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

Safe food for a healthier Nepal: Priming a national mycotoxin response

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Core stakeholder workshop: developing a mycotoxin communications strategy

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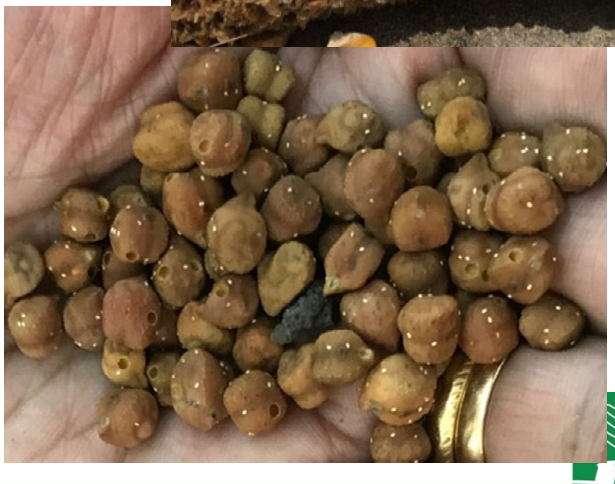
FEED THE FUTURE INNOVATION LAB FOR THE REDUCTION OF POST-HARVEST LOSS

Post-harvest loss categories

Quantity losses

Quality losses (economic, health)

- Nutrient content
- Food safety issues (can spike with shocks)
  - Mycotoxins (also a USA Ag issue)
  - Pesticide residues



DAILY NATION

Kenya alert over 2.3m bags of bad maize

SHARE BOOKMARK PRINT RATING

Farmers spread their maize to dry in Kibwezi. Researchers say spreading maize on the ground increases its contact with the soil, where the fungus that produces aflatoxins resides. Photo/FILE

By LUCAS BARASA
Posted Monday, May 31 2010 at 18:44

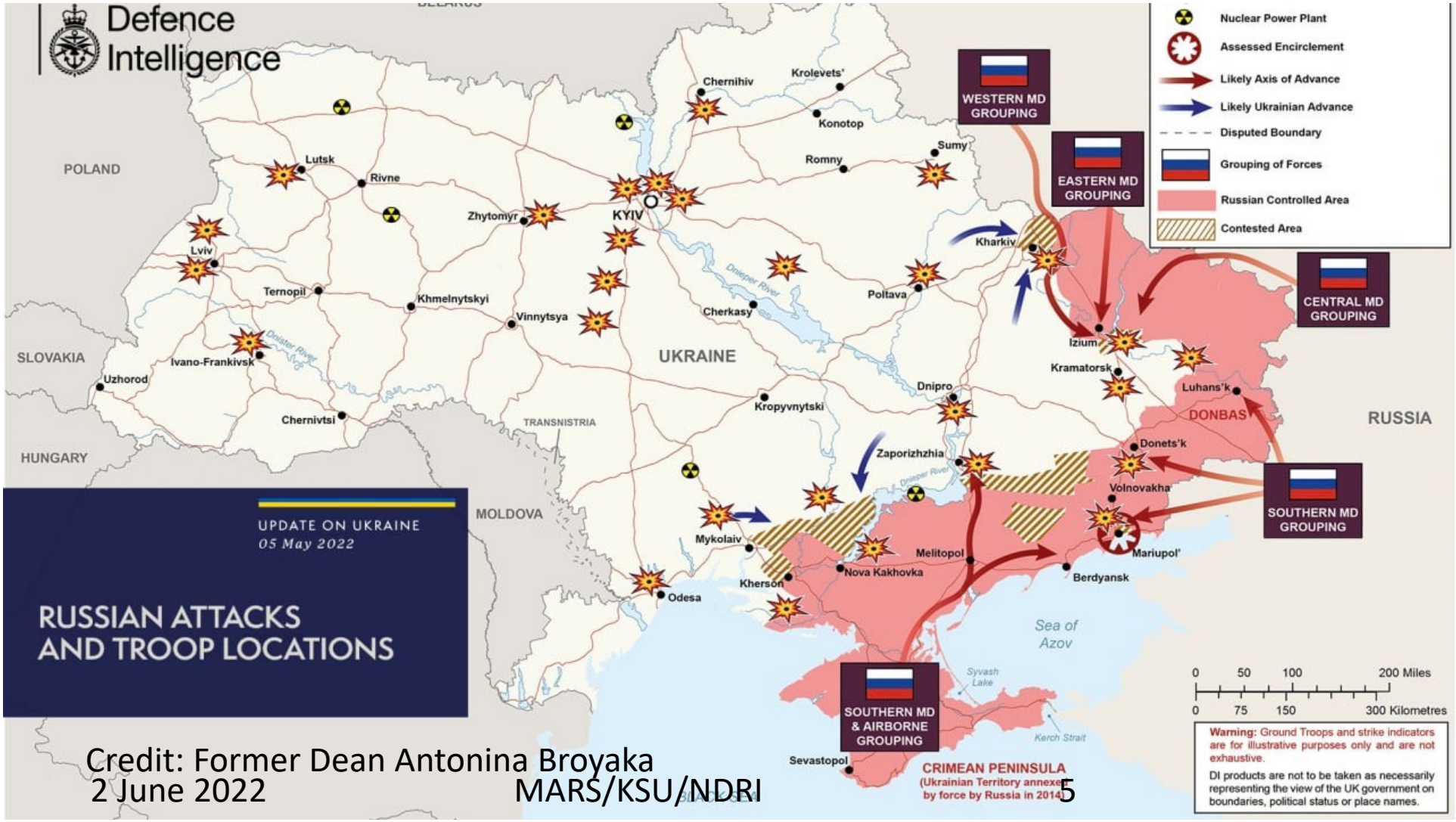
WATTAgNet.com Information on **global poultry, pig** and **animal feed** markets. Regis

Market Information | Poultry | Pig | Animal Feed | Industria Avícola | Blogs | Anima

Home » Mycotoxins confirmed across US during harvest

Mycotoxins confirmed across US during harvest

freeimages.com/Elizabeth Thompson | The Monday Mycotoxin Report from Neogen on October 5 highlighted new confirmed reports of mycotoxins in corn across the country.



