SEED ENTERPRISE MANAGEMENT INSTITUTE (SEMIs)

Seed Production Short Course

26th – 31st May 2014

Diseases in Seed Crop Production

Prof. James W. Muthomi
Department of Plant Science and Crop Protection
University of Nairobi

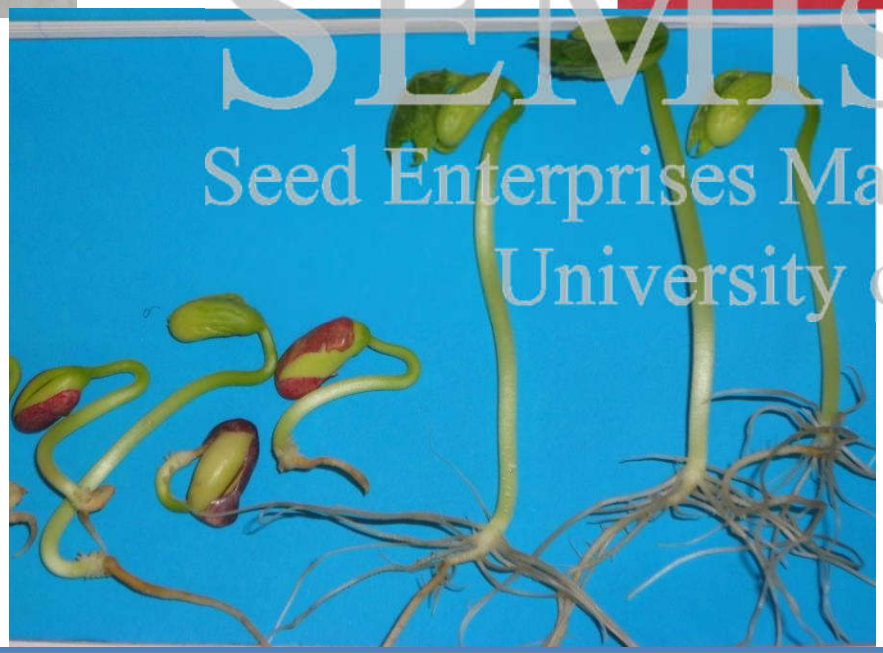
Diseases in seed crop production

Disease	Causal agent
Bean anthracnose	Colletotrichum lindemuthianum
Halo blight (bean)	Pseudomonas savastanoi phaseolicola
Common bacterial blight (bean)	Xanthomonas axonopodis phaseoli
Bean common mosaic	Bean common mosaic virus
Head smut (maize)	Sphacelotheca reiliana, Ustilago maydis
Gray leaf spot (Maize)	Cercospora zea-maydis
Maize leaf blight	*Drechslera turcicum*
Stalk rot / ear rot (maize)	*Fusarium graminearum, F. verticillioides, F. proliferatum , F. subglutinans , Stenocarpella maydis*
Bacterial blight (cow pea)	*Xanthomonas campestris vignicola*
Sclerotinia wilt & head rot (sun flower)	Sclerotinia sclerotiorum
Botrytis head rot (sunflower)	Botrytis cinerea

Diseases in seed crop production

Reduced seedling vigour

Seed discolouration, Shrivelling, rotting & reduced size



Reduced seedling vigour

How does seed contamination occur?

