The Fundamentals of Agronomy and Agroecology

Key Lessons from the Training Conducted at Ceffel in Madagascar

Soil Health and Fertility | Plant Nutrition | **Plant Health**

1 Key Factors

Plants are living organisms that are often confronted with pests/pathogens that can compromise production and the quality of their grains/seeds. Just like humans, plants therefore need to be in perfect health to ensure their **proper development and good crop production and reproduction**. On the other hand, a plant that is attacked weakens, its development is slowed, and the plant may even be destroyed. Ultimately, production and thus income are impacted.

Bacterial wilt on potato (Ralstonia)

Damage caused by Fall Army Worm on maize (insect)

2 Agronomic Considerations

Similar to a doctor who possesses knowledge to treat a sick person, a farmer must have the technical skills to manage the enemies of the crops they cultivate. To do this, they must know the main families of pests and their specificities: **fungal or bacterial diseases, insects, mites, weeds, viruses,** etc. It is necessary not only to identify the causative agent but also to know its biological cycle and its harmfulness/damage potential.

Alternaria leaf spot on onion (fungal disease)

This damage/harmfullness potential (in terms of yield and/or financial loss) manifests at all stages of the crop:

- **Germination:** poor emergence, damping-off, attacks on roots or seeds, particularly by pests consuming seeds and roots or even by some insects that lay eggs directly in the seedling tissues.
- **Growth and development:** pests often feed at the expense of the crop, causing stunted growth and abnormal appearance of the organs affected by the pests. The surface area of the leaves is reduced, thereby reducing photosynthesis.
- **Flowering:** delays, poor formation or sterility of flowers, flower drop often caused by insects feeding on flowers or young pods.
- **Fruiting:** delays, deterioration in quality (size, taste, visual appearance), absence or abortion, poor grain filling resulting in lower seed quality and sometimes in the transmission of diseases or viruses.

3 Observe and Diagnose

Observe symptoms :

- Compare a healthy plant to a plant showing symptoms
- General appearance: vigor, growth, color
- Leaves: shape, size, appearance, color, presence of abnormalities or foreign bodies
- Other elements: roots, stem, fruits and flowers
- Distribution and progression of symptoms on the plant and on the plot

Identify risky conditions

- Weather of the previous days
- Previous stressful climatic episode (cyclone, drought, etc.)
- Irrigation: water source and frequency

Question the farming practices

- Type of crop (family) and previous crop
- Time of appearance of symptoms and evolution
- Fertilizers (organic or not): type, content, dose, date, and mode of application
- Phytosanitary treatments: type of product, dose, date, timing and mode of application

Identify the causative agent:

- Type of agent/pest (insect, fungus, bacteria, virus, etc.)
- Species (possible aid using tools and recognition apps)
- Life cycle: reproduction, propagation, mode of survival/persistence
- ⚠️ A magnifying glass or mobile recognition apps can be used to help identify pests.

plantix
Pl@ntNet


Aflatoxin on maize (produced by a fungal disease)

Assess the risk to decide on future crops:

- What are the possible hosts, to avoid replanting a host plant the following season?
- Does the pest remain in the environment for a long time? Does it spread over long distances?


Bacterial wilt (Ralstonia) test (bacterial disease)

4 Main Strategies

Preventive measures (to be prioritized)

- **Crop rotation:** alternate plant families
- **Use of healthy and possibly treated seeds:** fungicide, insecticide, bactericide
- Use of **tolerant or resistant varieties**
- **Regular monitoring** of the nursery or plot
- **Promote beneficial organisms (auxiliaries):** avoid broad-spectrum pesticides, maintain a diverse landscape and plant biodiversity

1 – Diagnosis and decision
- Alerts
- Diagnosis methods and tools
- Thresholds

2 – Treatment and Control
- Chemical control
- Biocontrol
- Physical control
- Mechanical control
- Service plants

3 – Prevention and Indirect Control
- Agronomic practices: rotation, tillage, push/pull, nets, etc.
- Genetics: resistant varieties
- Beneficial organisms (auxiliaries)

Evaluation of the adopted strategy and adjustments

- **Good agricultural practices:**
  - Choice of crops and sowing dates adapted to soil and climate conditions
  - Well-decomposed organic fertilizers
  - High-quality plant nutrient
  - Use of agroecological products for prevention
  - Use, if necessary, of certified chemicals
- **Application of biopesticides** with preventive or repellent action in case of risk of attack
- **Regular cleaning of the field:** removal of weeds and sources of inoculum (diseased plants, residues, damaged fruit)
- **Cleaning and maintenance of agricultural tools and equipment (harvesters, etc.)**

Curatives measures

- Use of inorganic or organic pesticides, choosing an active ingredient that is effective on the target, respecting the dose, frequency, and method of application
- Mechanical: Uprooting and destruction (burning) of diseased plants, traps

