

# Aflatoxin Effect On Health



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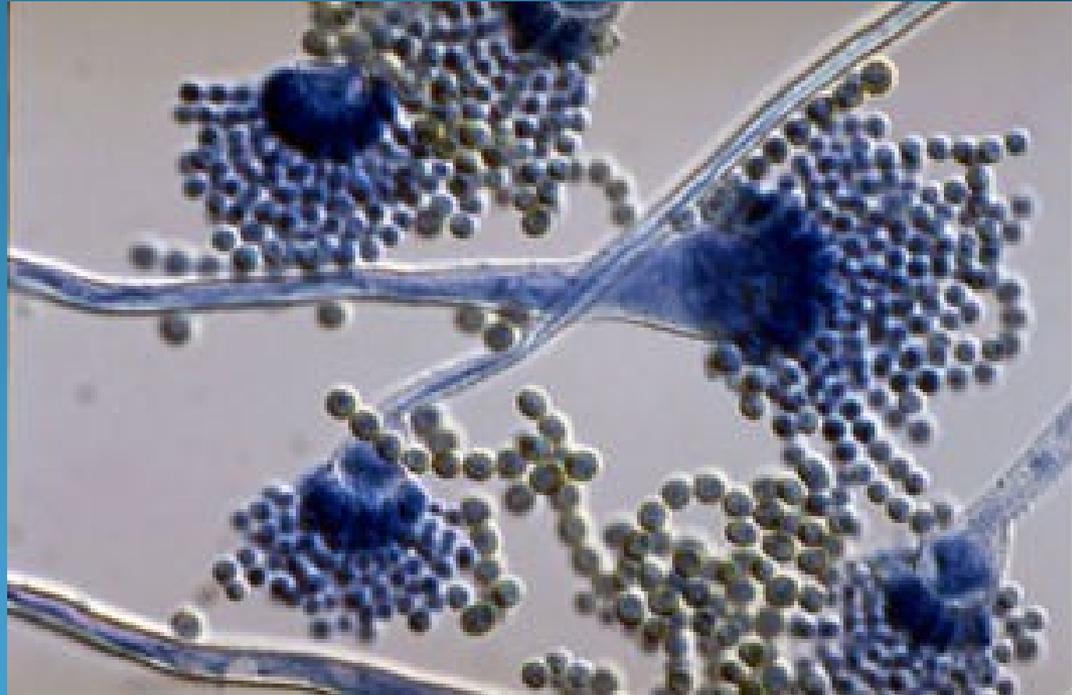
# What is 'Toxin'



- A toxin (from Ancient Greek: *toxikon*) is a poisonous substance produced within living cells or organisms
- It simply means, it is a biologically produced poison.