Seed contamination or infestation

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

- Harvesting
- Extraction
- Threshing
- Selection
- Packing

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

Location of pathogen in seed

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

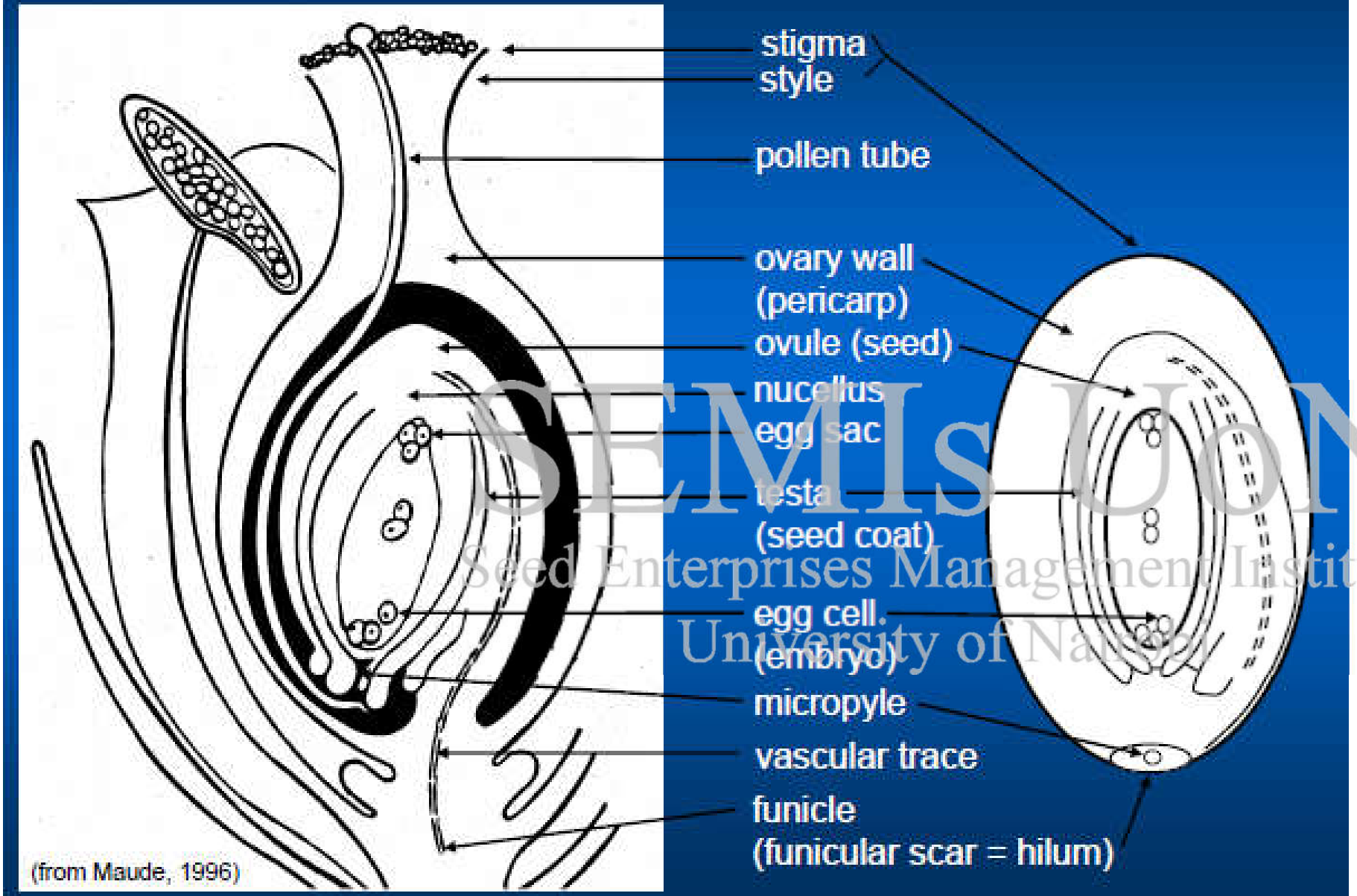
How pathogens infect seed

- **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

- **Seed contamination or infestation**
  - Pathogens that stick to the surface of the seed

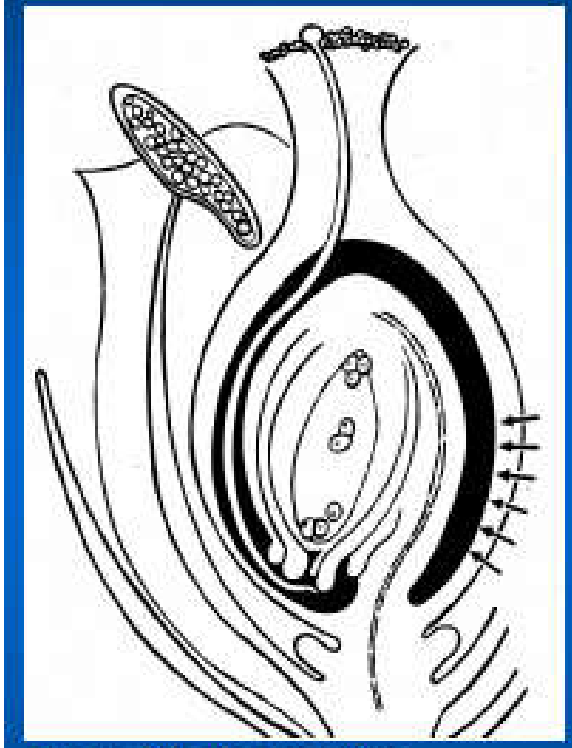
- **Accompanying contamination**
  - Structures of the pathogens
  - Mix with infected plant parts
  - Soil

Routes of active seed infection



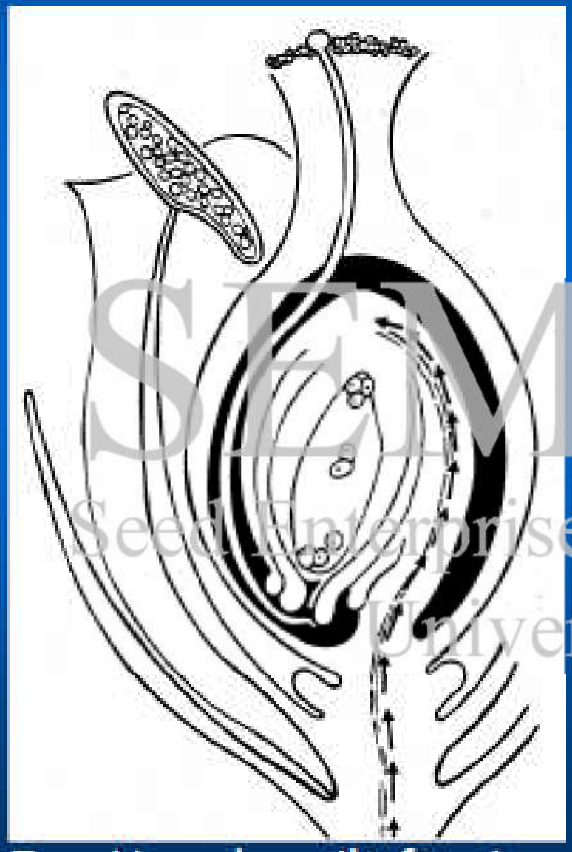
Routes of active seed infection

A. Penetration through ovary wall



E.g.: *Cladosporium variabile* (spinach), *Botrytis* spp. (onion)