Credit: Former Dean Antonina Broyaka

Post-Harvest Loss Innovation Lab

Focus countries:
Bangladesh, Ethiopia, Ghana, Guatemala

Expanded projects:
Afghanistan, Honduras, Malawi, Nepal

Funding:
- "Leader with Associates" Cooperative Agreement
- January 2014 – December 2021

Nepal –NAST Lab Establishment

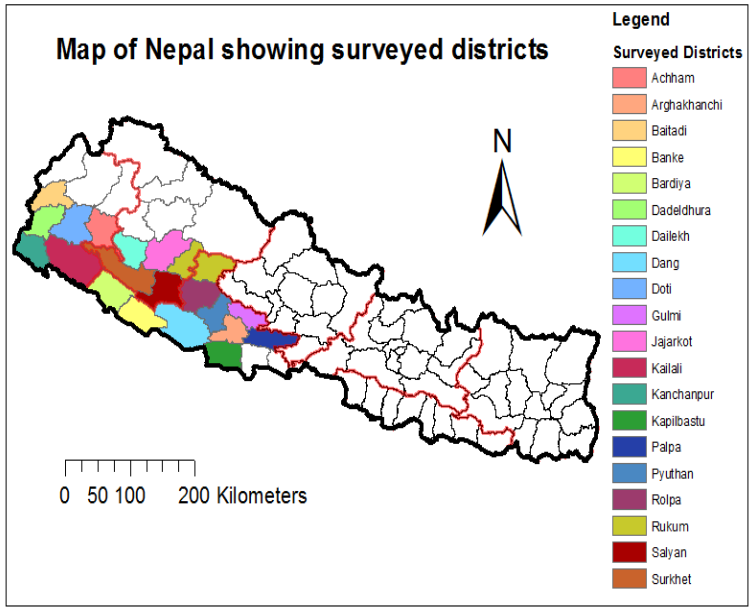
National lab capacity at NAST

- ✓ Trained team (UNL, Mars, in situ)
- ✓ Broad sample processing capability
- ✓ Broad sample analysis capability (two major methods)
- ✓ Official opening November 30, 2019
- ✓ NAST VC sees it as a pillar of their research for improving Nepal moving forward

Opportunity/Sustainability

- ➢ Service provision/ISO accreditation
- ➢ Hosting research for the research community

Household & Market Surveys



Helen Keller International (HKI-Nepal)

Geographical Coverage

- ✓ 20 districts of Feed the Future Zone of Influence:
  - Low land Terai districts
  - Mid hill districts across Western Nepal
  - Mid western and far western regions

Activities

- ✓ Semi-structured questionnaire
  - Demographic information
  - Agricultural economics
  - Characterization of pre and post harvest agricultural practices (HH Survey)
  - Characterization of storage, cleaning, sorting and storage practices (Market Survey)

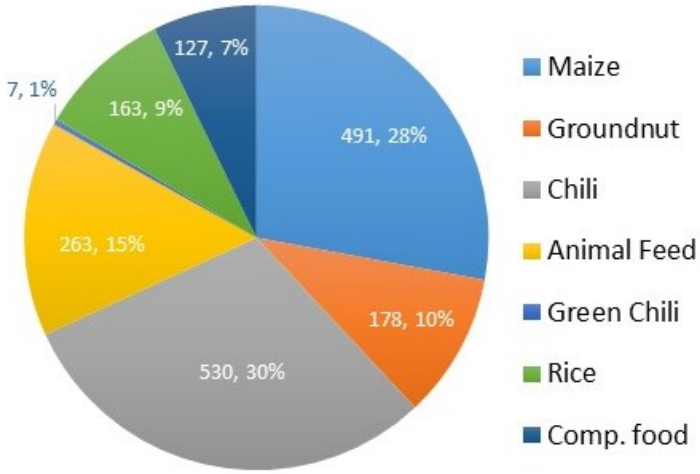
Household & Market Surveys

Enumeration/sample collection

- 1st round of surveys held from March -April 2018
- 2nd round survey completed October 2018
- 320 households in 4 districts
- Markets in 71 municipalities and 20 rural municipalities of 20 districts
- Maize, groundnut, chilies, animal feed, rice, soy balls, complementary food