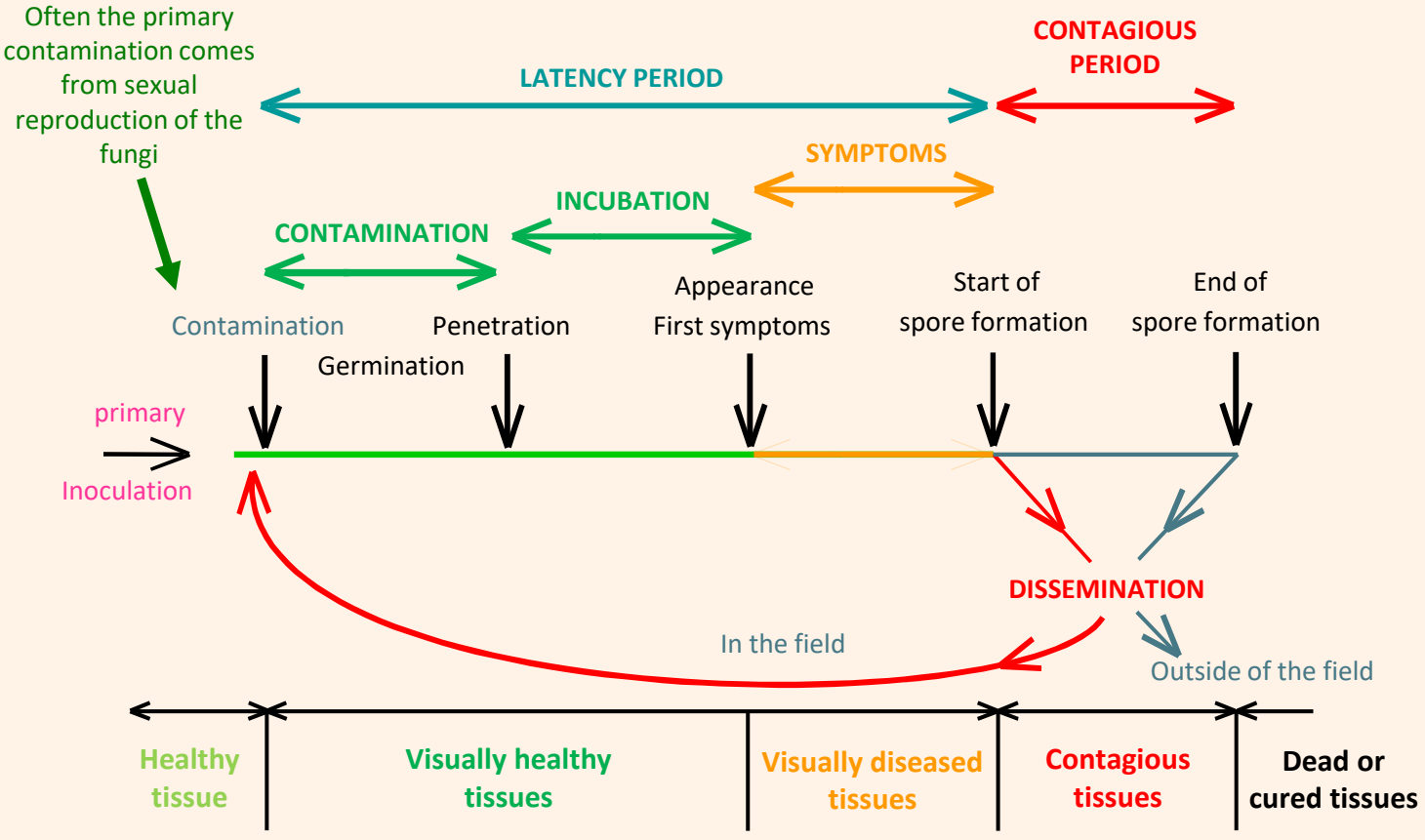
5 Key Elements to Consider

Ensuring effective treatment:

- Conduct regular observations, preferably in the morning or evening, as insects may hide during peak heat.
- Be attentive to risky weather conditions.
- Know the pest's life cycle to intervene at the appropriate time.
- React quickly if its evolution is fast and its harmfulness potential is high
- Rotate active ingredients to avoid the development of resistance.

➡ *Refer to the recommendations of the HRAC/FRAC/IRAC websites or download their apps.*

Cycle of a Fungal Disease ARVALIS



Controlling efficiently without impacting the environment:

- Respect the usage recommendations indicated on the label (for commercial products): target (species and lifecycle stage), active ingredients, dose, modes of action and penetration (contact/systemic).
- Apply biopesticides regularly, as they often have a preventive action. Application must be frequent to be effective.
- Carry out treatments in the morning or evening during calm weather to optimize effectiveness. Target the pest where it is located (on/underneath leaves, when it is active).

Personal protection:

- Use Personal Protective Equipment (PPE) when applying phytosanitary products.
- The feet and hands are the most vulnerable areas and must be covered in priority, as well as head.
- Avoid dissemination of the products to neighboring farms or homes.

Prevent propagation :

- Issues observed in one plot can spread to neighboring plots.
- The advisor's role is therefore essential to inform and alert quickly.
- Prioritize collective action and awareness creation at the territorial/ watershed level, especially for bacteria and soil-borne fungi (e.g., Ralstonia) that can be spread by water runoff on slopes.