

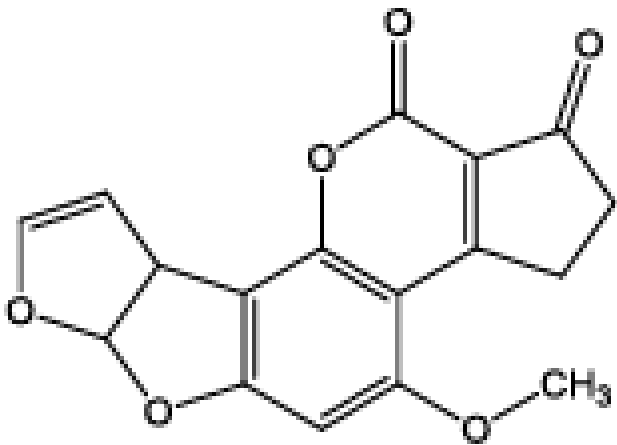
# **Scenario, Scope and Control of Aflatoxin in Feeds & Fodder in India**

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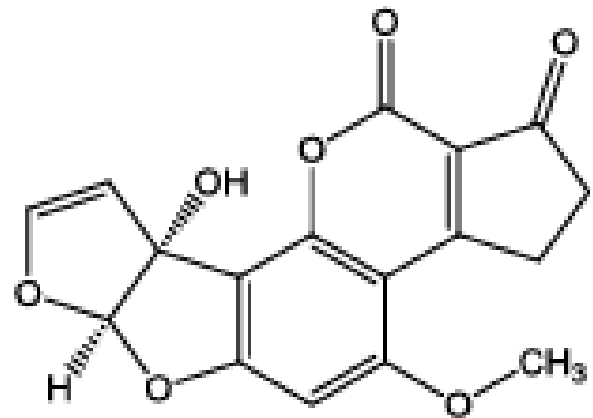


# Aflatoxins

- **Major classes:** Aflatoxin B1, B2, G1, G2
- **AFB1:** Toxic, carcinogenic, teratogenic & mutagenic.
- **AFM1:** Hydroxylated metabolite of AFB1
- **Transfer rate:** 0.3-6.2% for AFB1 to AFM1 (IFPRI, 2013).



**Aflatoxin B1 (AFB1)**

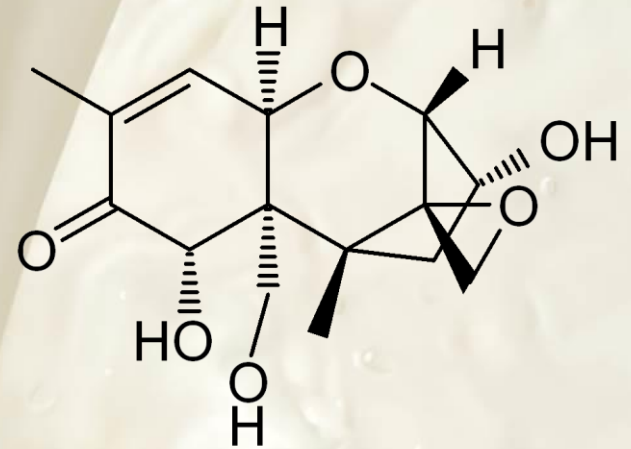


**Aflatoxin M1 (AFM1)**

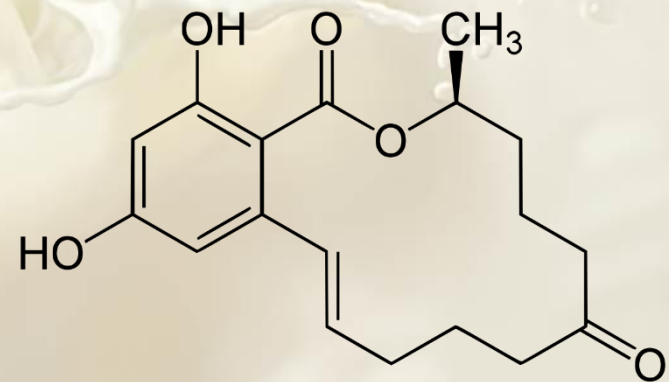


# Deoxynivalenol (DON) & Zearalenone (ZEA)

- Susceptibility to DON is low, since converted almost completely to less toxic metabolites by rumen micro flora (Krizova and Pavlok, 2011).