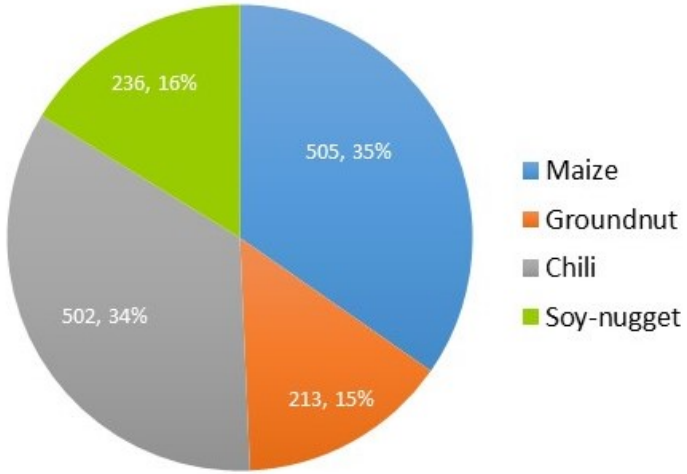
Survey samples collected

Summer season



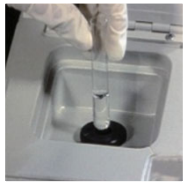
1,759
Samples collected

Winter season



1,456
Samples collected

Sample Analysis



Laboratory at UNL

- Receiving of
- Moisture det
- Mold analysi
  - *Aspergill*
- Aflatoxin ana

- Corn, wheat,
- Chili
- Animal feed

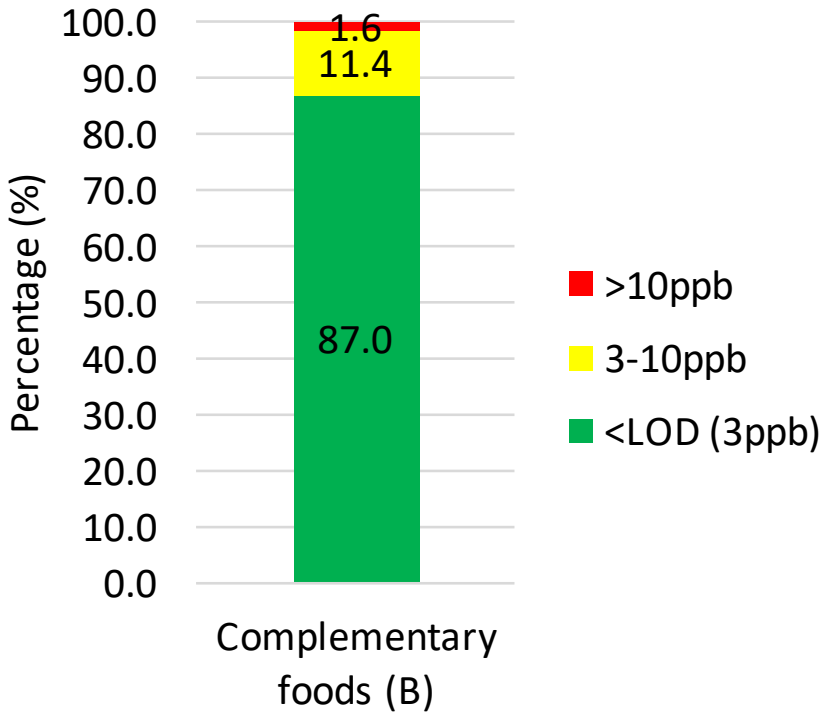
Laboratory at NAST

- Receiving of samples
- Moisture determination
- Aflatoxin analysis by ELISA strips

