Crop pests and diseases

Cereals
Maize stalk borers

*Busseola fusca; Chilo and Sesamia species*

Maize stalk borers are pests of maize, sorghum and other crops throughout many countries in Africa. The caterpillars bore into the stem of maize, feed on the internal tissues and cause the plant to wither and die. The pest can be controlled through a combination of cultural practices (most notably intercropping and the ‘push-pull’ system) and chemical insecticides or neem powder (but only at the early stage, before the larvae have bored into the stem).
The larger grain borer is a serious pest of stored maize throughout Africa. The beetle eats its way into the grain leaving a hole and empty shell. Having a clean storage facility is important to prevent the pest from becoming unmanageable. Shelling the grains from the cob prior to storage can minimize the damage.
The cotton bollworm is a major pest of many important food, oil and cash crops worldwide, including cereals, legumes, fruits and vegetables. A severe infestation of caterpillars of this moth can cause a complete loss in yield.

Chemical control needs to be carefully timed as the caterpillars bore into the grains or fruit of the plant and are then protected. Resistance to pesticides, such as pyrethroids, has been reported in many countries. *Bacillus thuringiensis* (Bt) and neem extracts provide effective control against the caterpillars while minimising damage to natural enemies.

Important cultural controls include removal and destruction of post-harvest crop residues, ploughing the soil to expose the pupae and uniform planting times.
Stem borers are a major pest of millet in the Sahelian and sub-Saharan regions. The larvae (caterpillars) of this moth tunnel into the stems causing them to fall over (lodging), ‘dead hearts’ and poor grain development.

The use of chemicals is rarely justified due to difficulty in timing the application and cost. A combination of cultural practices, such as early planting, practicing intercropping or the ‘push-pull’ system, and managing crop residues are the most effective approaches to controlling the pest.
The sorghum midge is one of the most important pests of sorghum. The larvae of the midge feed on developing seeds causing malformation of the grain and empty or chaffy heads.

Cultural controls are the best approach; chemical sprays have to be carefully timed since the pest spends the majority of its life cycle protected inside the spikelets.

Using resistant varieties, planting early and planting varieties that flower uniformly are the most important methods that can be used to reduce damage to the crop.
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The pest can be controlled through a combination of cultural practices, most notably intercropping and the ‘push-pull’ system. Pesticides can also be effective, but must be applied in the early crop stage before the larvae bore into the stem.

**Sorghum stem borers**

*Busseola fusca, Chilo partellus, Sesamia calamistis*

Stem borers are major pests of sorghum throughout Africa. The stem borers tunnel into the stem of the plant feeding on the internal tissues and causing the plant to weaken.

The pest can be controlled through a combination of cultural practices, most notably intercropping and the ‘push-pull’ system. Pesticides can also be effective, but must be applied in the early crop stage before the larvae bore into the stem.
Larvae of the African rice gall midge feed on young shoots (tillers) of rice, causing them to stop growing and yields to therefore be reduced. ‘Onion’ or silver shoots are the most noticeable symptom of infestations and this is unique to the gall midge. A combination of natural control, through encouragement of parasitic wasps, and planting of resistant or tolerant varieties is the most effective method for managing this damaging pest.

African rice gall midge

*Orseolia oryzivora*

‘Onion’ or silver shoots are an unmistakeable symptom of damage by rice gall midge larvae.
Grey leaf spot of maize has emerged as a yield-limiting disease throughout USA and southern Africa in the last 25 years. Although thought to be one species of fungus, *Cercospora zeae-maydis*, molecular tests have shown that another fungus, *C. zeina*, is dominant in eastern USA and southern Africa.

Spores, surviving in the remains of previous crops, are rain-splashed onto lower leaves causing long spots, merging on susceptible varieties, to cause a blight. Stems are weakened and fall over (lodge) during epidemics. The disease can be managed by destroying plant debris after harvest, crop rotation, using more tolerant varieties and, where economically justifiable, by fungicides.
Several fungi occur on maize and produce poisonous chemicals which contaminate food and feed. Known collectively as mycotoxins, these poisons have serious effects on human and animal health. *Aspergillus* is said to be the most important mycotoxin producer in Africa, though other fungi such as *Fusarium* are also involved. Both groups of fungi grow on dead and decaying plant material and cause rotting of maize ears in the field. They produce powdery masses of spores on cobs, pre- and post-harvest, but can also be present without any mould production. Ear rots caused by mycotoxin-producing fungi are more common when maize is stressed or growing poorly.

The most effective control of these fungi combines timely harvesting, and drying of cobs before storing. Aflasafe™, a new biological control option against *Aspergillus*, is applied in the field before flowering and shows considerable promise in reducing contamination prior to harvest and later accumulation of mycotoxins in stored products.
Maize lethal necrosis disease (MLND) is a new viral disease for Africa. It has caused great concern because plants are killed and little or no grain is produced.

The main thrust of the current management strategy is to prevent the introduction of the disease through sound surveillance and early destruction of diseased plants. Promising resistance exists to maize chlorotic mottle virus (MCMV), the main virus associated with the disease, but further work is needed before recommendations backed by scientific evidence can be given on what varieties to grow.

