - Start with cheaper and less destructive methods of cultural or biological control and treat chemicals as an option of last resort

Can you give an example of a disease resistant variety?

3.Pests: Scales

- What:
  - Scales are sap-sucking insects that feed on leaves and young twigs. Different types occur, but effects and treatment are similar
- Damage and symptoms:
  - Reduced growth and crop yield. Black sooty mould on leaves, sweet excrement of scales attracts ants that protect scales from their natural enemies
- Control:
  - Avoid ants entering the tree by removing any branches that touch the ground and applying a 10-15cm band of sticky material around the trunk;
  - Spraying of mineral oils (200ml per 18l of water), make sure the fluid completely covers the scales, only spray infected trees where more than 10 leaves are affected
  - Spray Cypercal (follow instructions on label)

Why do ants protect scales from natural enemies?

Growth stage:

Occurrence:

3. Pests: Mealy bug

- What:
  - Small bug (2.5mm) feeding on all green parts of the tree, but most often found around flowers and young fruit
- Damage and symptoms:
  - Reduced vigor, yield loss. Heavy honeydew production, white and/or sooty mould. Ants feed of honeydew and protect colonies from natural enemies
- Control:
  - Similar to scales

Growth stage:

Occurrence:

What is the white stuff in the second picture?

3. Pests: Stem borer

- What:
  - Insect that lays eggs in the bark, the larvae nestles in the stem and eats its way inside. Several different types occur.
- Damage and symptoms:
  - Wilting of leaves, loss of branches, whole tree can die if left unattended, yield decline.
- Control:
  - Less damage seems to occur under moderate shading conditions
  - From the top down, cut infected part of the tree just below the last set of wilting branches where the wilting. Burn the cut part immediately to avoid the larvae from spreading
  - If the borehole in the stem can be found it sometimes is possible to insert a thin metal wire and kill the larvae

Growth stage:






Occurrence:

How is the stem borer brought into the field?

3. Pests: Coffee Berry Borer

- What:
  - Insect that lays eggs in young green cherries. Its larvae feed on the young beans. Infestation is carried over from 1 season to the next in overripe and fallen cherries
- Damage and symptoms:
  - Premature cherry drop, yield loss. Infected cherries have a little entry hole at the top of the cherry
- Control:
  - Reduce heavy shade
  - Prune the coffee to keep the tree as open as possible
  - Harvest at least once a week
  - Pick ALL fallen cherries from the ground, if the field is mulched spread a tarpaulin under the tree during picking to avoid missing fallen cherries. This works best if ALL farmers do it!
  - All infested cherries should be burned
  - Before main flowering the tree should be completely stripped of any remaining cherries
  - Spraying can be done but is usually not needed if the above measures are carried out rigorously
  - Chemicals that can be used are Cypermetrin, Deltametrin and Chlorpyrifos
  - However, spraying without the cultural measures described above will have very little effect!

Why is it so important to keep the field clean of fallen cherries?

Growth stage:

Occurrence:

3. Pests: Coffee Berry Borer

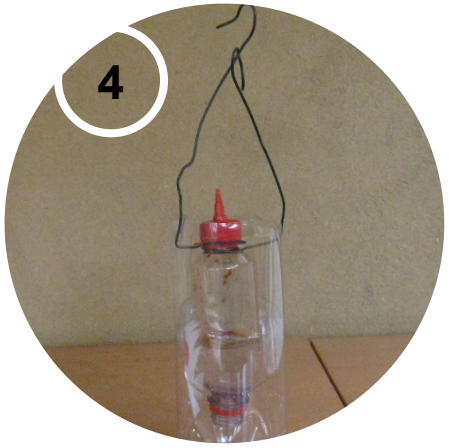
- Control:
  - Another control option is the use of traps;
  - Traps can be made quite easily and farmers in South America use them successfully
- How to make a trap?
  - Materials needed for 1 trap:
    - Empty plastic bottle of (volume of 1 or 2l)
    - Piece of metal wire, about 50cm long
    - Small plastic bottle with cap (volume of about 10ml)
    - Mixture of ethanol and methanol
    - A little bit of detergent
    - Sharp knife and pliers

?

What are good sources of empty bottles?

3. Pests: Coffee Berry Borer

- Construction:
  - Take the big bottle and cut the top off (picture 1)
  - Insert the cut off bottle top in the bottom of the bottle (picture 2)
  - Make a small hole (2mm or so) in the cap of the small bottle
  - Fill the small plastic bottle with a mixture of ethanol and methanol (1 part of each)
  - Attach the small plastic bottle to the metal wire by wrapping it around the neck (picture 3)
  - Punch 2 small holes opposite each other and 3 cm below the rim of the big bottle and thread the wire with the small bottle through the holes (picture 4)
  - Make sure the small bottle hangs in the middle of the opening and does not touch the sides of the big bottle
- The trap will be hung in a tree with the metal wire
- Hang the trap at about 1.2m height in the tree and fill the bottom of the big bottle with soapy water, take care that the original opening of the bottle is not submerged!