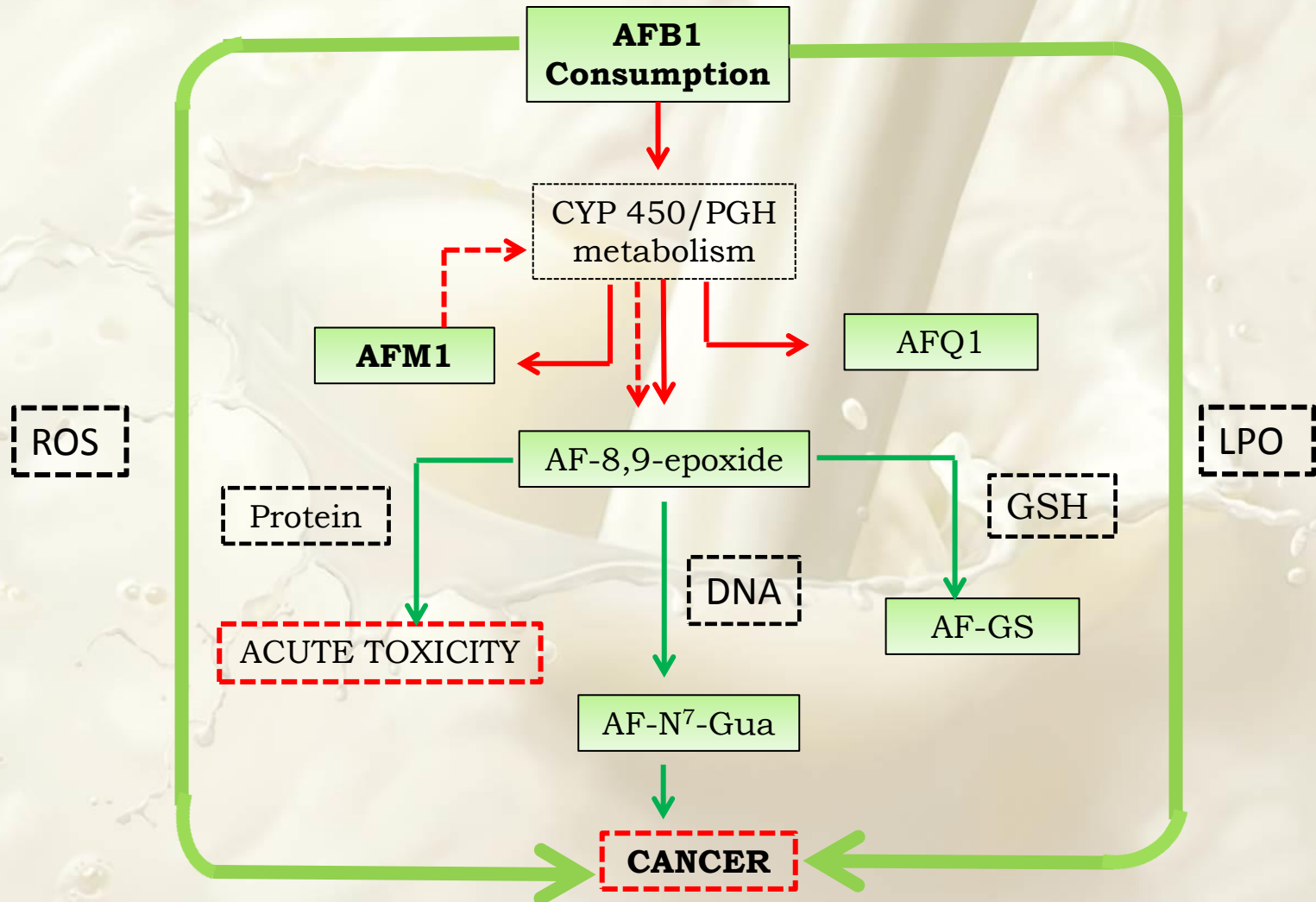


- ZEA is excreted in milk, but levels are very low (Gremmel, 2008).





