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Food
Health
Environment

COP14 Delhi, India – September 4 2019

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Grameena Vikas Samithi

Pathways for a Better Life.

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CleanWorks

- Clean Technology
- Clean Food Processing (food-safe)
- Clean Packaging (eco-safe)
- Clean Environment
- Clean Energy & Water Systems
- Clean Soil Management
- Clean Supply Chain Efficiency
- Clean Data and Mobile Systems
- Clean Label (food safe, certified & traceable)


Dry Chain


Dry Chain
Why is it important?


1/3 of food produced is lost
before reaching the consumer.


61% of global food loss and waste occurs for dry food commodities:
cereals, oilseeds and pulses.
Source: WRI analysis based on FAO 2011. Global Food losses and food waste – extent, causes and prevention, Rome: UN FAO, WRI 2013


4.5 Billion people
have aflatoxin in their diet.

25% of all crops in the world are affected by aflatoxins.


Aflatoxins negatively
affect human health.


Aflatoxin is produced by *Aspergillus flavus*, a common and toxic contaminant in staple dried foods.

Foods affected include maize, rice, wheat, groundnuts, nuts, pulses, millet, sorghum, soybean, spices, legumes, oilseeds, coffee, chilies and plant seeds.

Globally, consuming aflatoxin results in

28% of liver cancer cases.

Long-term exposure of children to aflatoxin-contaminated food leads to impaired physical and mental development (stunting).

Chronic exposure also leads to immune suppression, malnutrition, greater incidents of hepatitis viruses and contaminates fodder (for livestock).