**Aflatoxins**  
are naturally occurring toxins that are  
produced by species of a fungus called  
*Aspergillus*

*Types*  
*Aspergillus flavus* and  
*Aspergillus parasiticus*

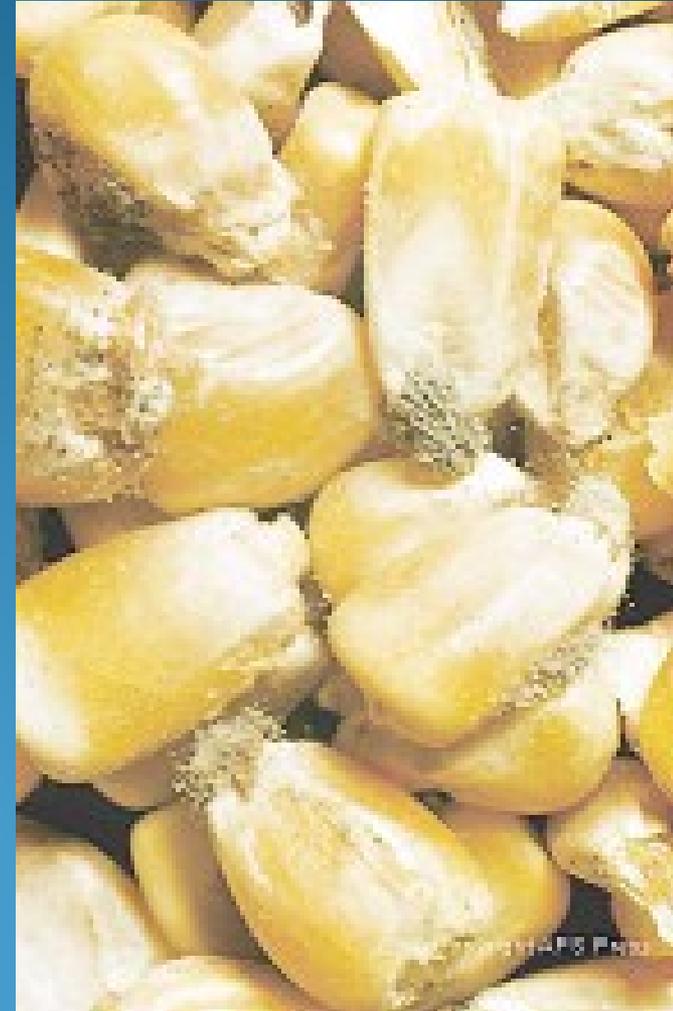


# The Fungus - Aspergillus

- Survive temperatures ranging from 12°C to 48°C
- Survives on many organic nutrient sources like plant debris, tree leaves, decaying wood, animal fodder, cotton, compost piles, dead insects and animal carcasses, stored grains, and even immunocompromised humans and animals.
- At latitudes between 40°N and 40°S of the equator
- Contaminate 25% of crops worldwide

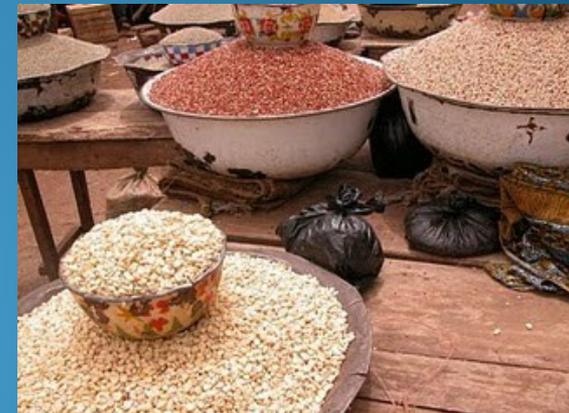
# When Is The Toxin Produced

The toxins are produced as *secondary metabolites* by *the* fungi in temperatures range between 24 and 35°C, within many commodities whenever the moisture content exceeds 7% (10% with ventilation)