# Schematic representation of AFB1 & AFM1 Metabolism





# Transfer of AFB1 to AFM1



12-24  
hrs



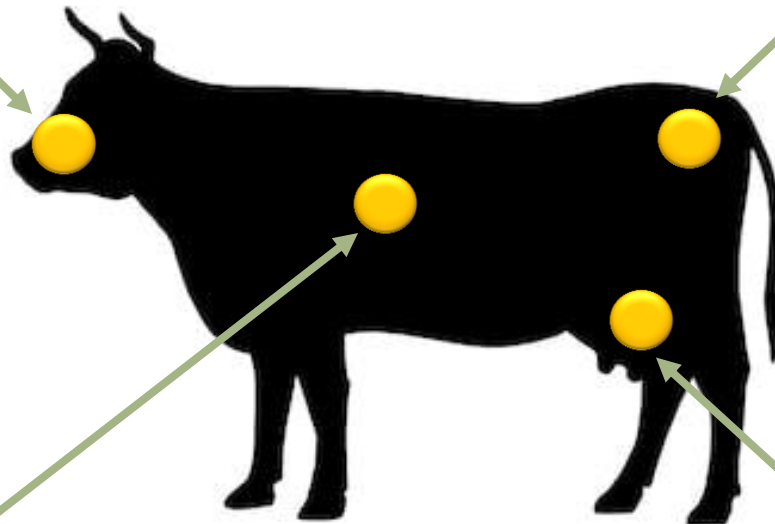
- Even within 6 hr, AFM1 residues can appear in milk.
- If ingestion stops, AFM1 decreases to an undetectable level (0.02 ppb) after 72 hrs (Hampikyan *et al.* 2010).



# Effect of Aflatoxins on Health, Production & Reproduction

- Reduced Feed Intake

- Reduction in conception rate
- Abortion
- RFM



- Liver damage

- Milk Contamination
- Decreased Milk Production



# Carry-Over Rate of Mycotoxins from FEED to MILK

<b>Mycotoxins</b>	<b>Reduction of biological potency</b>	<b>Estimated carry-over rates (%)</b>
<b>Aflatoxin B1</b>	<b>Minor</b>	<b>0.3 – 6.2</b>
Fumonisin B1	Unchanged	0 – 0.05
Ochratoxin A	Significant	< 0.02
T-2 toxin	Significant	0.05 – 2.0
Deoxynivalenol	Significant	0.0001 – 0.0002
Zearalenone	None	0.06 – 0.08



## Levels of Aflatoxins in Feed Ingredients

Feed Ingredients	Aflatoxin B1 (ppb)
	Range
Maize	1 – 680
Jowar	1 – 12
Broken rice	3 – 25
GNC	3 – 380
Rice bran	2 – 36
Cattle feed	2 – 100

- Samples are obtained from different livestock farms in Kerala



# Seasonal Comparison in Feeds

Season	No. of samples	Total AF (ppb)
Winter (Dec-Jan-Feb)	185	25.08
Summer (March-Apr-May)	157	21.09
Early Monsoon (Jun-Jul-Aug-Sept)	200	24.68
Late Monsoon (Oct-Nov)	167	65.19

- Late Monsoon (Oct –Nov) is the most critical period for AF contamination in feeds.