Once the disease enters a field there is little that can be done to prevent total loss of the crop.

Advanced symptoms include browning from the edge of the leaves, which does not occur in maize streak virus.
Downy mildew of pearl millet is caused by an oomycete or water mould, \textit{Sclerospora graminicola}. It is a serious disease in India and Africa with losses of at least 30% reported on susceptible varieties. Infection comes from the seed or from the soil. Leaves become yellow, flowers become leaf-like and plants are stunted. Two types of spores form: sporangia on the leaves, which spread the mildew to plants nearby, and oospores, thick walled spores, on all plant parts. These survive in the soil and are spread long distances in soil blown by the wind.

Management is dependent on hybrids bred for resistance, and treatment of the seeds with fungicides, most commonly metalaxyl.
Rust of pearl millet is caused by the fungus *Puccinia substriata*. It causes losses in grain yield, especially if infection is early, and also reduces the quality of fodder for livestock. The disease is present in USA, Asia and is widespread in semi-arid tropical and subtropical Africa.

Several asexual spore stages of the rust occur on pearl millet and wild grasses, with the sexual stage on eggplant (aubergine). Spores carried on the wind spread the rust, and survival is in the soil, on debris, volunteer pearl millet and alternative hosts.

Management relies on crop rotation, weeding to remove volunteer plants and weeds, use of tolerant varieties and destruction of crop remains after harvest. Fungicides are not economically viable unless crops are grown for commercial purposes.
Sorghum downy mildew is caused by *Peronosclerospora sorghi*, a fungus-like pathogen. It is predominantly a soil-borne disease. Thick-walled oospores can survive for several years in the soil before infecting young plants. Oospores can also be carried over in seed.

Systemic infections result in a distinctive striping of young leaves and stunted growth. Most plants fail to produce grain. Localized infections from wind-borne conidia are less damaging. The main control methods are clean seed and resistant varieties. Some strains of sorghum downy mildew also attack maize.
Bacterial leaf blight of rice kills seedlings and destroys the leaves of older plants. The disease is extremely serious worldwide and has emerged as a major problem in irrigated crops in the Sahel. Recently, it has also been reported from East Africa. Wild hosts maintain the disease between crops and spread occurs in irrigation, floodwaters, in wind and rain, and in seed. Management requires planting resistant or tolerant varieties, good drainage of fields, removal of weeds, ploughing under of stubble and removal of volunteer seedlings.
Rice blast, caused by the fungus *Magnaporthe grisea*, attacks leaves, stems and flowers, killing plants up to tillering, or reducing grain yield and quality on plants that reach maturity. In Africa it is a problem of upland rice in particular.

Diamond-shaped spots with white centres and dark borders occur on the leaves and rots develop on stems and flower heads.

Control is by using tolerant or resistant varieties, dividing nitrogen fertilizer into several splits, avoiding water-stressed plants, eliminating crop residues, and application of seed treatments if fungicides are affordable and available.
Rice yellow mottle disease causes major epidemics and yield loss in lowland irrigated rice throughout sub-Saharan Africa. Leaves turn yellow or orange with green streaks, plants are stunted, tiller number is reduced and panicles produce unfilled or sterile grain.

There are many ways it is spread: beetles and grasshoppers and perhaps also other insects and mites; leaf-to-leaf and root-to-root contact; and on harvest implements.

Management depends on use of tolerant varieties – crosses between African and Asian rice – supported by cultural techniques, e.g. removal of grasses and sedges that are alternative hosts of both virus and insects before planting, and destruction of crop residues after harvest.
The red-billed quelea is a small brown weaver bird that can occur in huge flocks. The world’s most abundant wild bird, quelea are found only in Africa, especially in semi-arid zones. They are seed-eaters, both of wild grasses and cereals such as sorghum, rice and wheat, but also eat insects, including pests of crops. Estimated annual damage to crops of up to US$80 million has been recorded across Africa.

Quelea attack crops when other natural food sources are exhausted. Rainfall linked to germination of wild grass seeds is used to predict likely growth in flocks and to plan early control interventions. Control methods include spraying fenthion, an organophosphate, but this also kills non-target birds and the pesticide needs careful handling. Methods with fewer side-effects include fire bombs and dynamite. Large-scale control efforts need area-wide coordination, farmer cooperation and adequate funds. Control methods used by smallholders range from scaring tactics and physical barriers, to home-made weapons (e.g. catapults) and can be successful if the threat of bird damage is relatively low.
Striga, or witchweed, are parasitic weeds which infest millions of hectares of land planted to maize, sorghum, millets, upland rice, cowpea and sugarcane, reducing yields by 30-100%. There are many species in Africa, growing mostly in arid regions of low soil fertility, but four dominate: *S. hermonthica*, *S. asiatica*, *S. aspera* and *S. gesnerioides*. Witchweeds tap into the xylem of host plants causing yellowing, stunting and wilting. Seeds are tiny and can spread over long distances, probably in wind-blown soil and over shorter distances in rain run-off, on shoes and hooves of livestock.

Management depends on use of resistant varieties and cultural control measures, including crop rotations, weeding, raising the fertility of soils and the use of trap crops.
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