Dry Chain
is critical to achieve….
Food safety
Food productivity
Food security

Dry Chain Research

USAID
FROM THE AMERICAN PEOPLE

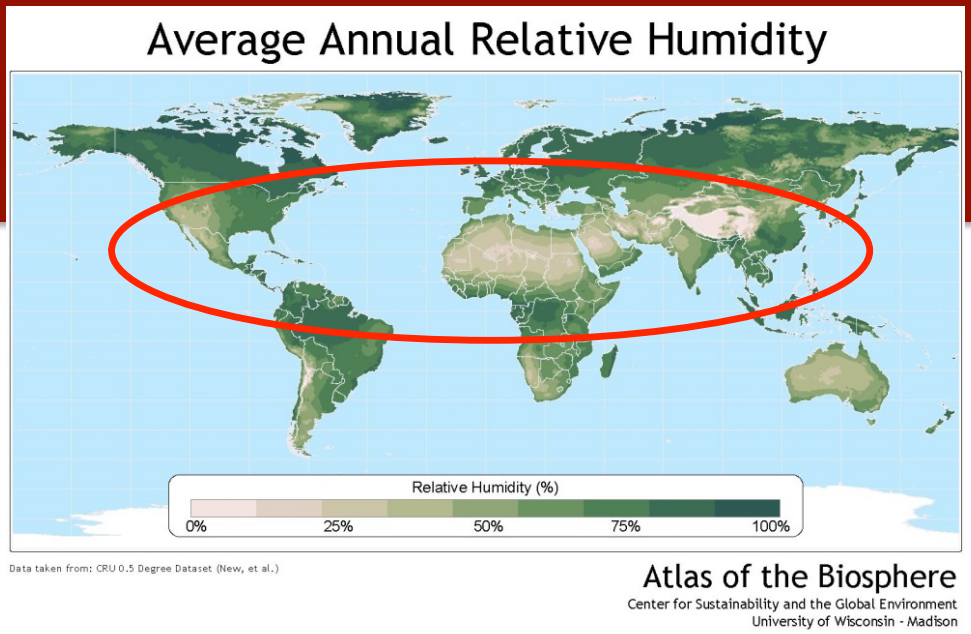
HORTICULTURE
INNOVATION LAB

UCDAVIS
UNIVERSITY OF CALIFORNIA

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

INTERNATIONAL CROPS RESEARCH
INSTITUTE FOR THE SEMI-ARID TROPICS

UCDAVIS
Seed Biotechnology Center



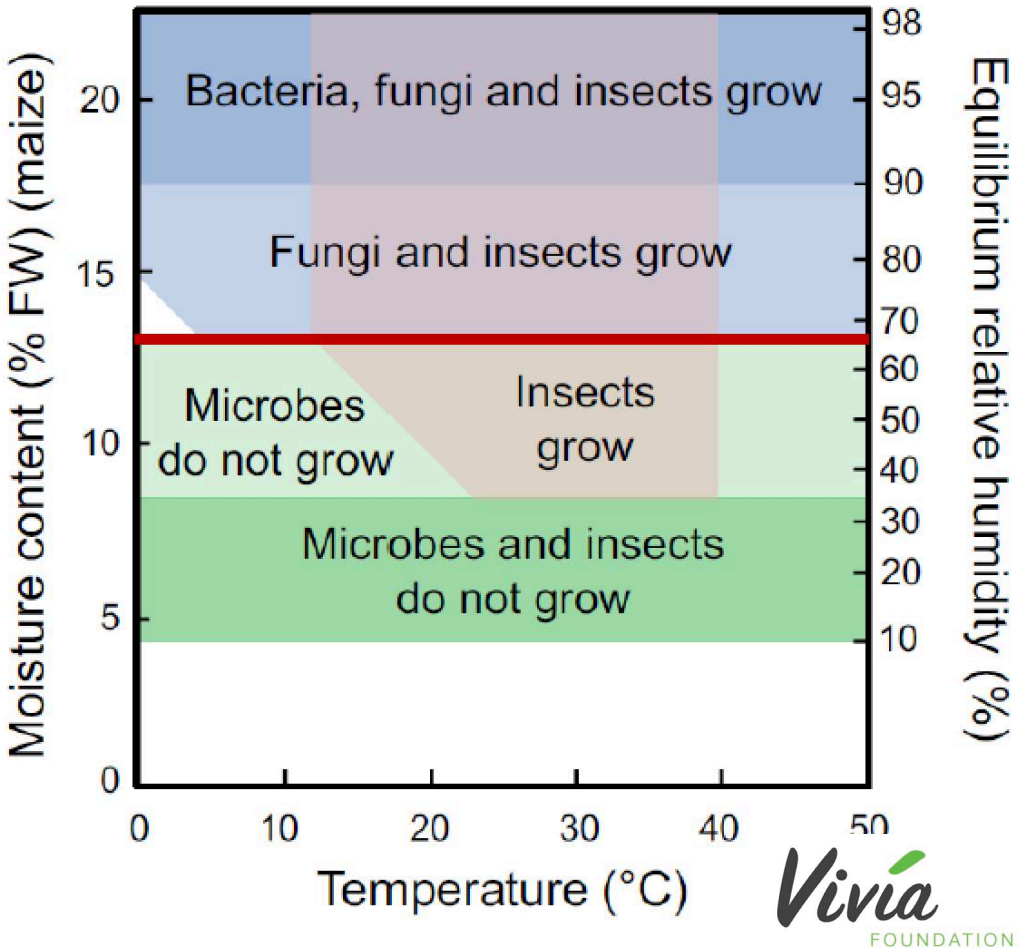
Aflatoxin Exposure:

A large and increasing fraction of the world's population lives in areas where high humidity creates problems for seed and commodity storage.

Williams et al. (2004) Am J Clin Nutr 80: 1106-22.

Dry Chain Research

Relative Humidity: Below critical moisture content levels fungi and insects are not able to grow on food commodities.



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Bradford et al. (2018) Trends in Food Science and Technology 71: 84-93.