**Raw Material  
Receiving**

**Control**



**Storage**



**Manufacturing**





# 1. Raw Material Receiving

## Instant Moisture Meter

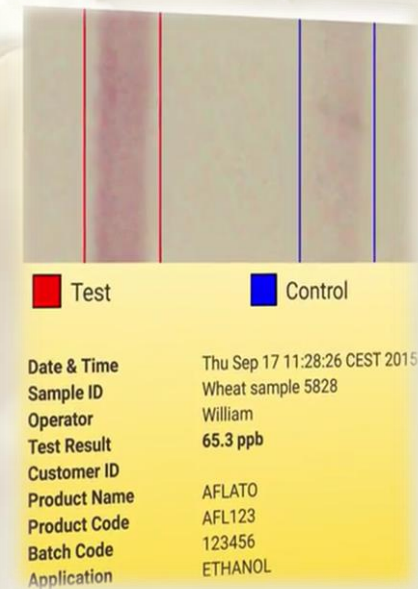
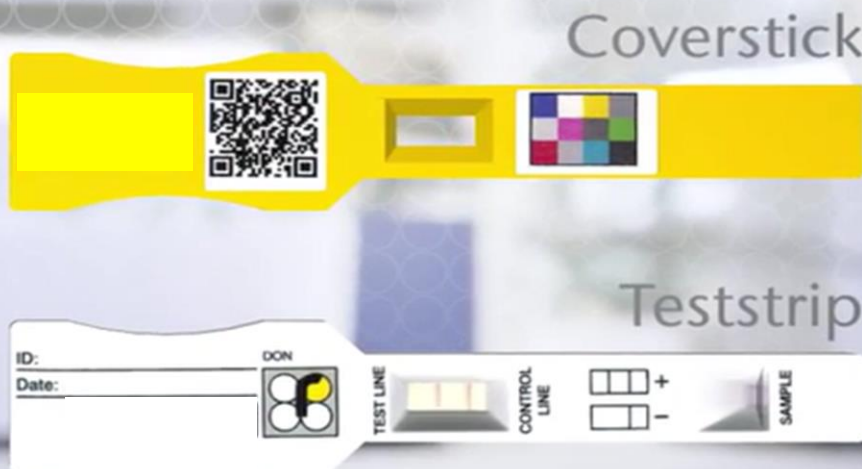
- Moisture should not be  $> 12.0 \%$
- If  $> 12.0\%$ , don't store.





# Rapid Detection Kits

- **Principle:** Antigen-antibody reaction. A specific antibody against Aflatoxin recognizes the Aflatoxin molecules in the sample.
- Negative : Test line is not visible
- Positive (>4 ppb) : Test line is clearly visible.



# Methodology

10 g ground  
sample



Extracting Aflatoxins  
using methanol



Shake & allow to  
sediment for 5 min.



