

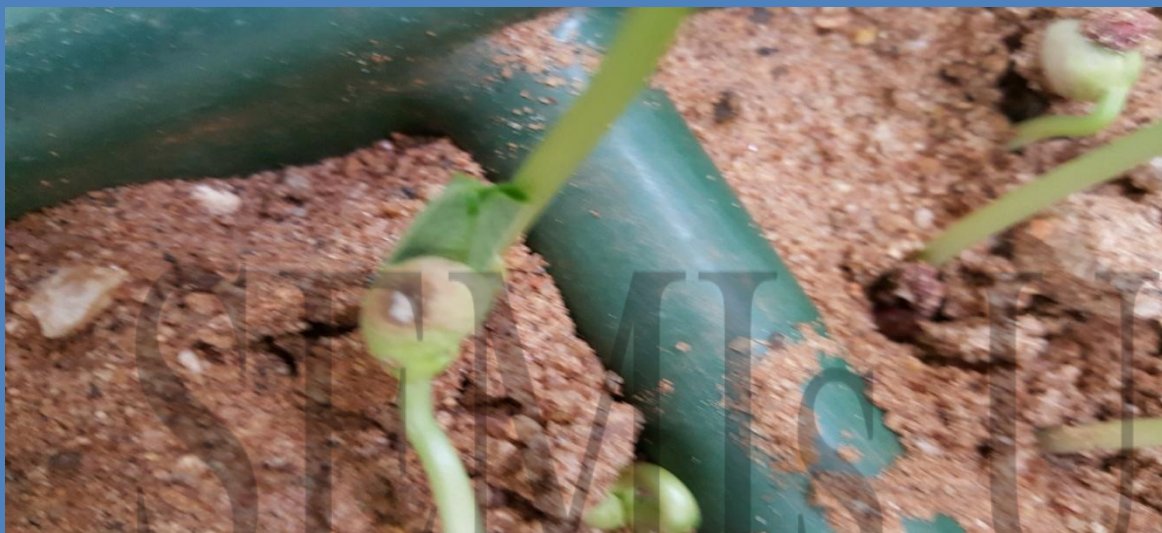
Seed Borne diseases of Seed Crops

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Prof. A. W. Mwang'ombe-Seed borne diseases



Seed Borne diseases of Seed Crops

- Seeds are attacked by plant pathogens at various stages:
 - The mother plant get infected by the pathogen, it can attack seed also.
 - During processing.
 - At the time of transportation.
 - During storage

Seed contamination or infestation

Pathogen itself or parts of it stick or mix with seeds during:

Harvesting

Extraction

Threshing

Selection

Packing

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Accompanying contamination

Physical mixing of the seed with pathogen's propagation organs

- Spores
- Sclerotium
- Nematode's galls
- Contaminated plant parts or soil particles containing pathogens

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Diseases in seed crop production:

Location of pathogen in seed

- Infection of the embryo
- Under the seed coat
- In the endosperm or cotyledon
- On the surface of seed

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Diseases in seed crop production

- How pathogens infect seed :

- Systemic Infection of the Seed

- Through flowers, fruits or funiculus
- Through the stigma
- Through the wall of the ovary or
 - immature seed covers
- Through wounds & natural openings

Diseases in seed crop production:

❑ Seed contamination or infestation

- Pathogens that stick to the surface of the seed

❑ Accompanying contamination

- Structures of the pathogens
- Mix with infected plant parts
- Soil

Seed Borne diseases of Seed Crops

- **In summary:** There are three types of infections:
 - ✓ 1) Internally seed borne: Pathogen attacks seed sod, endosperm & embryo
 - ✓ 2) Externally Seed borne: Pathogens externally carryover on the seeds.
 - ✓ 3) Fruity bodies/spores:

Effects of seed infection:

- Germination % get reduced.
- Due to changes in morphology, the market level get reduced.
- Due to infection it induces the changes in the content get reduced.
- Due to infection it induced the secretion of toxic chemicals ex: Aflatoxin and other mycotoxins

Methods of testing for the presence are of four main types. The seeds may be

- (1) directly examined ,
- (2) examined after incubation-using blotter methods,
- (3) plated on agar so that the pathogens grow out into colonies and
- (4) subjected to techniques which allow the use of modern serological developments viz., ELISA or other Molecular biology techniques

Methods for Detecting Seed Borne Fungi:

Examination of dry seeds:

- It is applied for detection of seed borne fungal pathogens which cause discoloration of the seed or change the shape and size of the seed.
- Also applicable for detecting fungal structures present in, on or with seed.
- Examples:
 - Karnal bunt of wheat caused by *Tilletia indica*
 - Ergot of sorghum caused by *Claviceps sorghi*

Washing test:

- This method is used particularly for smut and bunt fungi in gramineous hosts except loose smut of wheat and barley.
- It can also be used for downy mildew (*Peronospora manshurica*) of soybean.

