Aflatoxin Reduction and Microbial Safety for Locally Produced RUTF

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- All children need safe clean food
- Especially malnourished children
- We can control RUTF quality
- Proposed nutrient content standards too narrow
- Proposed microbial standards OK, except
- Can be met by local (national) producers
- Should be met by local producers
- Why Local Ingredients?
- Why Peanuts?

Example RUTF

- 7.3% water
- 15.3% protein
- 36.6% fat
- 10.4% fiber
- 24.8% other CHO
- 5.6% minerals
- 5431kcal/kg
- 30.2% dried milk
- 28.1% sugar
- 25.1% peanuts
- 15.1% oil
- 1.5 % vitamin and mineral mix

RUTF

- Successful: Ethiopia, Sudan, Malawi, Haiti
- Made in Haiti
- Meds and Food for Kids: Medika Mamba
- Nutriset: Plumpy Nut
- Tampala

Reversal of malnutrition

RUTF Implementation

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RUTF Implementation

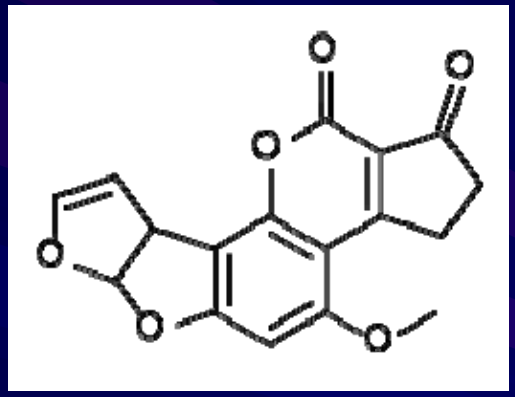
Aflatoxins

- Produced by *Aspergillus flavus* and *Aspergillus parasiticus.*
- Suppresses immune system
- Stunts growth, anti-nutritive
- Cirrhosis, liver cancer
- Peanuts, corn, other crops subjected to drought, insect attack or both more vulnerable
- Can grow in field or storage

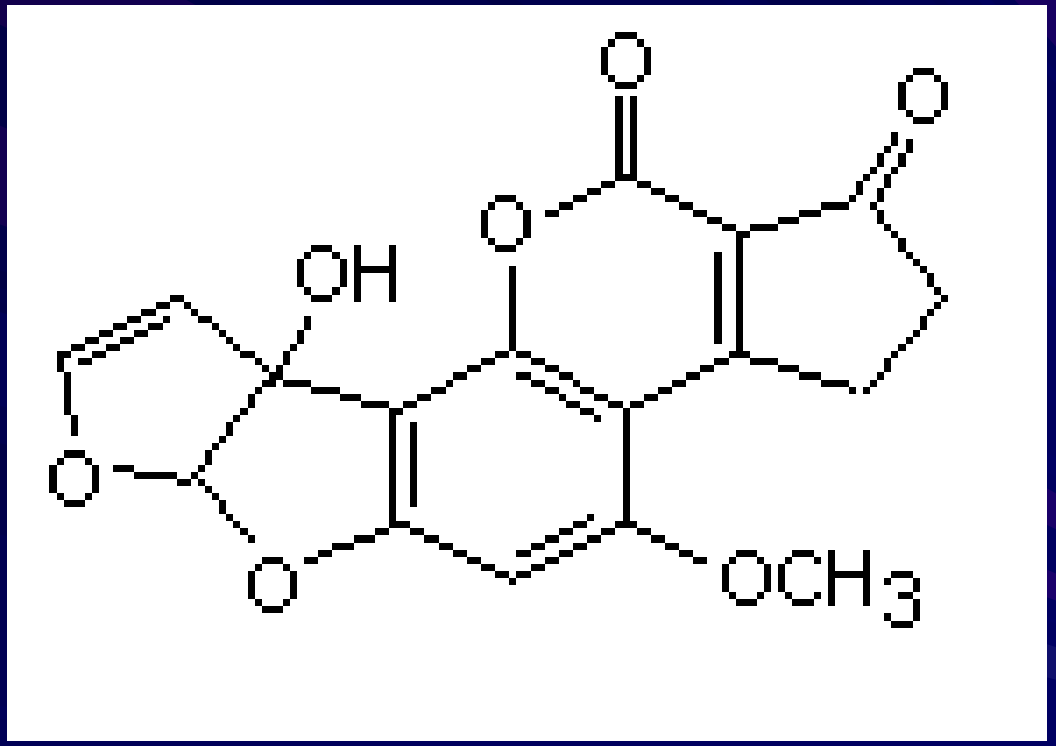
- Preharvest aflatoxin contamination of peanuts and corn is favored by high temperatures, prolonged drought conditions, and high insect activity
- Postharvest production of aflatoxins on corn and peanuts is favored by warm temperatures and high humidity.