Reacting with  
mobile solvent



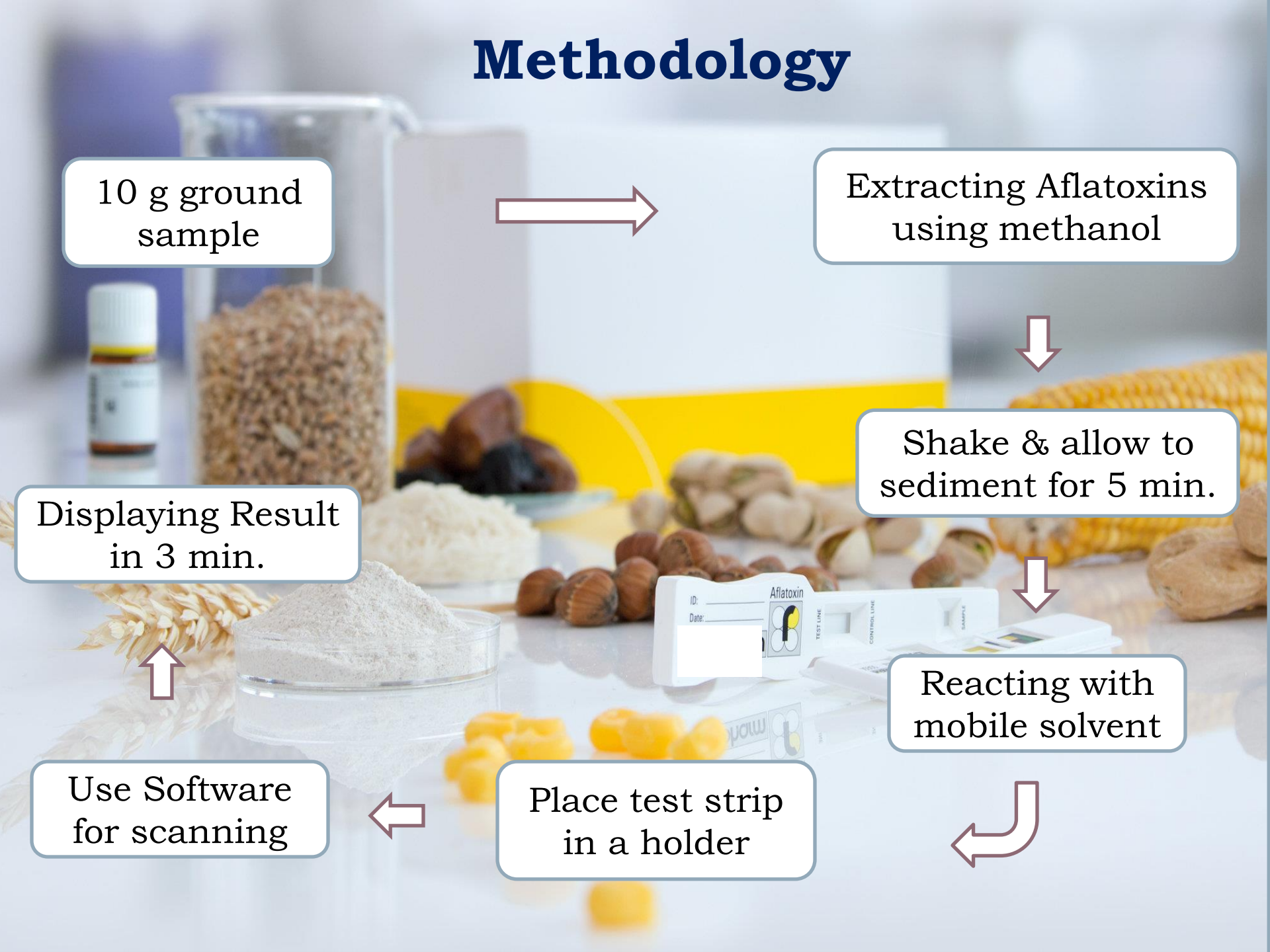
Place test strip  
in a holder



Use Software  
for scanning



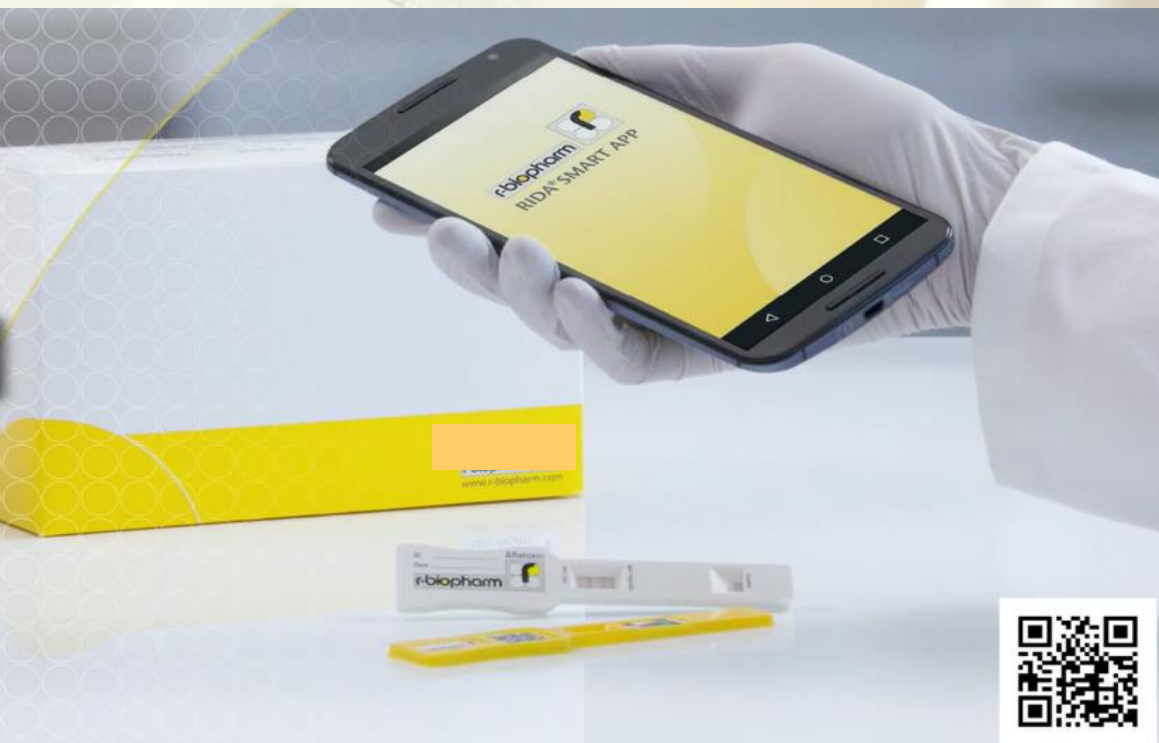
Displaying Result  
in 3 min.