NAOH seed soak method:

- Applied for Karnal bunt of wheat caused by *Tilletia indica*
- and bunt of rice caused by *Tilletia barclayana*

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Blotter method

- This method is widely used.
- All kinds of cereals, vegetables, crucifers, legumes, ornamentals and forest seeds are tested by this method.

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Seedling symptom test:

- This test is applicable for those fungi which are capable of producing symptoms on the root and shoot of the young seedlings.
- This test for certain pathogens, provide information pertaining to field performance of the seed lot.

Some Important diseases in Kenya

Diseases in seed crop production

**Maize
Lethal
Necrosis
Disease**



Some Important diseases in Kenya: **Diseases in seed crop production**

Diseases in seed crop production

Maize

Loose smut



Head Smut



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Diseases in seed crop production

Diplodia stalk and ear rot of maize

Maize



Diseases in seed crop production

Ear rot of maize

Maize

Fusarium ear rot



Diplodia



Fusarium ear rot



Trichoderma



Some Important Seed- Borne Fungal Diseases of Major Crops

Crop	Disease	Causal agent
Wheat	Loost smut Karnal smut Flag smut	Ustilago segetum var. tritici Neovossia indica Urocystis agropyri
Rice	Bunt False Smut Stackburn	Neovossia horrid Ustilaginoidea virens Pyricularia oryzae Trichoconiella padwickii
Maize	Black kernel rot Cob rot Southern leaf blight	Botryodiplodia theobromae Fusarium Moniliformae Drechlera maydis
Pearl millet	Downy mildew Smut	Sclerospora graminicola Tolyposporium penicillariae

Some Important Seed- Borne Fungal Diseases of Major Crops

Crop	Disease	Causal agent
Sorghum	Anthracnose Kernel or grain smut Downy mildew	<i>Colletotrichum graminicola</i> <i>Sphacelotheca sorghi</i> <i>Peronosclerospora sorghi</i>
Beans	Anthracnose Angular leafspot Charcoal rot	<i>Colletotrichum lindemuthianum</i> <i>Pseudocercospora griseola</i> (Syn. <i>Phaeoisariopsis griseola</i>) <i>Macrophomina phaseolina</i>
Cowpea	Anthracnose Root rots charcoal rot	<i>Colletotrichum lindemuthianum</i> <i>Rhizoctonia solani</i> <i>Macrophomina phaseolina</i>
Pigeonpea	Fusarium wilt Macrophomina stem canker	<i>Fusarium udum</i> (<i>Gibberella indica</i> -teleomorph) <i>Macrophomina phaseolina</i>

Some Important Seed- Borne Fungal Diseases of Major Crops

Crop	Disease	Causal agent
Banana	Panama disease or Fusarium wilt -vegetatively propagated	<i>Fusarium</i> <i>oxysporum f. sp.</i> <i>cubense</i>

Some Important seed-borne bacterial, Viral, nematode pathogens

Bacterial Pathogens Borne in True Seed

- **Crop Pathogen(s)**

- **Wheat:** *Pseudomonas syringae* pv. *syringae*,
Xanthomonas campestris pv. *translucens*

- **Maize:** *Pantoea stewartii* subsp. *stewartii*,
Clavibacter michiganensis subsp. *nebraskensis*

- **Rice:** *X. oryzae* pv. *oryzae*, *X. oryzae* pv. *oryzicola*,
Acidovorax oryzae

Some Important seed-borne bacterial, Viral, nematode pathogens

- **Bean:** *Pseudomonas savastanoi pv. phaseolicola* (*P. syringae pv. phaseolicola*), *Curtobacterium flaccumfaciens pv. flaccumfaciens*, ***Xanthomonas axonopodis pv. phaseoli*** (*Xanthomonas campestris pv. phaseoli*) and ***Xanthomonas axonopodis pv. phaseoli var. fuscans*** (*X. campestris var. fuscans*)
- **Soybean:** *P. syringae pv. glycinea*
- **Chickpea:** *Rhodococcus fascians*
- **Cereals, grasses:** *Rathayibacter sp.*
- **Alfalfa:** *C. michiganensis subsp. insidiosus*

Some Important seed-borne bacterial, Viral, nematode pathogens

- **Crop Pathogen(s)**

- **Potato:** *Clavibacter michiganensis* subsp. *sepedonicus*, *Ralstonia solanacearum*, *Streptomyces scabies*, *Erwinia/Dickeya* spp.,

- **Cassava:** ***Xanthomonas axonopodis* pv. *manihotis* and *cassavae*** (*Xanthomonas campestris* pv. *manihotis* and *cassavae*)

- **Banana:** *X. campestris* pv. *musacearum*

Some Important seed-borne bacterial, Viral, nematode pathogens

- Seed health testing: Important means of reducing disease risk
- Direct testing
 - ✓ Symptoms/grow-outs
 - ✓ Isolation of pathogen
 - ✓ Identification
 - ✓ Proof of pathogenicity

Some Important seed-borne bacterial, Viral, nematode pathogens

Indirect testing

- Detection of proteins (serological)
- Detection of nucleic acids: (PCR, isothermal amplification, etc.)