B. Systemic infection via vascular system



E.g.: Vascular wilt fungi, endophytes

C. Penetration through floral parts

E.g.: *Ustilago nuda* (grains) *Cucumber mosaic virus*

From Maude (1996)

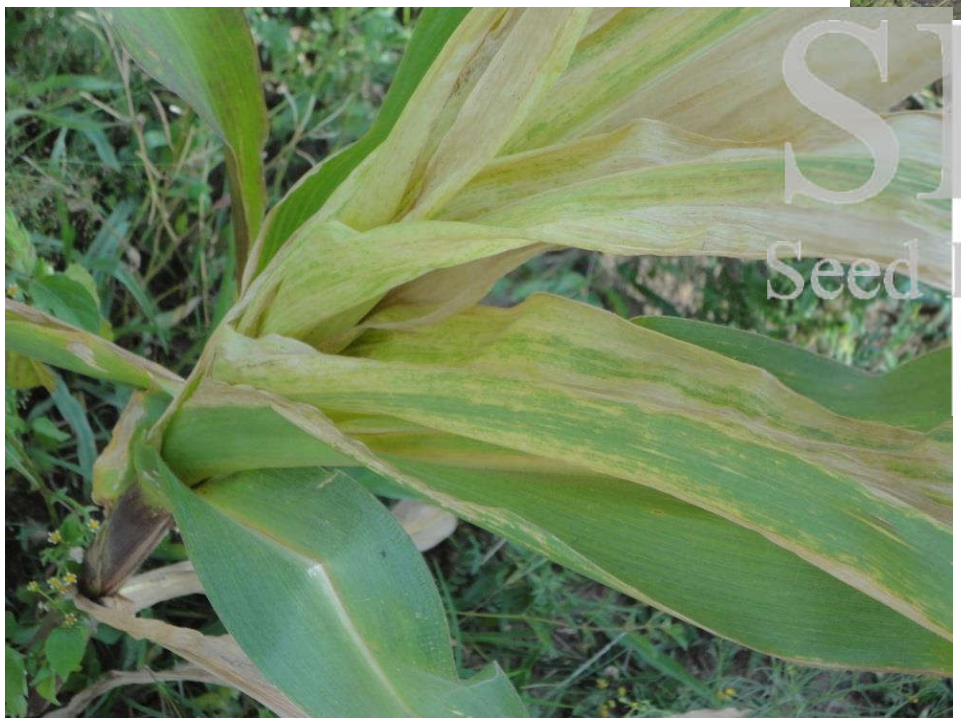
Infected seeds





Diseases in seed crop production

Maize Lethal Necrosis Disease



Maize

Loose smut

Head Smut

Maize

Maize leaf blight

Gray leaf spot

Maize rust

Maize

Fusarium stalk rot of maize

Charcoal rot

Diplodia stalk and ear rot of maize

Maize