- Peanuts

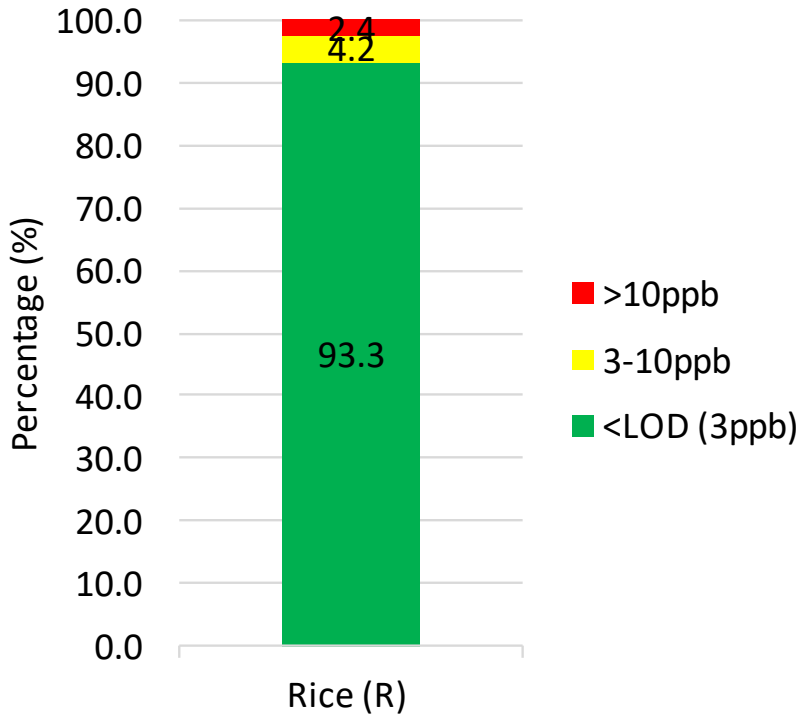
Complementary foods, Banke

Max 39ppb



Rice, Banke

Max 25ppb

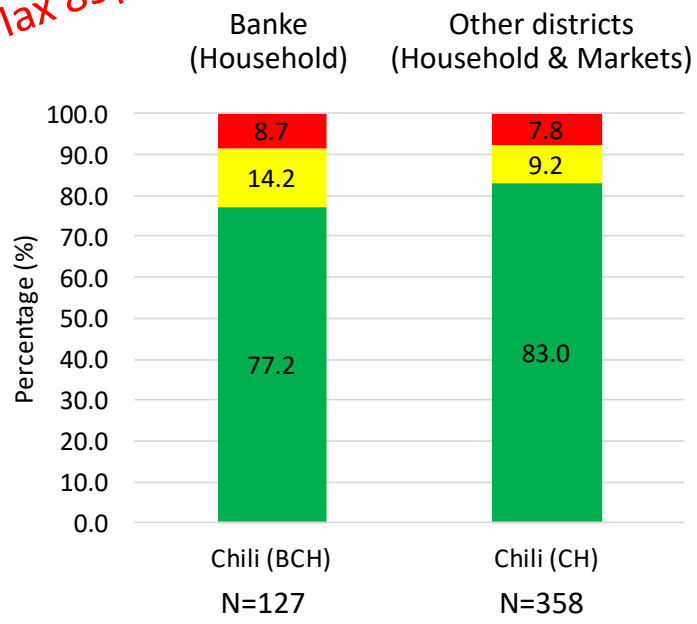


Potential for *aflatoxin* contamination among sampled foods in Nepal

Chili

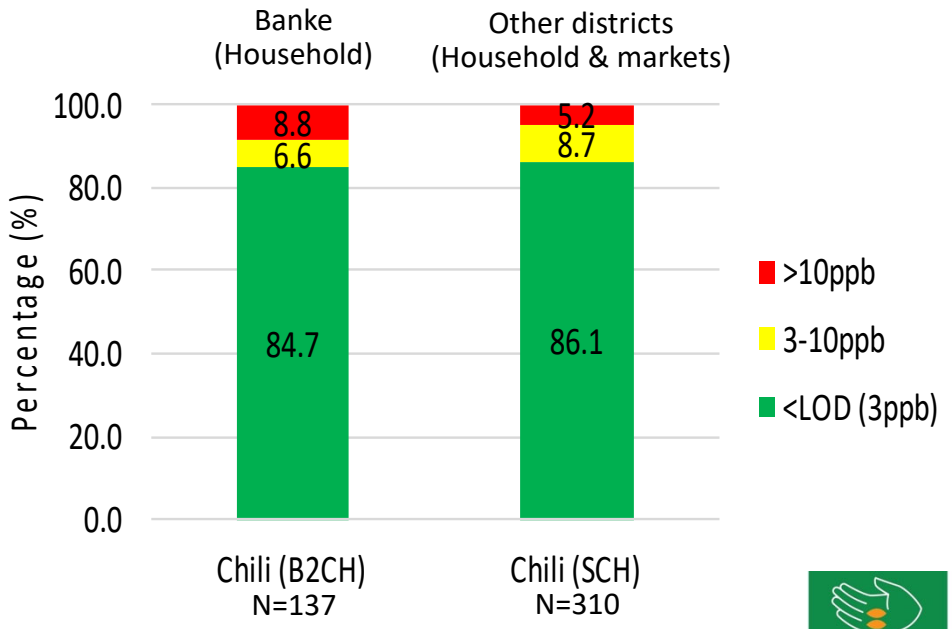
Round 1 (summer)

Max 85ppb

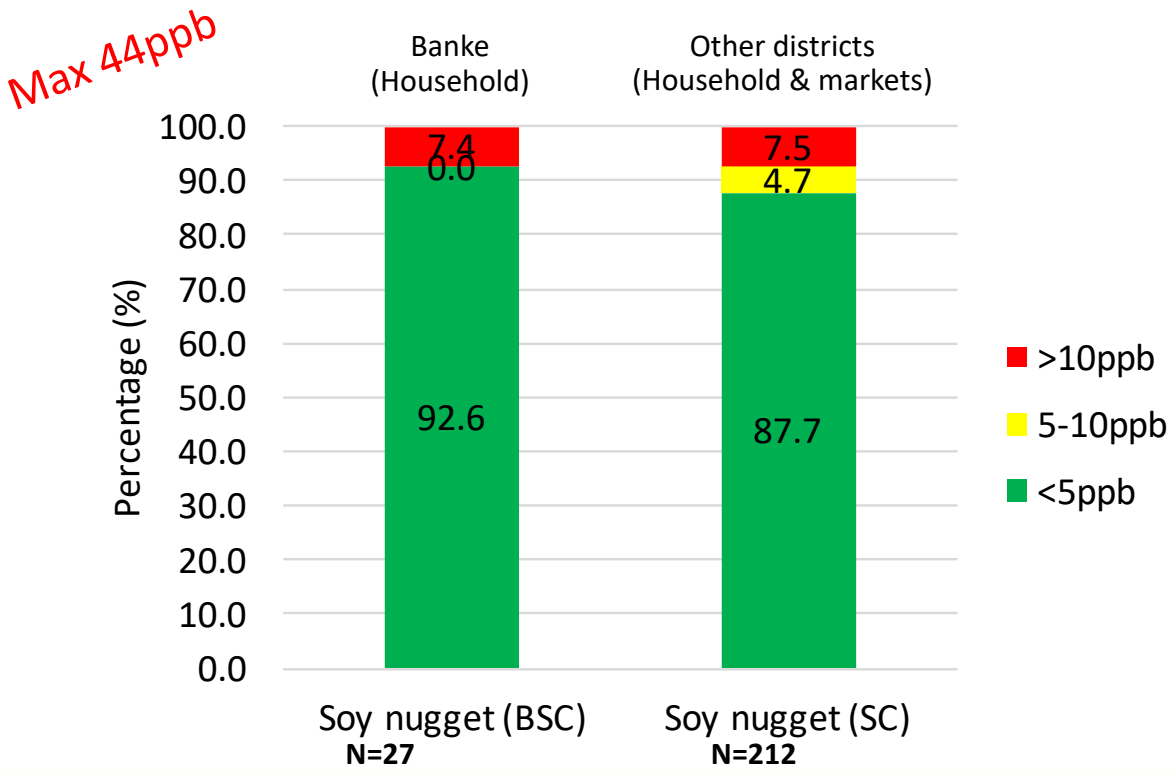


Round 2 (winter)