# Aflatoxin Prone African Dietary Staples

- Maize
- Rice
- Corn
- Cassava
- Nuts
- Peanuts
- Chilies
- Spices



**One form of the toxin  
is also released  
in milk**



# Exposure

- Primarily through contaminated food
- Some evidence exists through respiration

# Who Gets Exposed

**Everybody & Anybody**

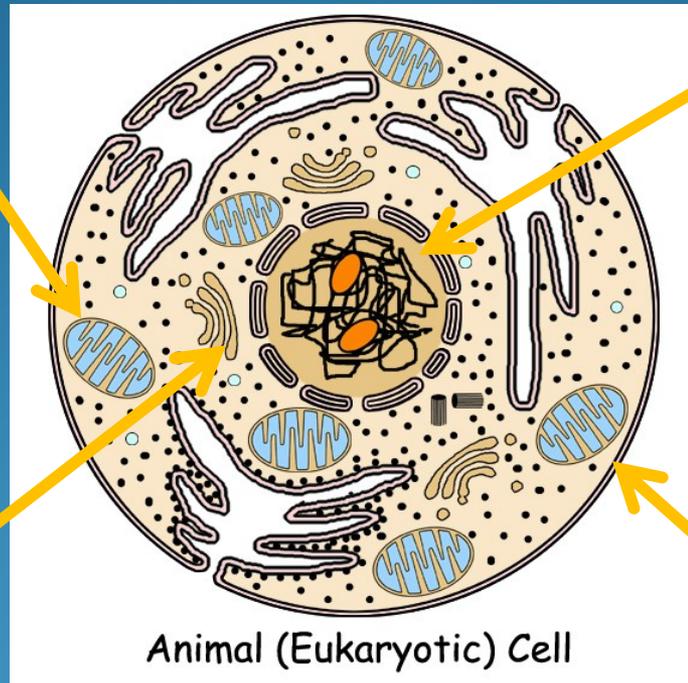
**Both humans and live-stocks living  
in region where the fungus grows  
uncontrolled**

**But most are those in the lower socio-  
economic section and much of the  
live-stock in the unorganised sectors**

# How Dose The Toxin Act?

**Apoptosis  
(programed cell death)**

**Inhibits of nucleic acid  
(DNA – RNA) synthesis**



**Decrease protein  
synthesis**

**Effects membrane stability  
leading cell damage**

# How Dose The Toxin Act?

- Apoptosis → Cell death
- Inhibits of nucleic acid (DNA – RNA) synthesis → Mutation → Cancer
- Decrease protein synthesis → Stunting
- Effects membrane stability → cell damage

# Aflatoxin Effect on Human Health

<b>Organs/ Systems</b>	<b>Effects</b>
Pathological changes	Liver, kidney, and spleen enlargement, fatty liver syndrome
Urinary System	Kidney inflammation leading to kidney failure
Digestive system	Decreased protein and fats digestion and absorptions, impaired carbohydrate breakdown, decreased motility, diarrhea

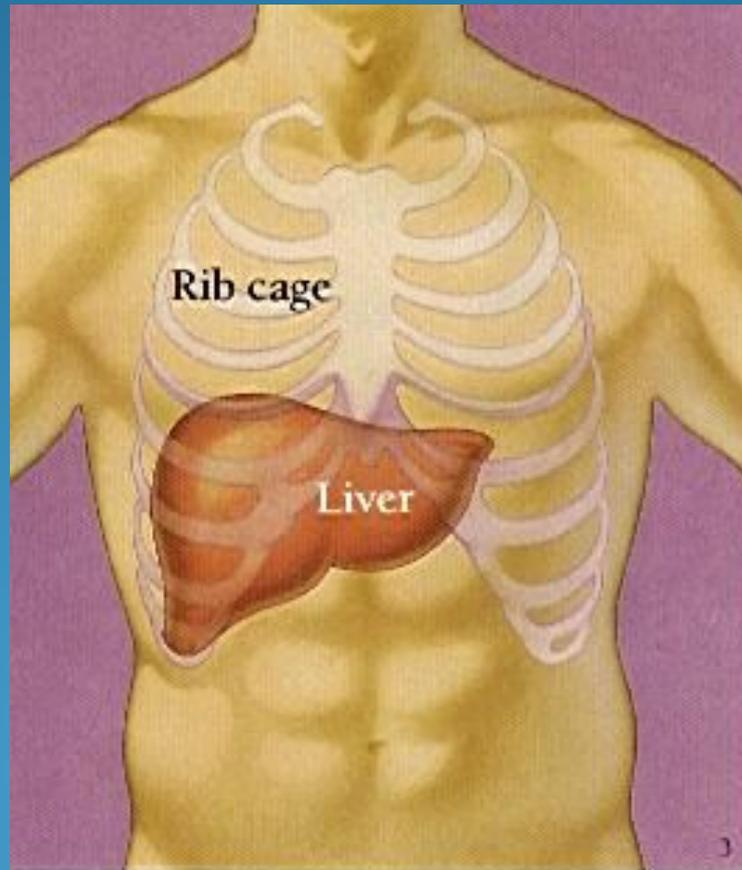
# Aflatoxin Effect on Human Health

<b>Organs/ Systems</b>	<b>Effects</b>
Nervous system	Abnormal Behavior, depression
Reproductive System	Reduced sperm count and infertility; neonatal outcomes-low birth weight
Growth	Recent human research confirms that dietary Aflatoxin reduces the rate of growth