Ear rot of maize

Maize

Fusarium ear rot

Diplodia

Fusarium ear rot

Trichoderma

Maize

Aspergillus ear rot

Gibberella ear rot

Sorghum

Anthracnose

Helminthosporium leaf blight

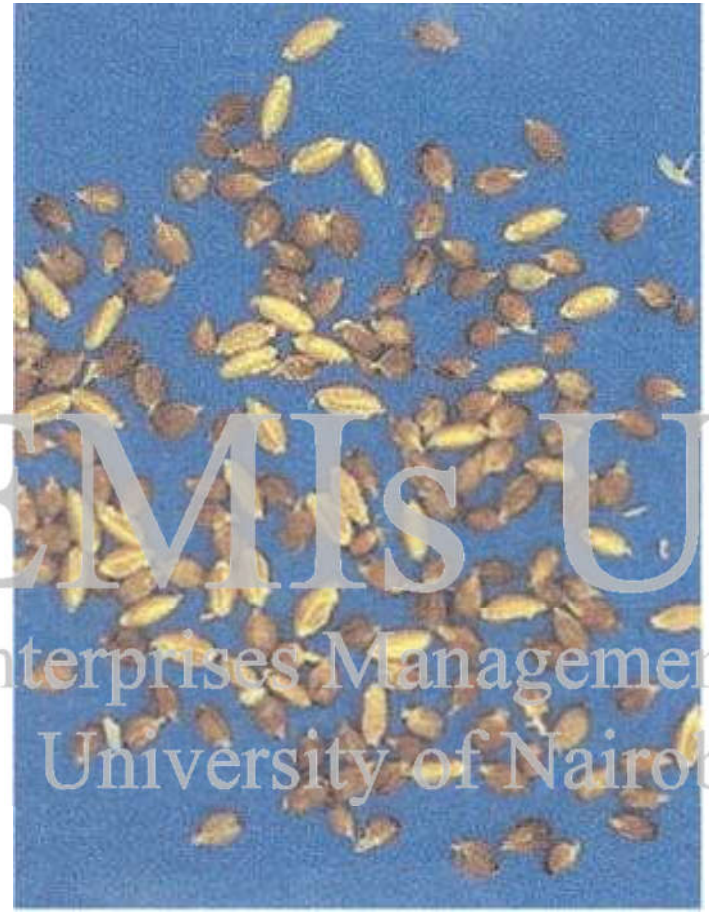
Target spot

Head blight

Wheat

Smut on wheat ears

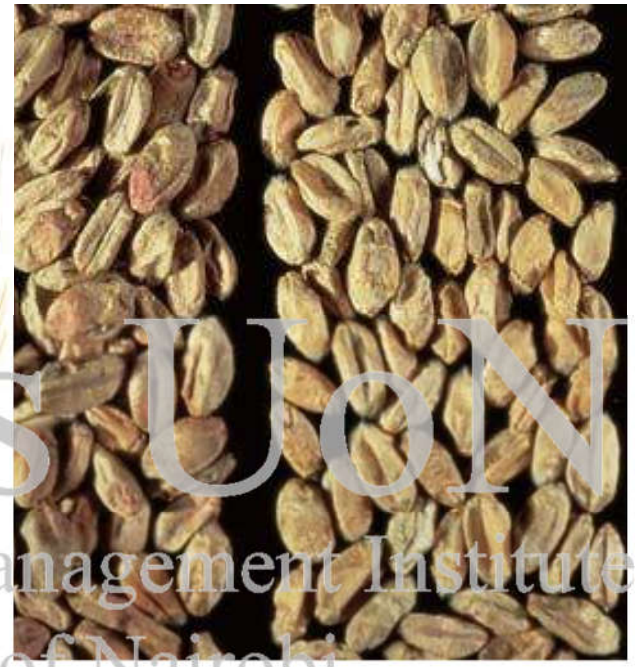
Wheat kernels with smut symptoms



Wheat

Wheat scab on ears

Wheat scab symptoms on kernels



Wheat

Loose smut

Stem rust

Leaf rust

Wheat

Powdery mildew

Barley yellow dwarf