Max 130ppb



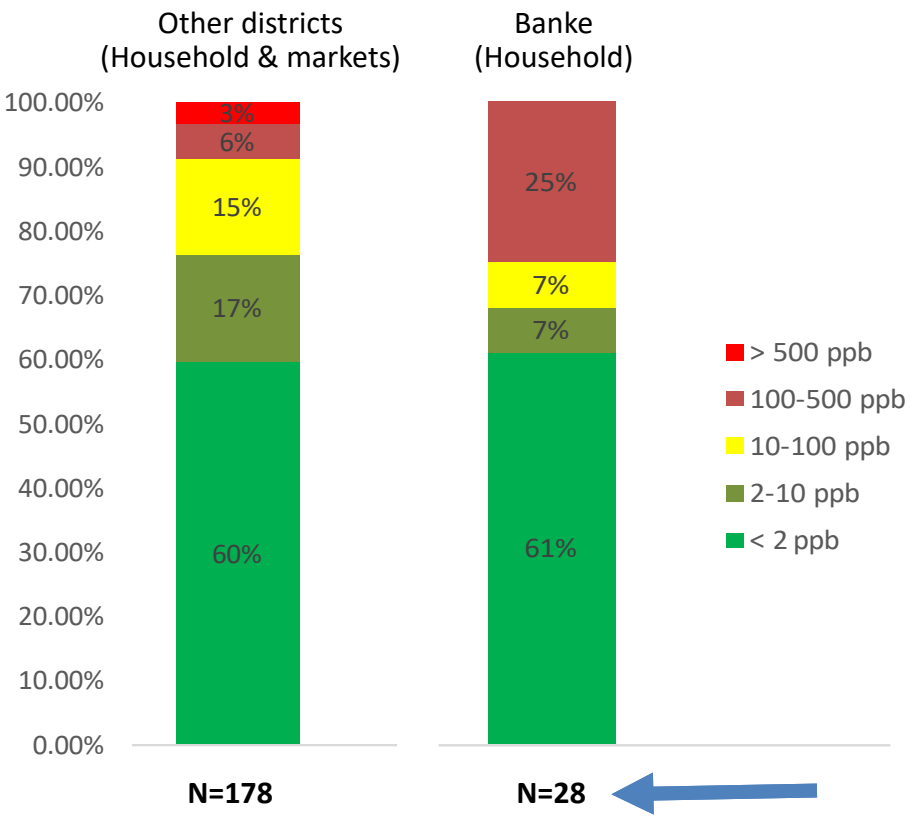
Soy Nugget


Max 44ppb
Banke (Household)
Other districts (Household & markets)
Percentage (%)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
7.4
0.0
92.6
7.5
4.7
87.7
>10ppb
5-10ppb
<5ppb
Soy nugget (BSC)
N=27
Soy nugget (SC)
N=212

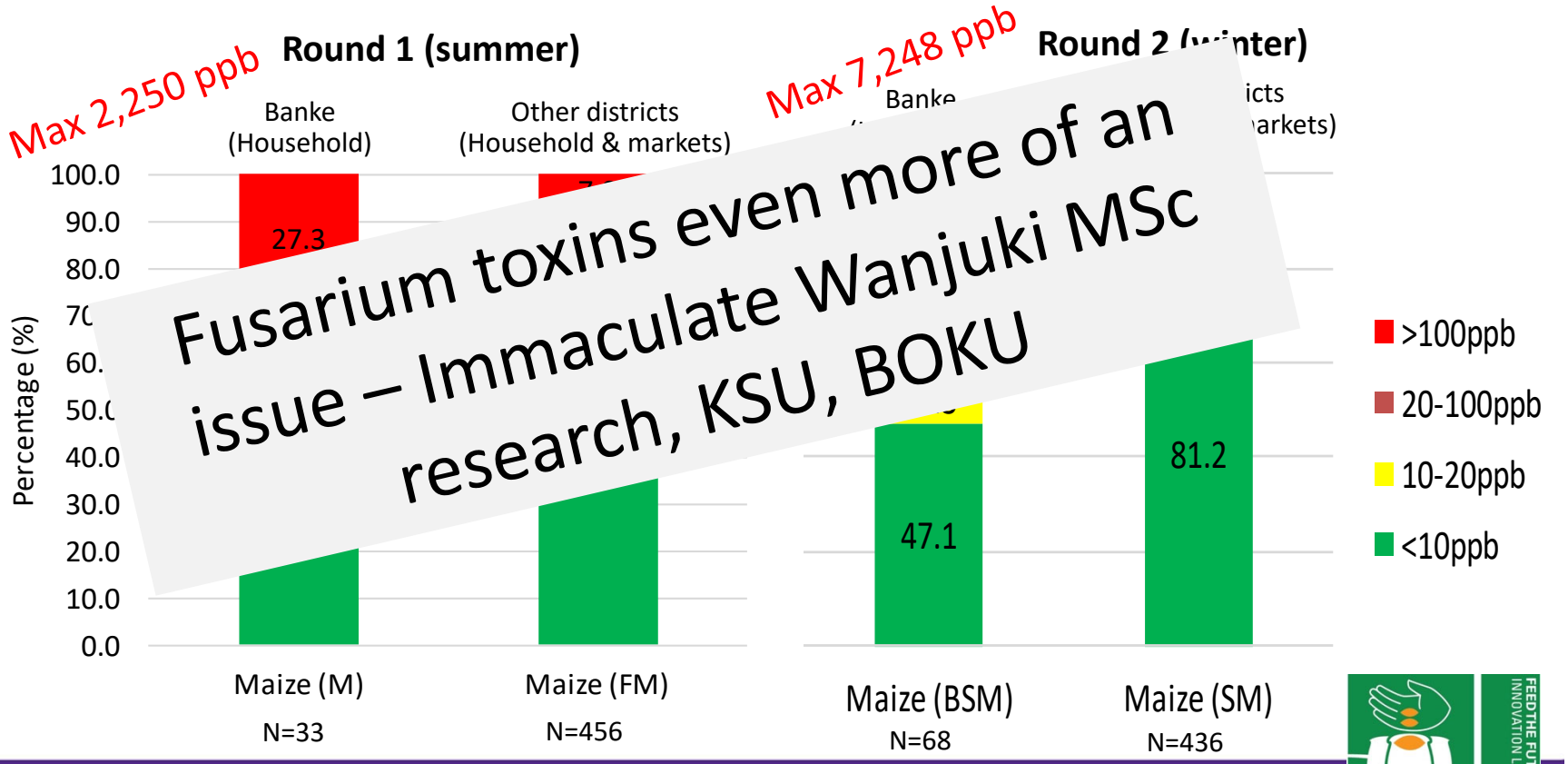
Potential for *aflatoxin* contamination among sampled foods in Nepal