Harvest

Aflatoxin B1



Aflatoxin M1



Initial Levels Found in Haiti

- 380-1567ppb total aflatoxins (late 2005, early 2006 samples)
- Average 797.5 +/- 218.5ppb
- >20ppb illegal to feed to US dairy cows
- Extremely high levels, potentially harmful
- Variable
- Unacceptable

HPLC verification

- January 2006: 192.1ppb total AF
- 88.5% B1, 11.5% B2
- May 2006: 353ppb total AF
- 77.9% B1, 11.4 B2, 8.9 G1, 1.7G2

- At least two *Aspergillus* present

Progress

- September 2006 (Market peanuts, sampled and rejected never included in product): 412.5 +/- 32.1ppb
- November 2006 (Farmer stored, not used): 125 =/- 7.1 ppb
- November 2006 (Stringent selection of Port Margot peanuts):26.8 +/- 7.0 ppb
- January 2007: 0.20 +/- 0.10 ppb !!

How was this done?

- How did they go from a range of 380-1567ppb (avg 798) to a range of undetectible-1.0ppb (avg 0.2)?

1. Visual-Tactile Sort in the shell
2. Flotation of select kernels
3. Immediate roasting and grinding
4. Monitoring

Visual and Tactile Sort

Visual and Tactile Sort

Float Selected Kernels

Results

- The 20.0% rejected in shell carried away 81.7 +/- 16.1 % of the toxin
- 6.24% were selected peanuts that floated and took away another 17.9% +/- 16. 2 of original toxin load
- The remaining sinking select kernels (73.74%) retained just 0.44 +/- 0.2 % of original toxin load at a concentration of 0.20ppb in the peanuts

Disaggregated Results - % of Load

- First 4 replicates
  - Rejects 97.7%
  - Floaters 1.8%
  - Sinkers 0.5%
- Fifth and last sort
  - Rejects 17.4%
  - Floaters 82.6%
  - Sinkers ND

If water testing, Roast Immediately

Grind and Use Soon

Monitor

Rejected ingredients must be destroyed
Alternative Uses?

- Burn directly
- Extract oil
  - Biodiesel
    - SVO
    - Methanol esters
    - Ethanol esters
  - Food oil and feed press cake
    - Steam strip of toxin
    - Ethanol strip of toxin