# Aflatoxin Effect on Human Health

<b>Organs/Systems</b>	<b>Effects</b>
Gene and Gene Expression	Teratogenic effect (birth defect)
Gene and Gene Suppression	Carcinogenic effect—higher incidence of cancer
Immunosuppression	Decreased resistance and susceptibility to, HIV, TB, and other opportunistic infections

# The Principal Target Organ For Aflatoxins Is The Liver.



# Aflatoxicosis

**Aflatoxicosis is the poisoning that  
results from ingesting  
aflatoxins**

# Aflatoxicosis

## Is Exposure related

- 1) large doses lead to acute illness and death, usually through liver cirrhosis;
- 2) Chronic low doses have nutritional and immunologic consequences; and
- 3) All doses have a cumulative effect on the risk of cancer

An iceberg floating in the ocean. The tip of the iceberg is above the water line, and the much larger, submerged part is below. The sky is blue with light clouds, and the water is a deep blue. The text is overlaid on the image.

**Acute Aflatoxicosis**

**Chronic Aflatoxin  
Exposure**

# Acute Aflatoxicosis

- Acute poisoning is characterized by an acute hepatotoxic disease that manifests itself with
  - Depression
  - Anorexia
  - Jaundice
  - Hemorrhages
  - Edema of the lower extremities
  - Abdominal pain and vomiting

**Adult humans usually have a high tolerance of aflatoxin, and, in the reported acute poisonings, it is usually the children who die**

# Chronic Exposure

- **4.5 billion people worldwide are at risk**
  - Liver cancer: causative role in 5 – 28% of liver cancer cases
  - Impaired immune function
  - Childhood stunting
  - Possible neural tube defects

**Both acute and chronic aflatoxin exposures are preventable**

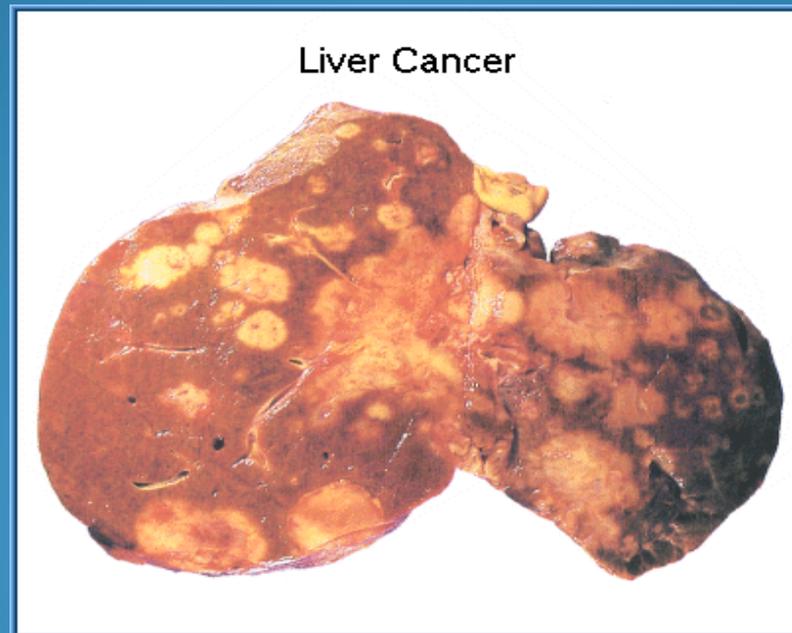
# Aflatoxin and Cancer

Aflatoxin (B<sub>1</sub>) is regarded as a

class I carcinogen

by the World Health Organization

**As per one estimate, 40% of the  
hepatocellular carcinoma  
(liver cancer)  
in Africa  
can be attributed to aflatoxin**