Groundnut

Max 5,425 ppb

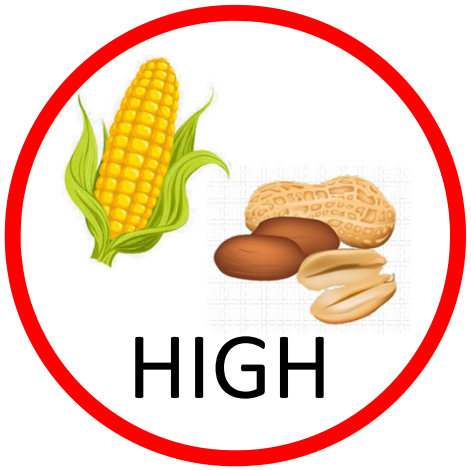


Maize



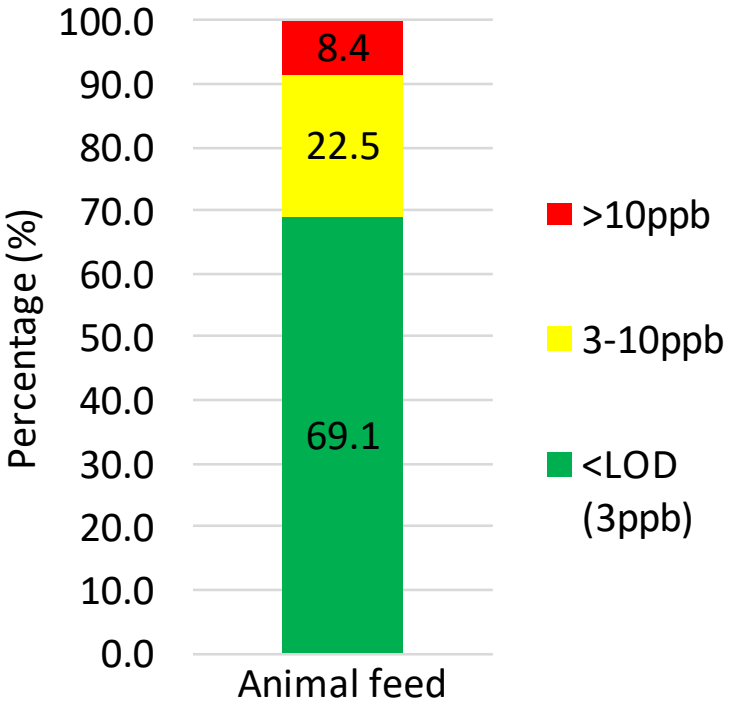
Fusarium toxins even more of an issue – Immaculate Wanjuki MSc research, KSU, BOKU