3. Pests: Coffee Berry Borer

- How does it work?
  - The Coffee Berry Borer is attracted by the smell of the ethanol methanol mixture and it keeps circling the small bottle
  - Eventually it will tire and drop down, right in the top half of the bottle which acts as a funnel
  - The Coffee Berry Borer end up in the soapy water from which it can not escape
- Operation:
  - One needs about 15 traps per hectare of coffee land. Traps should be regularly spaced over the land.
  - Ideally the traps are put in the trees after the main harvest. They should be kept in the trees until the peak of the first rainy season.
  - Every week the traps should be checked. The soapy water and the ethanol/methanol mixture should be topped up if needed
  - Depending on how many Coffee Berry Borers you catch you should occasionally empty the bottle, clean it and put it back in the tree
- Note: several designs are possible, you could also try the one in the bottom picture

Try to keep track of how many you borers catch by counting them!

3. Pests: Antestia bug

- What:
  - Small bug feeding on small cherries, flower buds and growing tips. Eggs are laid at the underside of leaves
- Damage and symptoms:
  - Blackening of flower buds, fall of immature cherries, multiple branching and shortened internodes[1]
- Control:
  - Prune to open the tree
  - Hand collection of bugs can be successful in small plantations. Collect once week, place a tin with smoldering plant material under the tree. The smoke causes the bugs to run to the centre of the tree where they can be picked up. Drop them in a container with a little kerosene to kill them.
  - Spraying may be necessary when the number of bugs per tree exceeds 2. Chemicals that can be used are: chlorpyrifos-methyl + cypercal, deltamethrin

Growth stage:

Occurrence:

Does it make sense to try and collect Antestia bugs during harvest?

3. Pests: Leaf miner

- What:
  - Moths that lay eggs on the leaves. Larvae then feed on leave tissue. The full grown larvae is a whitish caterpillar. After about a month the caterpillar spins a white cocoon from which it will appear 2 weeks later as a moth.
- Damage and symptoms:
  - Infected trees show large, irregularly shaped brown spots (do not mistake this type with a more innocent one that results in silvery tracks on the leaves). Leaves can drop prematurely and in case of heavy infestation result in dieback
- Control:
  - Before spraying the size of the moth population needs to be determined. Check this by shaking an infected tree and estimate how many moths fly out. If this number exceeds 30, spraying may be needed. At the same time samples of cocoons should be taken. When these give a yellow fluid when squeezed the caterpillar is still present and spraying on that day will not be effective.
  - Depending on the distribution of moths in the field spraying only infected trees can be enough. During the moth season and if infestation exceeds the threshold level of 30 moths per tree, spraying should be done once a week. You can use Cypercal.




Why does spraying not work when the caterpillar is still in its cocoon?

Growth stage:

Occurrence:

3. Pests: Nematodes

- What:
  - Soil-borne pest, mostly invisible to the naked eye. Nematodes feed on sap from the roots
- Damage and symptoms:
  - Nematodes can cause fungal and bacterial infections of the root system, reducing vigour. Actual damage depends on the tolerance threshold and actual condition of the tree. In bad cases the tree can die. In the nursery a reduced root development and thickening of the root collar is indicative of nematode infection
- Control:
  - Effective control starts in the nursery by sterilizing nursery soil. This can be done by covering the nursery soil with clear plastic for 2-3 days prior to use. This should be done on a sunny day, the high temperatures kill large amounts of nematodes
  - Weed control is important, several weed species are host plants for nematodes
  - Pruning of the tree stimulates root development, good pruning can help overall tree health and thereby increase the tolerance threshold level to nematodes
  - The roots of Crotelaria are suspected to release a substance toxic to nematodes, inter-planting of this plant may help
  - Seed beds of nurseries can be treated with a nematicide such as Plantima

Why is chemical control of nematodes so difficult?

Growth stage:

Occurrence:

4. Diseases: Brown eye disease

- What:
  - Fungal infection of leaves and sometimes cherries
- Damage and symptoms:
  - Affected mostly during seedling stage, can reduce vigor. The diseases shows as browns spots on leaves and cherries
- Control:
  - Brown eye disease is associated with a lack of in particular nitrogen and a lack of shade
  - Improvement of tree nutrition and shading should be sufficient to control the disease
  - Fungicide applications can be used but do not remedy the cause of the disease and is hence not recommended

Growth stage:

Occurrence:

Why does a lack of shade reinforce a lack of nitrogen?

4. Diseases: Damping off

- What:
  - A soil-borne bacterial infection affecting root system of seedlings, caused by over-wetting the nursery or by re-use of old nursery soil
- Damage and symptoms:
  - The stem of young seedlings can be rotten, patches of seedlings can die off quickly
- Control:
  - Do not re-use old nursery soil
  - Avoid excess humidity in the nursery
  - Disinfect soil prior to seeding. This can be done by sprinkling formalin in a 2% concentration over the seedbed
  - If the disease does appear affected seedlings and those surrounding them should be burned and the soil and remaining healthy seedlings should be sprayed with a fungicide

Growth stage: 

Occurrence: During nursery stage

How often should you check the health of your nursery?