Dry Chain Model

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Dry Chain Model

Make it dry and keep it dry throughout the Dry Chain

Initial Drying

Storage

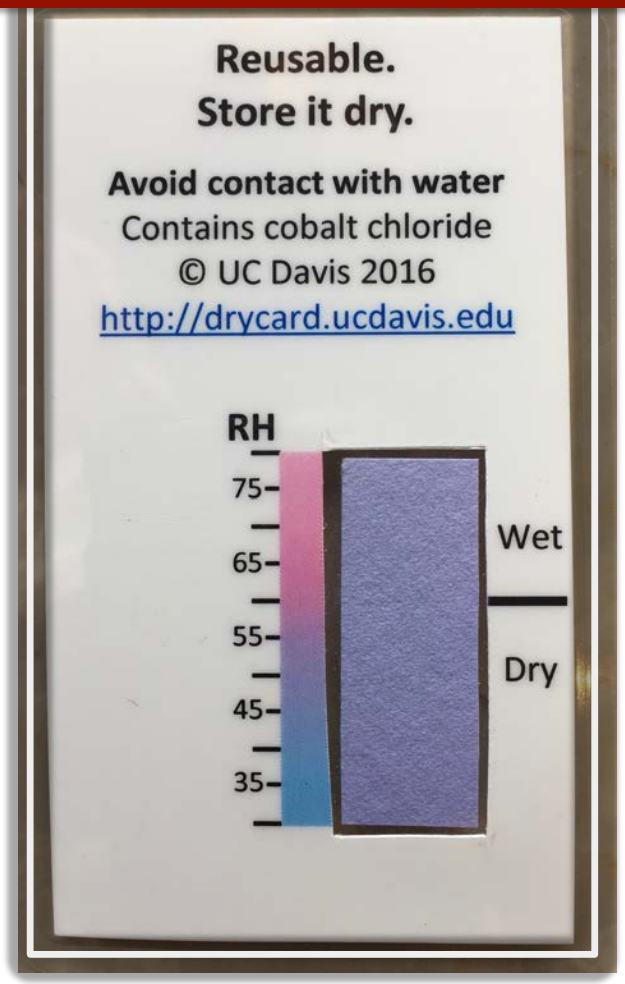
Transport

Processing

Make it Keep it DRY

Dry Card™

FRONT



BACK

Relative humidity should be less than **65%**

Paper should be“blue-ish” at storage

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Dry Chain
for Groundnuts

Dry Chain for Groundnuts

Research Consortium Partners:

- Grameena Vikas Samithi (GVS), India
- Renuka Bio Farms (Andhra Pradesh, India)
- UC Davis
- Mars Inc.
- Kalgudi – India; Vasudhaika Software Pvt Ltd. (mobile app)
- ICRISAT (International Crops Research Institute for the Semi-Arid Tropics)

UC DAVIS
UNIVERSITY OF CALIFORNIA

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ICRISAT
INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS

RENUKA BIO FARMS

Kalgudi
A Business network platform

MARS incorporated

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Dry Chain for Groundnuts

Other Collaboration Partners:

- Vegetable Growers Association of India (VGAI)
- Millennium Institute (iSDG)
- Institute of Frontier Technology (IFT)
- Regional Agricultural Research Station (RARS)
- Dr. Ramadgu Ratnekar, Impact Evaluation
- Telangana State Seed & Organic Certification Authority (Dr. Keshavulu, research & advisory)
- Indian Institute of Packaging

VGAI

Packaging for Better Living
भारतीय पैकेजिंग संस्थान
Indian Institute of Packaging

Telangana State
Seed & Organic Certification Authority

MILLENNIUM INSTITUTE

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India is first in the world for the largest geographical area of groundnut cultivation;

India produces **31% of groundnuts** cultivated in the world.

(ICRISAT, India, 2016)

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Aflatoxin infected groundnuts

Aflatoxin is a deadly pathogen affecting groundnut crops, other grains and many dry foods in India, resulting in toxic contamination, food losses and food waste.

(ICRISAT, India, 2016)

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Mr. Rajan Reddy, Senior Manager,
Farm Programs, Clean Works India

Dry Chain Pilot for Groundnuts

managed, controlled and monitored at Renuka Bio Farms:

- **50% of groundnuts** used traditional methods.
- **50% of groundnuts** used "Dry Chain" practices with moisture controls.

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Dry Chain Pilot for Groundnuts:

- Spring 2018 to Summer 2019
- 30 acres in Andhra Pradesh, India
- Farmers participating, "*Kharif*" rain season
- Farmers participating, "*Rabi*" dry season
- Centralized on-farm management controls

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Dry Chain Cultivation:

- Controlled planting cycles, crop management
- Improved bio-based crop inputs (non-chemical)
- Plant health and soil health

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Dry Chain Harvest:

- Stronger groundnut pod shells, less soil moisture, reduced insect infestation
- Mature harvest with larger shells and stronger, resilient, mature pods

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Dry Chain at Post Harvest:

- Proper drying and storage reduces aflatoxin contamination for the groundnuts
- Use of strong, black moisture-barrier drying tarps accelerates proper drying
- Relative humidity must be kept below <65% to eliminate aflatoxin contamination.