# Aflatoxin: Hepatitis B and Cancer

Hepatitis B virus (HBV) infection contributes to liver damage that is potentiated by chronic AF exposure leading to cancer

- The presence of the virus may interfere with AF metabolism and detoxification process
- Predisposition of HBV-infected hepatocytes to aflatoxin induced DNA damage;
- Viral replication and chronic inflammation in liver cell, may contribute to the mutation potentiated by AF

# Aflatoxin and HIV

- ❑ HIV increases the toxic effect of Aflatoxin (AF) by decreasing the levels of anti-oxidant nutrients that helps detoxify AF in the body
- ❑ For HIV virus to penetrate a cell it has to overcome the barrier of cell membrane & secretory IgA. AF reduces the level of secretory IgA thereby easing one of the barriers.
- ❑ In a large number of HIV cases there is a co-infection of HBV causing liver damages thereby potentiating the effects of AF

# Aflatoxin and Growth Stunting

- Several studies have indicated the effect of Aflatoxin on growth leading to stunting
- The patho-biochemical mode of action of Aflatoxin indicates it can have direct effect on growth

**Under-nutrition  
Can Potentiate  
All These Effects Of  
Aflatoxin**

# Animal Health and Aflatoxin

- ❑ Animals have similar (& potentiated) pathological effect as found in Humans
- ❑ In general animals have greater pathological effect at lower concentrations
- ❑ In animals, the affects of aflatoxin on the liver is greater at a much lower concentration than that for humans



# Impacts of Aflatoxin on Livestock and Livestock Products

## Direct Impacts on Animals:

- Acute Toxicity
- Reduced growth rates and weight
- Immunosuppression at low doses

## Product

## Contamination:

- Meat
- Dairy, eggs, and cheese
- Farm fish
- Organ meats

# Diagnosis

The diagnosis of aflatoxicosis is often difficult because of

- Variation in clinical signs,
- Gross pathological conditions
- Presence of infectious diseases due to the suppression of the immune system.
- No consistent diagnostic changes in hematocrit, hemoglobin, and differential cell counts

# Treatment

- The source should be eliminated immediately.
- Levels of protein and vitamins A,D,E,K and B should be increased.
- Secondary infections must receive immediate attention and treatment.
- Good management practices to alleviate stress
- Address specific system diseases

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# PREVENTION

- Remove the sources
- Promotes better agricultural and storage techniques
- Have good resources for testing and early diagnosis
- Strict food quality standards
- General awareness and personal protection.
- Better livestock feeding & management

# Permissible Limits

## United States Food and Drug Administration

Parts Per Billion	Criterion
<b>20</b>	<ul style="list-style-type: none"><li>• Food for human consumption</li><li>• Feed corn, grains, and cottonseed meal for immature animals</li></ul>
<b>100</b>	<ul style="list-style-type: none"><li>• Feed corn and grains for breeding beef cattle, breeding swine, or mature poultry</li></ul>
<b>200</b>	<ul style="list-style-type: none"><li>• Feed corn and grains intended for finishing swine of 100 pounds or greater</li></ul>
<b>300</b>	<ul style="list-style-type: none"><li>• Feed corns and grains and for finishing (feedlot) beef cattle</li></ul>