Potential for aflatoxin contamination among sampled foods in Nepal



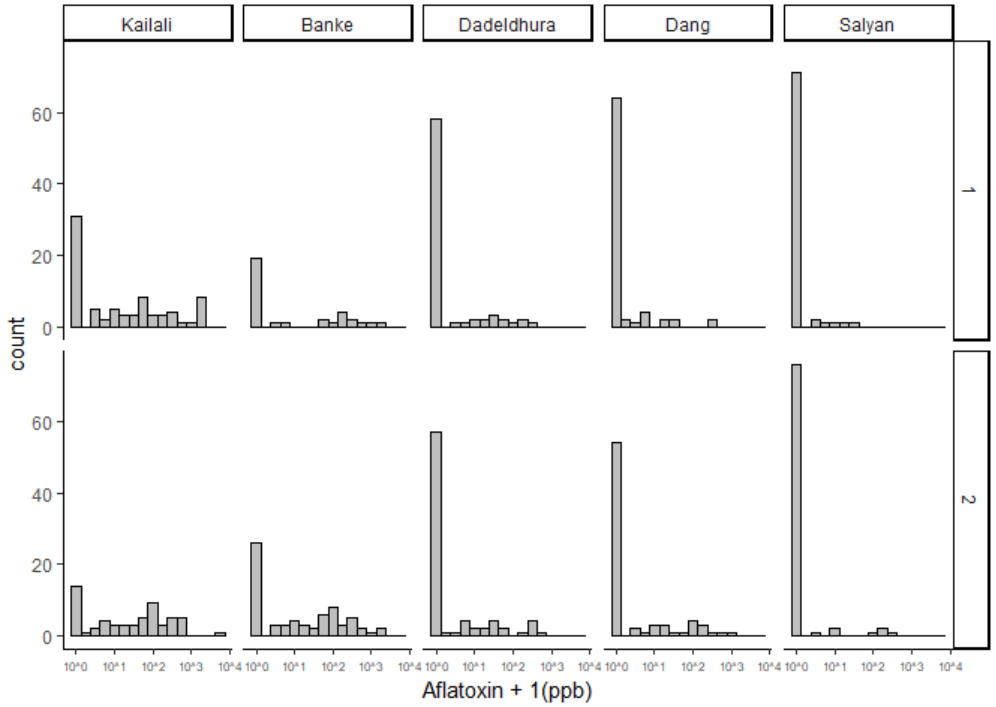
Animal Feed

Max 650 ppb



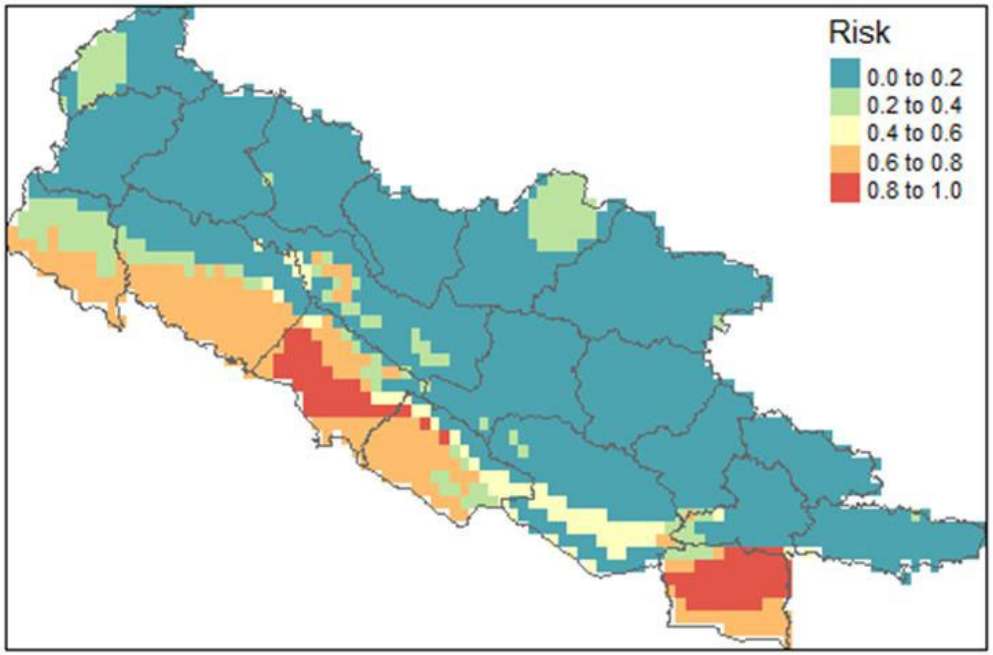
Aflatoxin in maize – Round 1 households

Aflatoxin levels highly skewed (typical for aflatoxin contamination)



District	Median	Mean
Banke	71.8	402.1
Kailali	61.4	344.2
Dadeldhura	27.8	156.0
Dang	23.9	133.9
Salyan	17.1	95.8

Risk mapping for a moving target



- Survey aflatoxin food data (4 districts; 75% data) + weather data → risk mapping model
- Validated on 25% survey data
- Risk map for 2018 harvest/survey

Results + stakeholder input = recommendations

Stakeholder input

recommend short-, medium- and long-term intervention options

2019 Stakeholder Workshop

- Adapted from PHLIL Afghanistan Buy-In
- Output: qualitative and quantitative stakeholder-sourced assessment of future directions
- Session topics include:
  - Sociology and economics
  - Remediation and mitigation
  - Human and animal health
  - Communications
  - Physical infrastructure and human capacity building

Multiple mycotoxins, foods still need assessment

What food/feed mycotoxi

By crop/commodity
- *Animal feed – cattle & buffa*
  - Aflatoxin
- *Apple juice*
  - Patulin
- *Chilies*
  - Aflatoxin
  - Ochratoxin
- *Coffee*
  - Citrinin
  - Ochratoxin
- *Dried fruits and vegetables*
  - Aflatoxin
  - Ochratoxin
- *Eggs*
  - Aflatoxin
- *Finger millet*
  - Zearalenone
- *Infant formula*
  - Aflatoxin
- *Lentil nuggets (snack food)*
  - Aflatoxin
- *Maize*
  - Aflatoxin
  - Fumonisin

What food/feed mycotoxin combinations need to be evaluated for health risks in Nepal in the next 3-5 years?

By toxin

- *Aflatoxin*
  - Animal feed – cattle & buffalo
  - Chilies
  - Dried fruits & vegetables
  - Eggs
  - Ginger
  - Infant formula
  - Lentil nuggets (snack food)
  - Maize
  - Meat
  - Milk & other dairy products
  - Peanuts (ground nuts)
  - Potato (storage)
  - Rice (storage)
  - Spices
  - Tree nuts
  - Wheat (storage)
- *Citrinin*
  - Coffee
- *Ergot*
  - Wheat
- *Fumonisins*
  - Maize
- *Ochratoxin*
  - Chilies
  - Coffee
  - Dried fruits and vegetables
  - Milk & other dairy products
  - Spices
- *Patulin*
  - Apple juice
- *Trichothecenes (Deoxynivalenol, T-2, etc.)*
  - Maize
  - Potato
  - Wheat
- *Zearalenone*
  - Finger millet
  - Maize
  - Wheat