4. Diseases: Coffee Leaf Rust

- What:
  - Fungal infection of leaves. Leaf rust needs sufficient humidity and temperatures above 20°C to develop.
- Damage and symptoms:
  - Red rust patches on affected leaves resulting ultimately in leaf drop. Reduced foliage limits photosynthetic capacity and can reduce yields
- Control:
  - As with all diseases the first priority should be to have strong and healthy trees. Proper pruning can help somewhat to limit spread of the disease
  - Leaf rust resistant varieties exist, but are not available in Cameroon
  - If Leaf rust occurs, copper-based fungicides can be sprayed. When spraying, care should be taken that the underside of the leaves is reached as this is where Leaf rust develops.
    If the disease continues to spread other fungicides can be used such as Bumper or Tilt

Growth stage:

Occurrence:

Can pruning help in the control of leaf rust? How?

4. Diseases: Coffee Berry Disease

- What:
  - Fungal infection of berries
- Damage and symptoms:
  - Cherries become infected just after flowering and die on the tree leading to cherry drop. Up to 80% of the potential yield can be lost of infection is severe. The disease shows as dark, sunken spots on premature cherries. Development of the disease starts during the pin head stage (about 6 weeks after flowering).
- Control:
  - Coffee Berry Disease is hard to control, the single most important thing to do is to use resistant varieties such as Java
  - Fungal spores can be spread by wind, water and organisms that move in the field. A moderate level of shade can help to prevent spreading of the disease. Shade plants (not trees) planted in between coffee trees also helps to control the spread of the disease by forming a physical barrier.
  - Farm hygiene is important as well, pick any infected cherries from the tree and the ground and burn them
  - Chemical control can be done by 7 to 8 applications of Chlorotalonil and cuprics (Copper oxychloride, Copper hydroxide), or by 5 applications of fungicides that contain Bumper

What should be done with the situation in picture 2?

Growth stage:

Occurrence:

4. Diseases: dieback

- What:
  - Dieback is not actually a disease but results from a heavy crop in 1 year and a decline in yield the next. It can also be brought about as a result of diseases such leaf rust
- Damage and symptoms:
  - Severe loss of leaves and dying of young branches, in severe cases the whole tree may die. The decline that is seen on the tree also affects the root system
- Control:
  - Ensuring healthy and strong trees by applying sufficient fertiliser and/or mulching and manure
  - A moderate level of shading helps
  - Proper pruning is also important

Growth stage:

Occurrence:

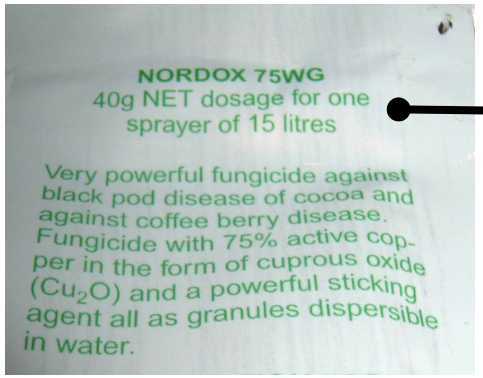
What should be done with the situation in picture 2?

5. Types of agrochemicals

- Types of agrochemicals are:
  - Fungicides: work against fungal diseases
  - Herbicides: used to kill weeds
  - Nematicides: used to kill nematodes
  - Insectides: used kill pests
- Within these broad categories a further distinction can be made between selective and broad spectrum chemicals. Selective ones only affect the pest, disease or weed for which it was designed whereas broad spectrum can also affect natural predators of the pest you are trying to control
- Note: information on safe application of pesticides is given in the Health and Safety training!

6. Dosage calculation example

- How much pesticide should I use?
  - The backside of the package tells how to mix the chemical, but you still need to calculate how much you need. This calculation is based on the number of trees that you have in your field.



Concentration

With 1 liter I can spray about 16 trees

I have 1600 trees in my field

1600/16=100 litre of mixture is needed for my field

According to the package 1 sachet of 40gr is enough for 15 liters

100/15=7 sachets needed

My knapsack sprayer has a content of 20 liters
100 liter / 20 liter per knapsack =5 knapsacks is what I need to apply

7. Locally available coffee pesticides

Pesticide	Brand name	Used against	Toxicity
Cypermethrine	Cypercal	Scales, Mealy bug	Class II-Class III Moderately to slightly toxic,
Endosulfan	Thiodan	Antestia	Class II Moderately toxic, banned by Utz
Cypermetrin	Ammo ,	Antestia	Class II Moderately toxic
Deltametrin	Cymbush, K-Obiol,	Antestia	Class II Moderately toxic
Copper oxychloride	Decis	Leaf rust, Coffee Berry disease	Class III Slightly toxic
Copper hydroxide -	Kocide	Leaf rust, Coffee Berry disease	Class III Slightly toxic
Chlorpyrifos	Dursban	Antestia	Class II Moderately toxic
Chlorothalonil	Bombadier	Coffee Berry disease	Class IV Moderately toxic
Oxamyl	Vylate	Nematodes	Class I Highly toxic
Propiconazole	Bumper,	Coffee Berry disease	Class IV Practically non toxic
Imidaclopride	Plantima	Leaf miner, nematodes	Class II Moderately toxic