# Aflatoxin Abatement Measures

*Protection is Required throughout the value chain  
from “field to fork”*

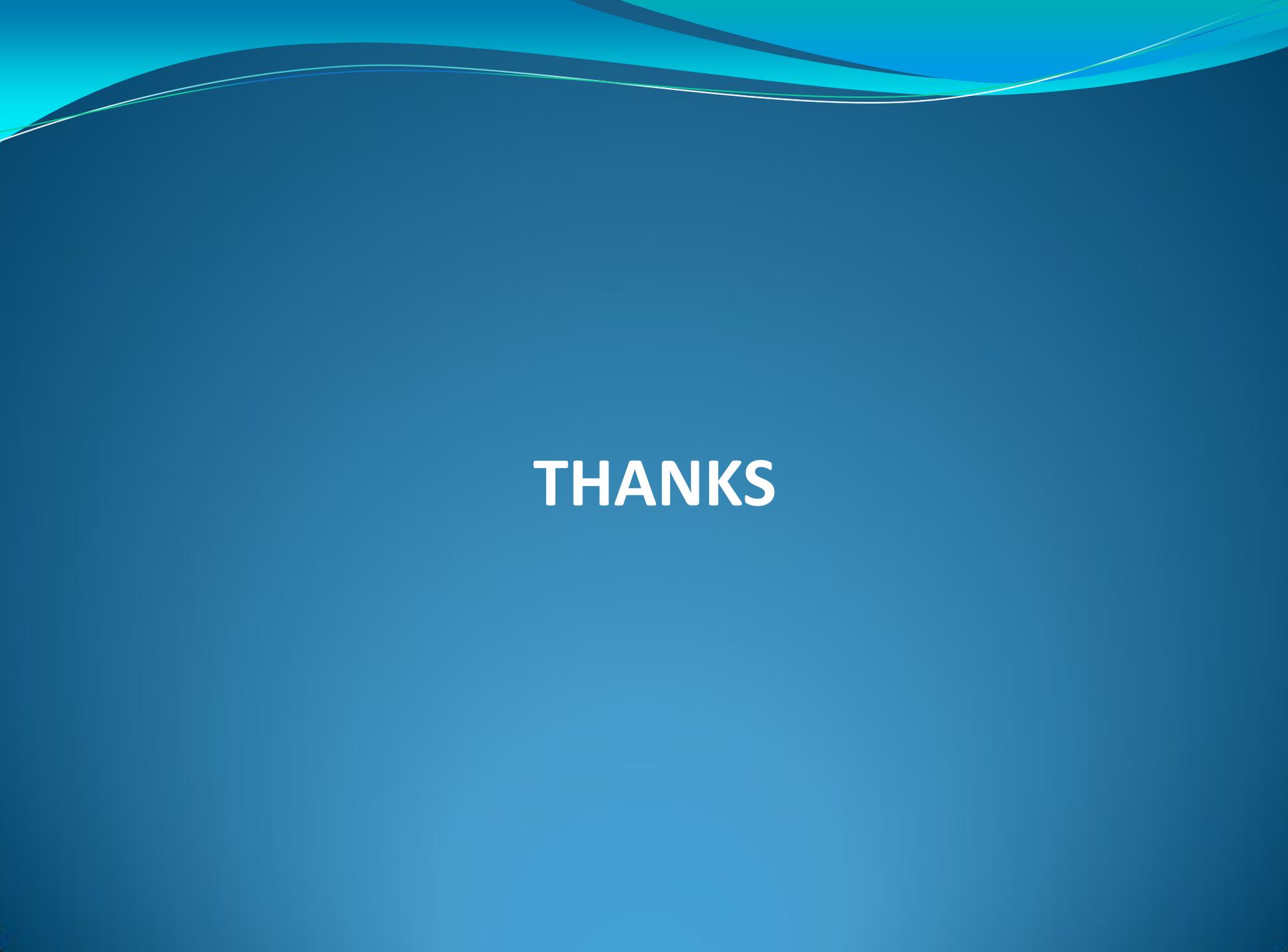
## 1. Pre-harvest

- Bio Control
- Improved Plant Varieties
- Integrated Pest Management

## 2. Post-harvest

- Post-Harvest Handling
- Improved Storage
- Quality Assurance of the Food Chain

**Stop The  
Silent Killer And Disabler  
Before It Gets To Us**



**THANKS**