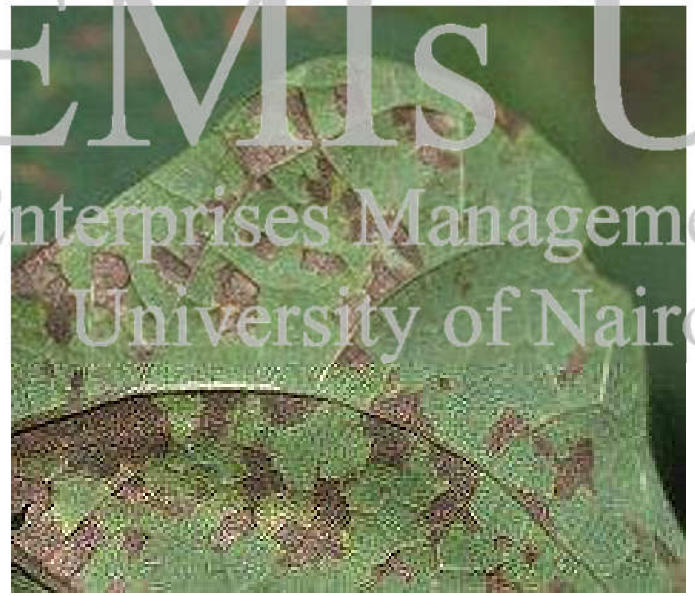
Rice

Rice blast

Bean anthracnose on pods and leaves

Bean

Angular leaf spot on bean



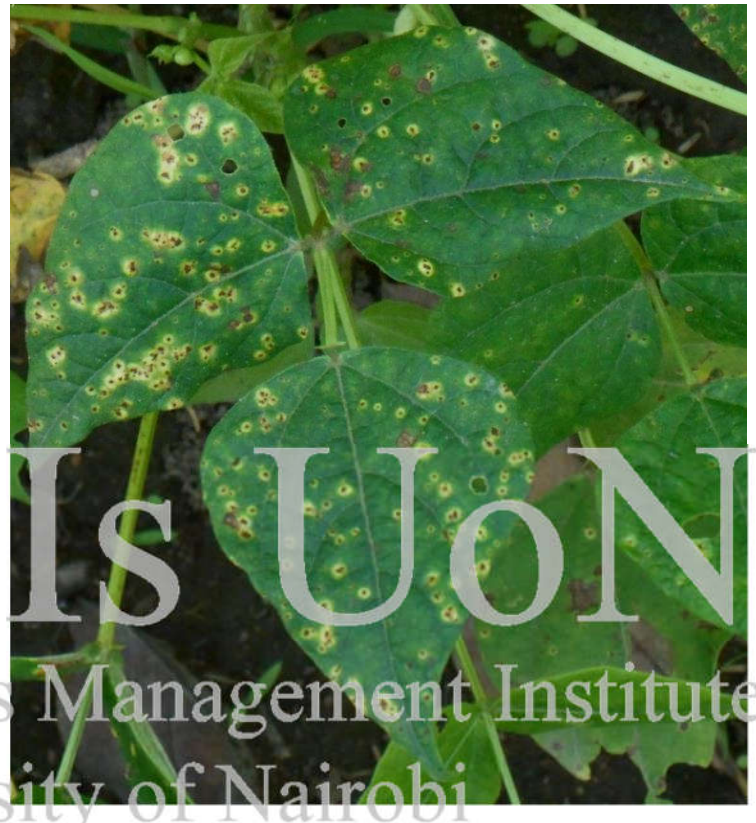
Sclerotinia on bean stems and pods

Bean

Aschochyta leaf spot

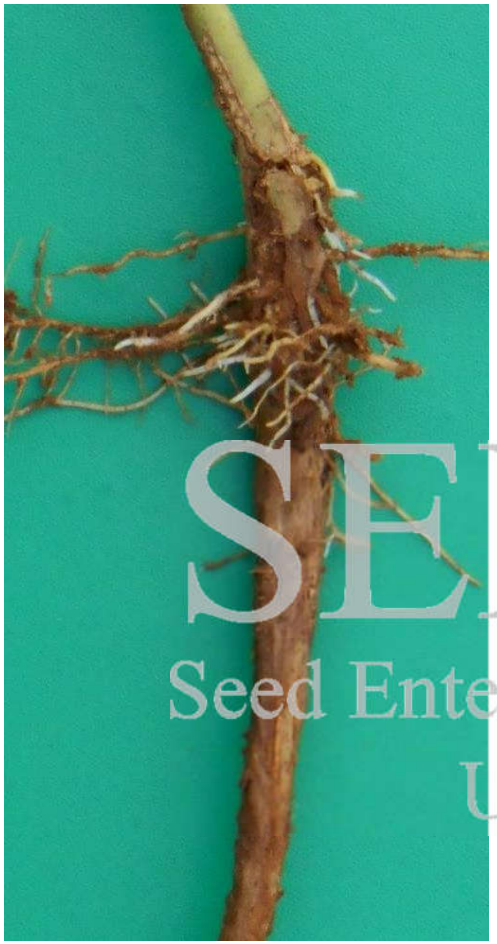
Web blight

Bean rust

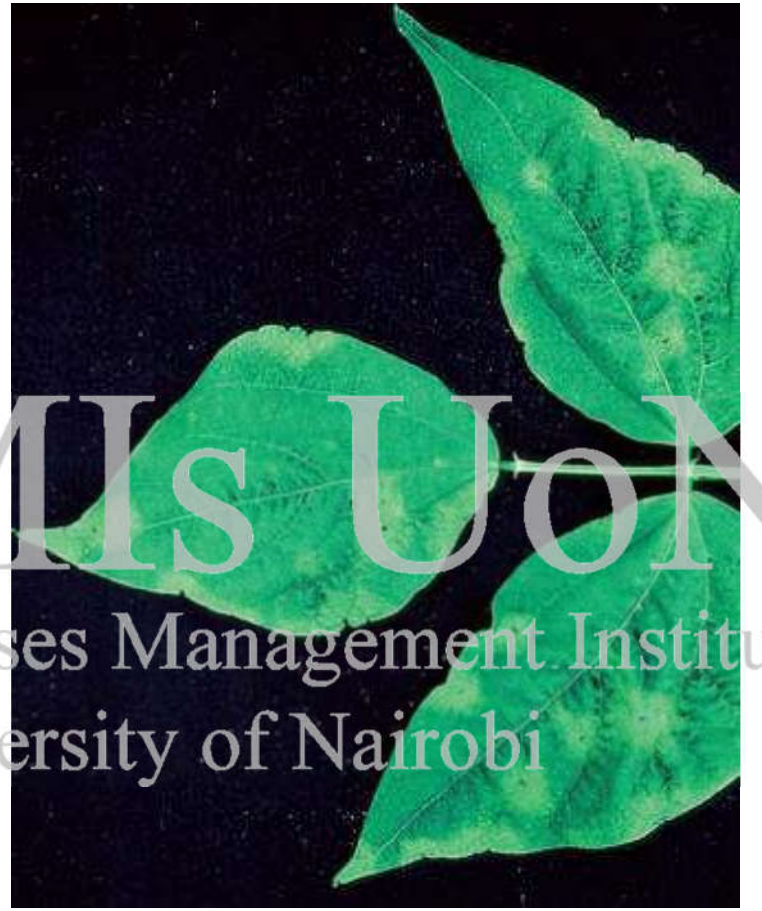


Beans

Root rots

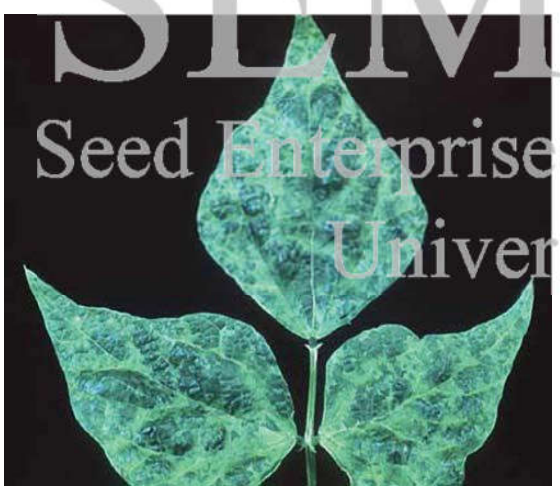


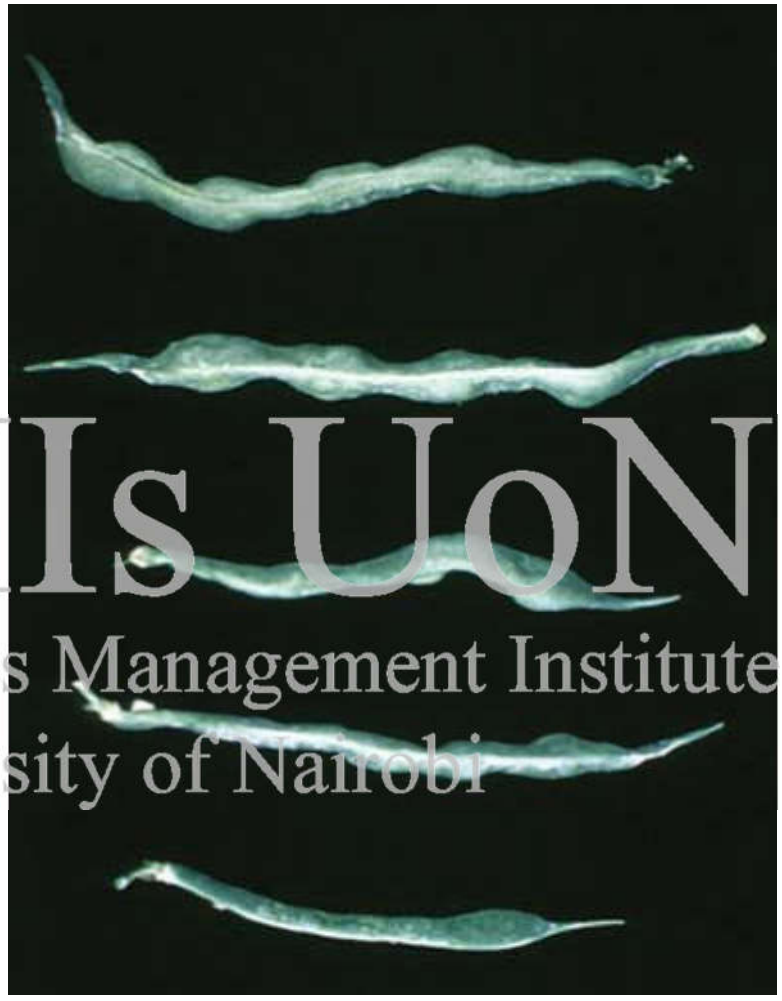
Halo blight on bean



Bean

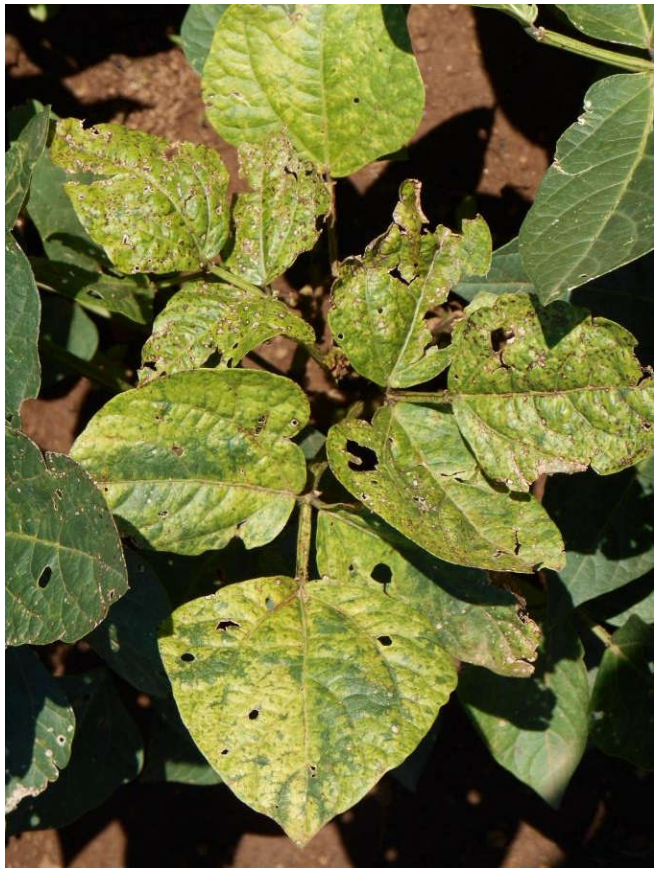