# Testing Kits are Available

- **Testing** : B1, B2, G1, G2
- **Sensitivity**: 3-300 ppb
- USDA-GIPSA approved





## 2. Storage

- Grain should be stored <13% moisture.
- If storing >2 weeks, keep aerated & cool.
- Regular cleaning of Bins, Silos & other storage facilities to eliminate source of inoculations.

### 3. Manufacturing



- **Toxin Binders/ adsorbents** : act by reducing bioavailability of the toxins (EFSA, 2009).

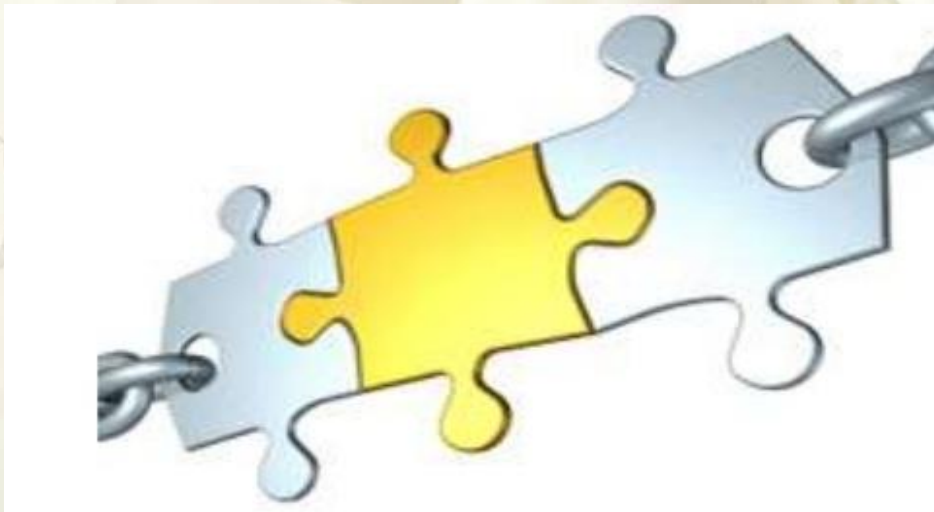
#### **Good binders:**

1. **Adsorption capacity** : >90% at pH 5.0
2. **Irreversibility** : Strong binding.
3. **Specificity** : Aflatoxins are adsorbed.
4. **Safety** : Safe for animals, consumers & the environment.



# Various Toxin Binders

1. **Silicate products** : Bentonite, HSCAS
2. **Carbon products** : Activated charcoal
3. **Yeast Cell Wall** : MOS,  $\beta$ -glucans
4. **Inorganic polymers** : Polyvinylpyrrolidone





# **Comprehensive Approach for Aflatoxin Control**



# Approaches

- **Strip test at farm/ DCS level**

- Provide preliminary qualitative results
- Sensitivity: 5 ppb



- **Hand-held kits/ instruments**

- for detection of Aflatoxins in feed raw materials.





# Approaches

- **Vendor qualification.**

- **Training.**

- **Sensitization of farmers.**





# Take Home Messages

1. **Regular screening of raw materials at CFP level using “Rapid Detection Kits”**
2. **Proper storage, FIFO**
3. **Use of suitable toxin binders.**
4. **Awareness building, extension.**

***The secret of success without hard work is....  
still a SECRET.***

**Thank You**





# Maximum permissible limits of Aflatoxins

Particular	US FDA	EU	BIS/FSSAI India
Compound feed AFB1 (ppb)	20	5	20
Milk, AFM1 (ppb)	0.5	0.05	0.5
Cereal grains (Maize & other cereals) AFB1 (ppb)	20	20	
Oilseeds and meal (GN & cottonseed) AFB1 (ppb)	20	20	