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Use Rejects as Fuel

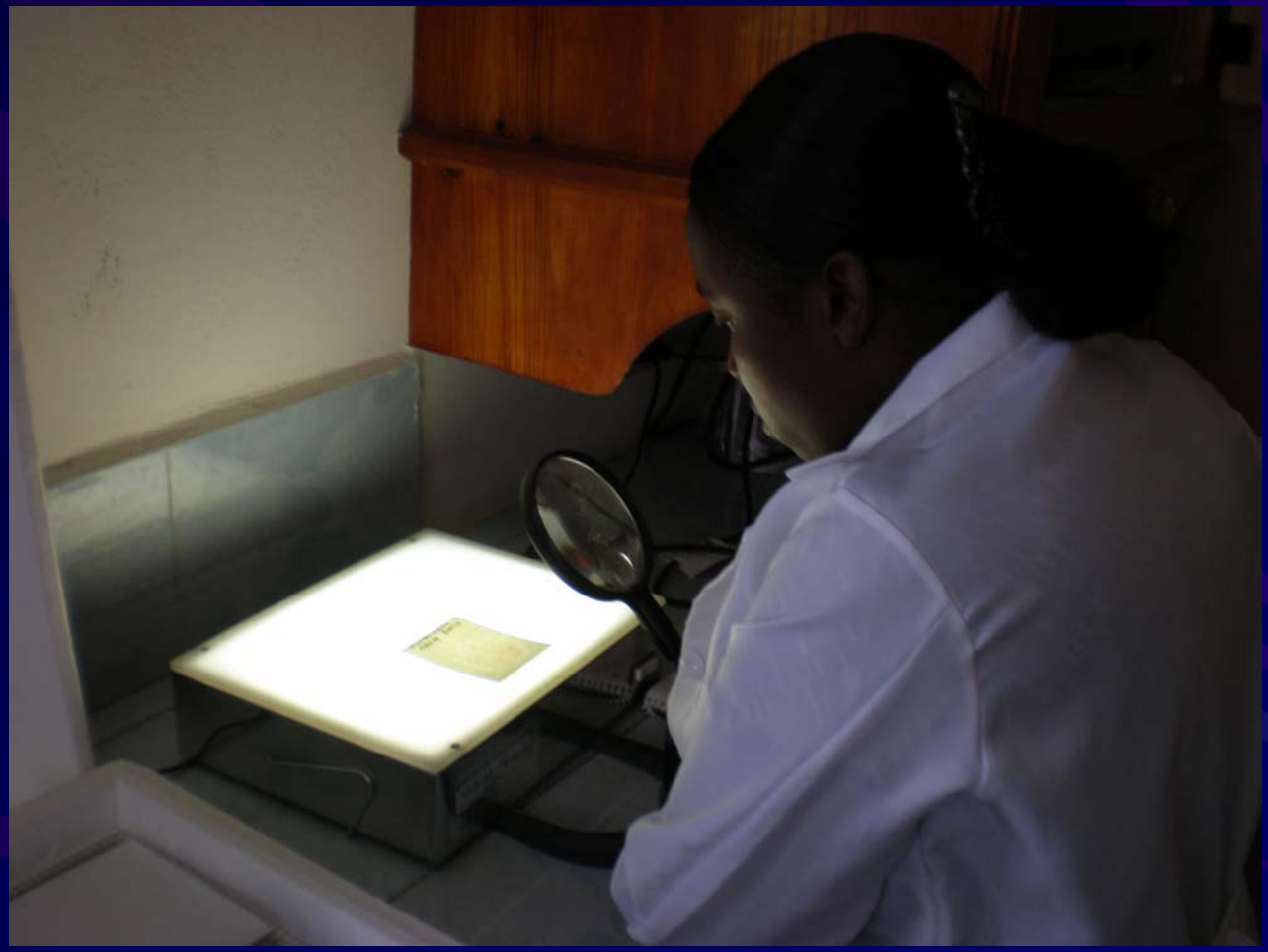
Cooking Fuel is the Major Ecological Factor in Deforestation (and failed reforestation)

Monitoring

- Improved Sampling
- Black Light
- Dipstick
- TLC
- Backup: ELISA and HPLC with fluorometer and MS/MS

Monitor

Monitor microbial quality on site



Total System Considerations

- What happens to highly contaminated rejects? Alternative nonfood uses?
- Is aflatoxin a real problem among the general or at risk populations? Are the people exposed?
- How could malnutrition be prevented in the first place? Animal Source Foods?
- Insecticides vs aflatoxin

Is Aflatoxin Really a Problem?

- How much stunting is not just malnutrition?
- How much liver disease beyond hepatitis, alcohol ingestion and ART?
- How much liver cancer?
- How much T cell count suppression?
- Could urine biomarkers answer these?

Better system?

- RUTF with local ingredients
  - Peanuts
  - Milk
  - Sugar
  - Oil
- Household access to animal source foods
  - Raise their own
  - Power to purchase

Alternatives

Conclusions

- Safe low aflatoxin RUTF can be made with local peanuts
- High quality RUTF can be made in countries where they are needed, and where it can be, it should be.
- The relationship between demand and deficiency in animal source foods deserves consideration.