Bean virus diseases





Cowpeas

Virus diseases



Cowpeas

Bacterial blight

Aschochyta

Cercospora

Cowpea

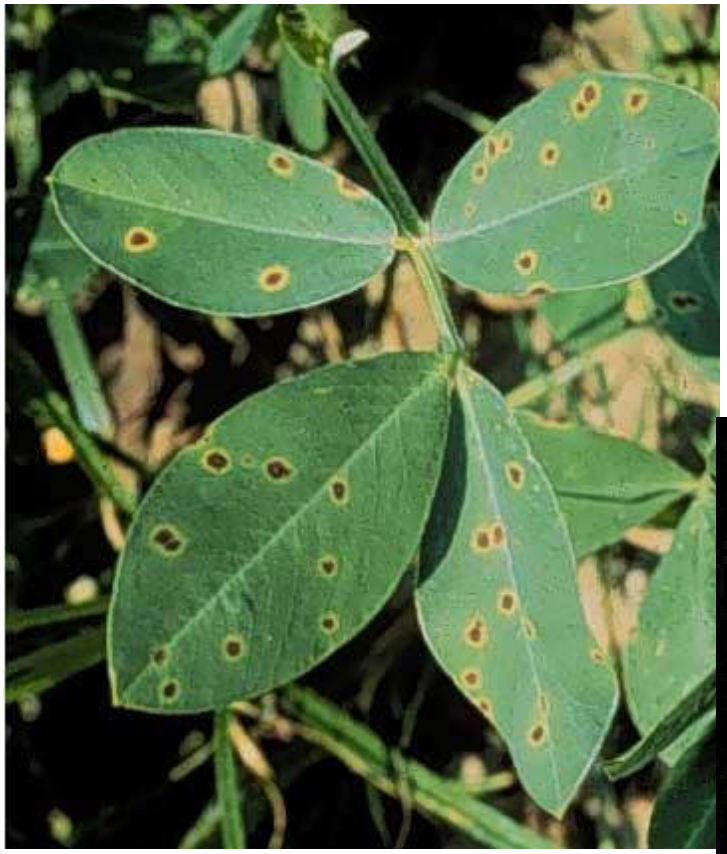
Root rot

Rust

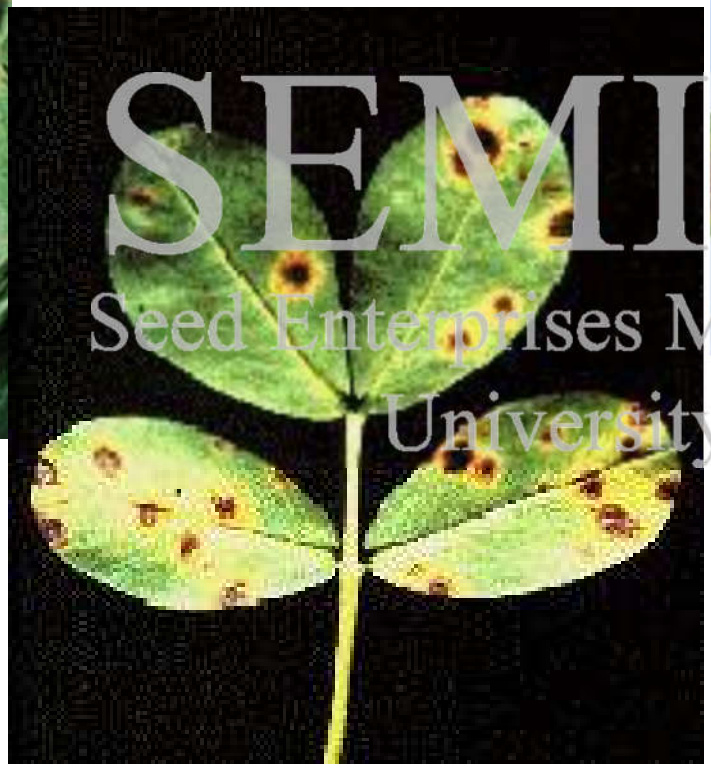
Anthracnose

Ground nut

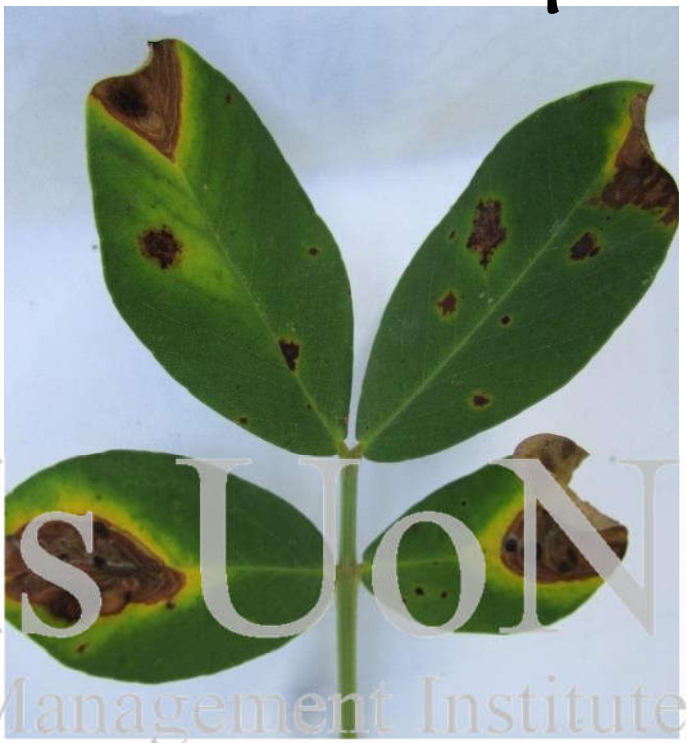
Early leaf spot



late leaf spot



Alternaria leaf spot



Groundnut

Rust

Aspergillus crown rot

Alternaria

Wheat

Ground nut rosette

Virus diseases

Green gram

Sunflower

Sclerotinia Head Rot of sunflower

MANAGEMENT OF SEED-BORNE DISEASES

Previous cropping

- Seed production fields should be free from volunteer plants to avoid contamination of the crop seed by:
  - Any seed which is difficult to remove from the crop seed
  - Cross-pollination;
  - Seed-borne diseases transmitted from volunteer plants
  - The previous cropping shall be such that there is the least
  - possible risk of any soil borne diseases being present which
  - could subsequently be transmitted in the harvested seed.