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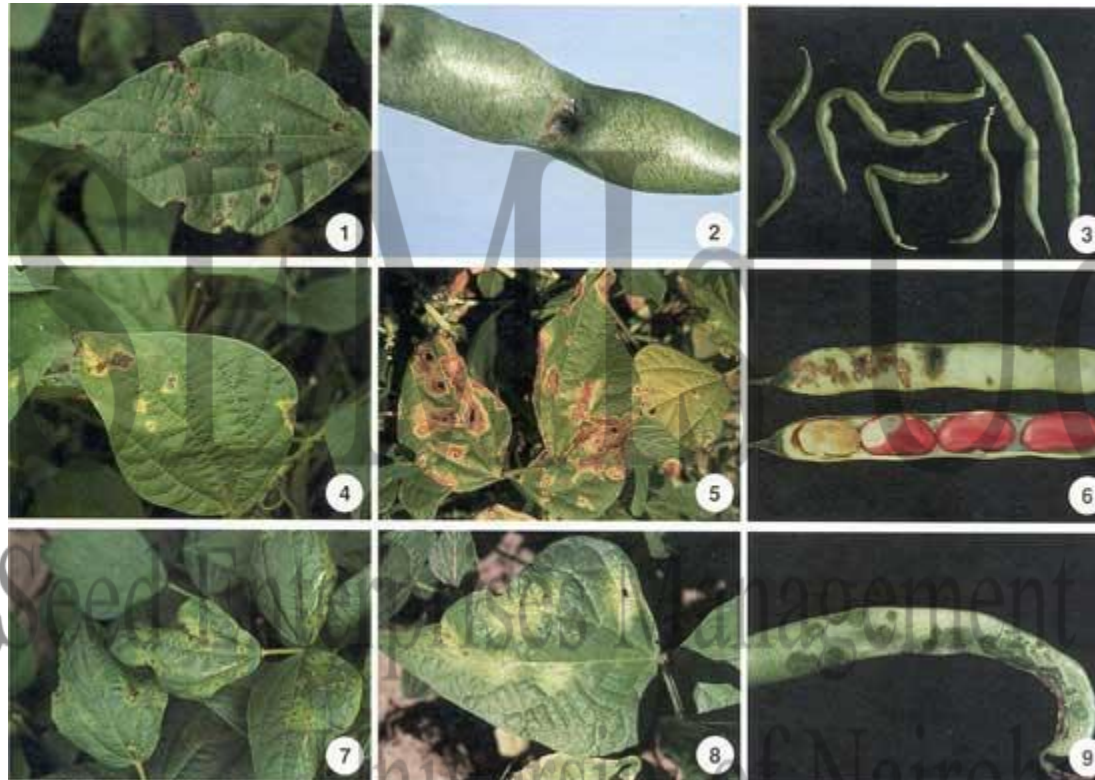
Halo blight of beans: The blackish spots have a small or sometimes large light halo (chlorosis or yellowing tissue) around them



Common bacterial blight of beans



Common Bean: Halo Blight & CBB



Ralstonia solanacearum (bacterial wilt)-Symptoms

Tomato plant showing advanced stages of bacterial wilt.



Longitudinal section of a tomato stem showing the browning vascular system.



Seed Borne Viral Diseases:

- *Bean common mosaic virus* (BCMV) is still an important disease of beans worldwide
- BCMV is seedborne in bean.
- *Bean yellow mosaic virus* (BYMV),
- **Bean Common Mosaic Necrotic Virus**
- *Soybean mosaic virus* (SMV)

Maize Lethal Necrosis Disease (MLND):

The **Maize Lethal Necrosis Disease (MLND)** is a result of a combination of two viruses, the Maize Chlorotic Mottle Virus (MCMoV) and any of the cereal viruses in the Potyviridae group, like the Sugarcane Mosaic Virus (SCMV), Wheat Streak Mosaic Virus (WSMV) or Maize Dwarf Mosaic Virus (MDMV).

The double infection of the two viruses gives rise to what is known as MLND, also referred to as Corn Lethal Necrosis (CLN).

In Kenya: so far: Maize Chlorotic Mottle Virus (MCMoV) and Sugarcane Mosaic Virus (SCMV)=MLND

Seed borne Nematodes

- Wheat: *Anguina Tritici*
- Potato cyst nematode: ***Globodera rostochiensis in Kenya***

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Potato cyst nematode: *Globodera rostochiensis* in Kenya.



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