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Solar drying tent and chimney solar dryer

Dry Chain with Solar Drying:

- Controlled dry processing methods
- Groundnut drying in Solar Drying Chambers
- Solar fans for increased, consistent air-flow
- Zeolite drying beads used as moisture dessicants (optional),

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Dry Chain Bagging & Storage:

- Humidity monitoring techniques with real time data collection:
- Hermetic bags for storage and transport with moisture barrier.and multi-layer films
- Sensors dynamically monitor relative humidity.
- Data collection and supply chain platform.

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Field data is collected & monitored:

Pre-harvest:

- Stage A: Farmer and farmland profile (set up)
- Stage B: Planting details and soil conditions
- Stage C: Crop management and farm inputs

Post-harvest:

- Stage 1: Harvest conditions
- Stage 2: Ground drying (tarps)
- Stage 3: Solar drying (tents and fans)
- Stage 4: Bagging (bulk product)
- Stage 5: Storage @ bagging, 30, 60 & 90 days

* 50% “Dry Chain” / 50% “Traditional”

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Dry Chain Groundnut Farmer Training

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Dry Chain: Groundnut Project Initiation

Dry Chain: Groundnut Cultivation


Dry Chain: Groundnut Harvest


Dry Chain: Groundnut Harvest

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Dry Chain: Groundnut Tarp Drying


Groundnut samples sent to ICRISAT for Aflatoxin testing during each stage.
BA-TAP-STG4 B2
BA-TAP STG4 -H1
BA-TAP-STG4 -H2
BA-TAP-STG-4 B1
BA-TAP-STG4 -B1
BA-TAP-STG4 -H1
BA-GAP-STG4 -B1

Dry Chain Field Research

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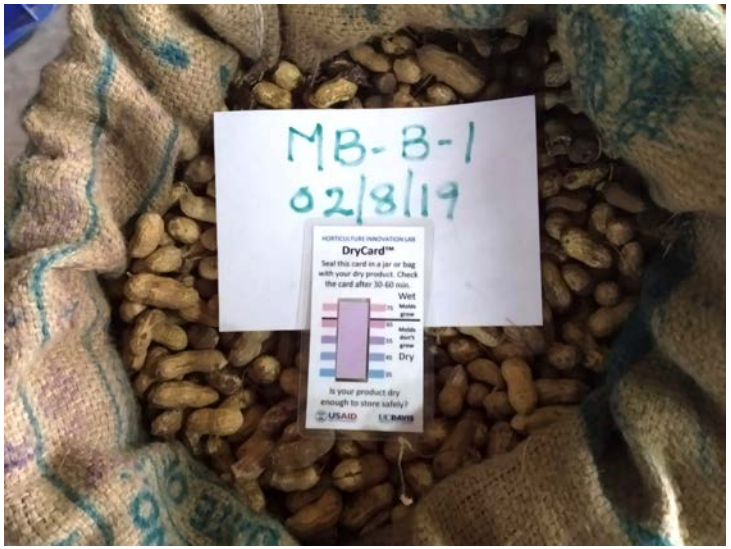
DryCard Field Research

WET (PINK)



DRY (BLUE)

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About Clean Works India

"*Dry Chain to Reduce Aflatoxins in Groundnuts*" is a rural research study directed by Clean Works India, a program of the Vivia Foundation.

Clean Works India is a scalable program to reduce post harvest waste. The program encourages climate smart, food-safe, sustainable practices for small holder farmers – while building economic resiliency for better livelihoods through a "clean", efficient and sustainable supply chain.

Vivia Foundation is a Netherlands social benefit organization that facilitates innovative programs and technologies to accelerate positive global impacts. Programs focus on improved food, health and the global environment which are guided by the United Nations Sustainable Development Goals (SDGs).

www.viviafoundation.org

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