Production in disease-free areas

- Dry areas with low humidity (use irrigation)
- Bean anthracnose and Bacterial blights of bean
- Altering time of planting
- Crop isolation from other fields containing possibly diseased plants

Good production practises

- Use of certified seed
- Minimize plant stress – fertilization & watering
- Weed management
- Well-drained soils
- Seed rate – proper plant density to promote rapid drying of foliage

Eradicate disease-causing pathogen from production area

- Remove alternate hosts and volunteer host plants
- Crop rotation
- Sanitation – residue management
- Creating conditions unfavourable to pathogens
- Polyethylene mulching
- Drip irrigation instead of overhead irrigation
- Soil sterilization for greenhouse & nursery plants
- Seed treatment

Sanitation

- Destroy/ plough under crop residues
- Proper crop handling (wash hands & implements)
- Removal of infected plants (roguing)
- Avoid working in field when wet

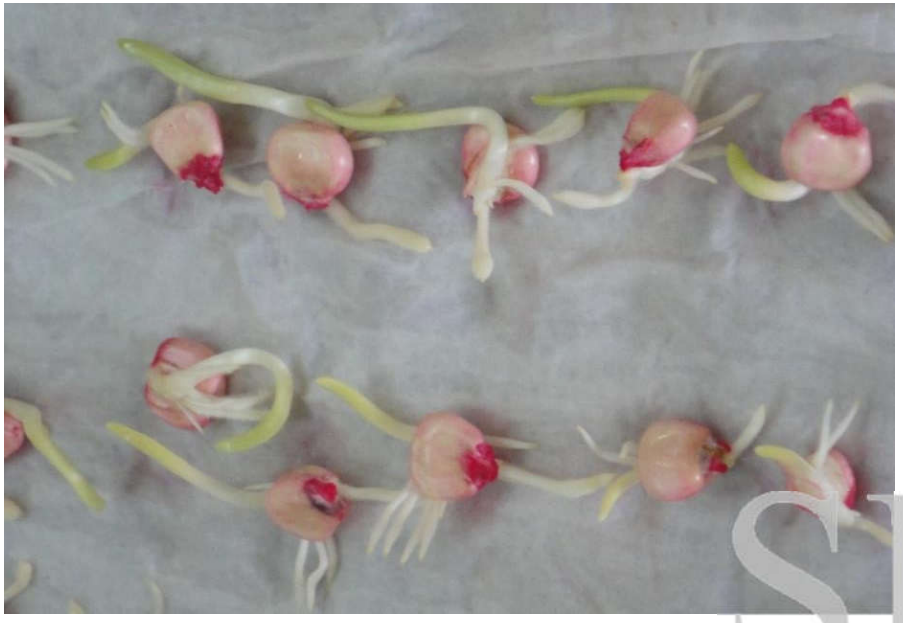
Protect crop from disease

- Use resistant/ tolerant crop varieties
- Use of disease-free planting materials
- Spray protective fungicides,
- Protect from vectors
- Control of Insect Vectors

Isolation and Field Inspection

- Seed crops should be isolated from all sources of pollen contamination and seed-borne diseases (including seed-borne virus infection and wild plants that might serve as a source of disease)
- Crop should be inspected at least once at appropriate stage of growth
- At least 20% of the crop of Certified Seed should be inspected
- Presence of any seed-borne disease should be at the lowest possible level

Seed health testing

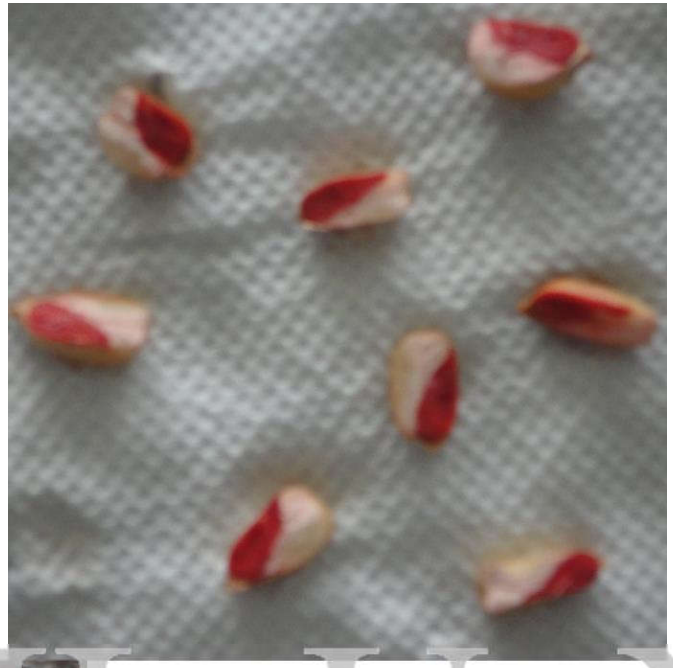


Germination test

Diseases in seed crop production

Fast green test
for physical damage

Seed health test
for seedborne
pathogens



Tetrazolium test
for seed viability

Tolerated levels for seed borne diseases

Disease	Tolerance level
Head smut (maize)	2 plants per hectare
Loose smut (maize)	2 plants per hectare
Bunt (wheat)	1 head per 100 sq. m
Bunt (sorghum)	1 plant per 1,000 plants
Halo bight (bean)	None at inspection
Anthracnose (bean)	None at inspection
Common bacterial blight (bean)	None at inspection
Bean common mosaic	None at inspection
Bacterial blight (cow pea)	None at inspection
Botrytis head rot (sun flower)	5 plants per 1,000 plants
Sclerotinia wilt & head rot (sun flower)	5 plants per 1,000 plants

THANK YOU