Control of ear rots, aflatoxin and fumonisin by push-pull technology

When maize is planted under push-pull, damage by stemborer and fall armyworm is reduced. Since many ear rots starts from wounds on the maize cob caused by stemborer and fall armyworm, in this way push-pull controls the appearance of ear rots.

When ear rot appearance are low, it means the maize has a small number of fungi. Fungi produce aflatoxin and fumonisin and therefore when push-pull reduce stemborer and fall armyworm, ear rots and fungi, it also reduce amount of aflatoxin and fumonisin.

Another method of reducing aflatoxin and fumonisin by push-pull is when desmodium release chemicals into the soil. The chemicals kill some of the fungi that produce aflatoxin and fumonisin.

Other advantages of push-pull technology

- Increased maize yield
- Continuous supply of cattle feed from napier/Brachiaria grass and desmodium
- Protection of soil from erosion
- Water retention by soil as desmodium acts as live mulch
- Nitrogen fixed into the soil by desmodium help save on fertilizer cost
- Maize protected from strong winds by surrounding grass
- Money from selling desmodium and milk

Cultural ways of reducing ear rots, aflatoxin and fumonisin contamination of maize

Harvest maize stovers for hay instead of direct grazing of cattle in order to prevent scattering materials infected by ear rot, aflatoxin, and fumonisin fungi in the whole farm.

Hand sorting out rotten cobs reduces aflatoxin and fumonisin in maize as rotten maize has more fungi than clean maize.

Proper preparation of compost and farm yard manure. Materials intended for preparation of manure might contain ear rot fungi but when properly rotten, the fungi die and there is no production of aflatoxin and fumonisin in maize where the manure is used.

Removal and burning of maize stovers kills that fungi that would have caused ear rots, aflatoxin and fumonisin in the next season.

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Push-Pull Technology Controls

Ear Rots, Aflatoxins and Fumonisins in Maize

and ensures safe food and feed for humans and livestock by controlling stemborer and fall armyworm

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Maize ear/cob/grain rots

One of the most important barrier to production of high quantity and maize that is safe for human and livestock consumption is a disease called maize ear rot. Rotten maize cobs/ grains are usually moldy. The molds are of different colors, depending on the causative agent. The microorganisms that cause maize rots are called fungi.

Sometimes, the rotten cobs decay and become light weight. Maize ear rots mainly start in the field while maize is growing and continue in storage. Clean maize harvested while still wet can start rotting in storage.

Rotten maize are more in farms infested by insects like stemborer and fall armyworm.

Gibberella ear rot, which exhibits reddish colouration at the tip of the cob

Fusarium ear rot, which is pinkish to purple in colour, infects random kernels within the cob.

Diplodia ear rot, which exhibits white colouration from the bottom of the cob

Consequences of maize ear rots: Aflatoxin and fumonisin in maize

While the ear rots grow, the fungi produce poisonous chemicals called **mycotoxins**. The commonest types of **mycotoxins** are **aflatoxins** and **fumonisins**.

Aflatoxins and **fumonisins** are colourless, tasteless, and odourless, therefore can not be detected except by chemical testing in a laboratory.

Aflatoxins and **fumonisins** can also be produced on maize grains that do not show physical signs of insect damage and ear rots.

Aflatoxins and **fumonisins** can be transferred from livestock to humans by eating eggs, milk and meat.

Side effects of aflatoxins and fumonisins

- Suppressed immune system
- Damage of and cancers of vital body organs such as liver, kidneys, lungs
- Worsened diseases like malaria, TB, HIV/AIDS
- Reduced productivity in humans and animals
- Birth defects in children
- Death

Aspergillus ear rot, which is greenish-yellow in colour

Penicillium ear rot, which is dark green in colour

Push-pull technology

Push-pull is a farming system where a cereal such as maize and sorghum is intercropped with the legume desmodium, and the plots surrounded with Napier of Brachiaria grass.

The cropping system was developed for control stemborer and striga, resulting in increased grain yield. The cropping system also controls damage caused by fall armyworm.

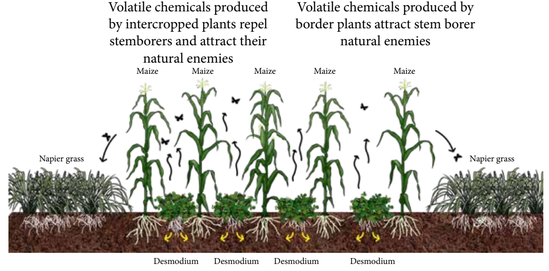
Effects of striga, stemborer and fall armyworm on maize production

- Striga weed takes nutrients from maize by attaching its roots into the roots of the maize plant.
- Stemborers and fall armyworm attack maize leaves, stems and cobs
- Striga, stemborer and fall armyworm cause loss of harvest

How push-pull technology works

Desmodium produces a smell that stemborer and fall armyworm moths don not like. This smell 'pushes' away the moths from the maize. The moths are 'pulled' by pleasant smell produced by the Napier/Brachiaria and they lay eggs on it.

Desmodium also release chemicals into the soil that stop striga weed from growing on maize.



Chemicals secreted by desmodium roots control *Striga* and deplete *Striga* seed bank in the soil

Desmodium roots fix atmospheric nitrogen in the soil; shoot and root biomass increase soil organic matter