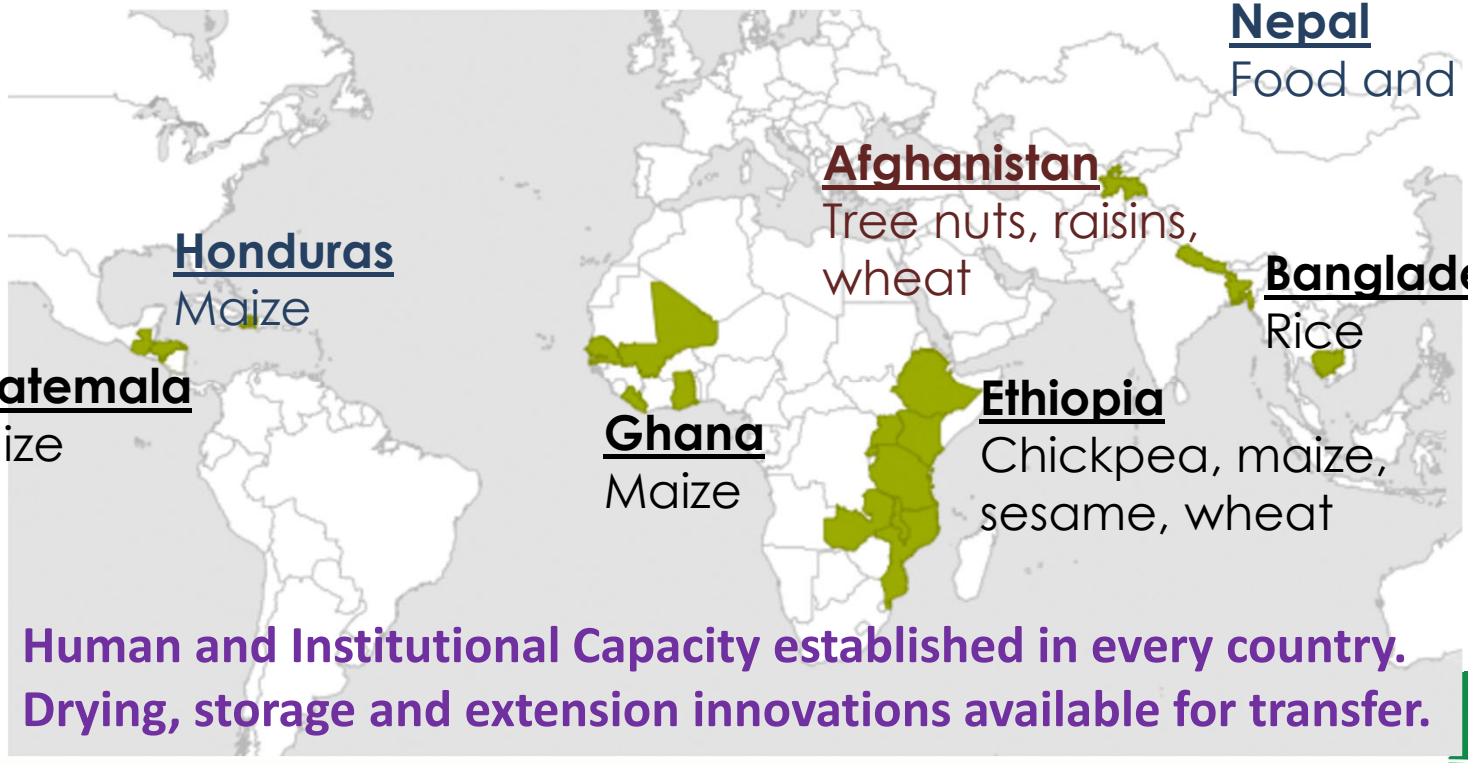
Conference Take aways

- Nepal is not alone in its problems
- Nepal has some advantages to tackling the problem
- Thanks to NIL for bringing this problem to the forefront
- Need a partnership between Ag & Health
- Need a stakeholder alliance ***and communications plan***
- Consensus that there are Nepali systems (health, ag, farmer federations, Ag Info and Training Center,…) that can be mobilized to address mycotoxins.

Actionable takeaways: survey + stakeholders

- Low aflatoxin awareness/risky agricultural practices
- Poor drying and storage practices, need for innovation packages at multiple value chain entry points (on farm, including as service provision or community-based efforts; traders/aggregators; market vendors,..)
- Research capacity has been enhanced; however, expanded, hub-spoke, surveillance/mitigation, risk communication capacity is needed (provinces, academia,…)
- Pair enabling policy with private sector & agricultural system capacity & awareness **(communications plan)**

Post-Harvest Loss Innovation Lab



Human and Institutional Capacity established in every country.
Drying, storage and extension innovations available for transfer.

SESI TECHNOLOGIES

ZeroFly® Hermetic Protected hermetic properties

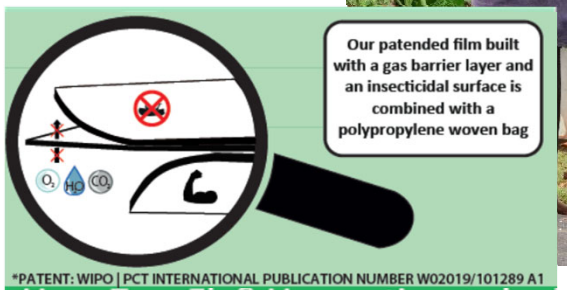
Upgrading from the PICs approach, with ideas from Grain Pro & the food packaging industry:

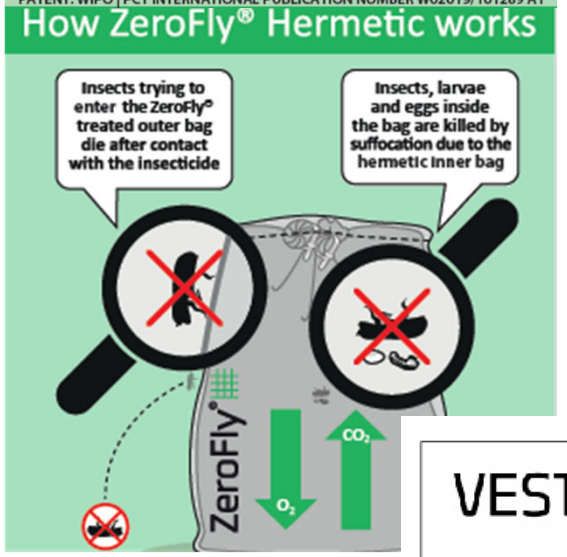
⬆ Technology ⬇ Plastic

Our technology protects the hermetic properties from boring insects trying to enter the bag

Our hermetic technology kills any oxygen consuming insects in the bag

Grains are not in direct contact with insecticide layer (even when grains are in direct contact with insecticide layer residues are safe)





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IMPACTING PEOPLE

Partners: In Country

Nepal Development Research Institute: survey design and implementation, lab establishment, sample analysis, policy linkages, in-country lead

Helen Keller International: survey implementation lead

Tribhuvan University: research and capacity building

Nepal Academy of Science and Technology: mycotoxin laboratory establishment and hosting, shared research capacity

Broader stakeholder group: initial and ongoing consultation, including August priority setting workshop

Partners: US and International

Kansas State University: lead; mycology, mycotoxin, agricultural economics

University of Nebraska-Lincoln: mycotoxin/mycology analysis, capacity building

CSIRO Australia: modelling, sampling, stats

Nutrition Innovation Lab: Diet-exposure/ stunting association (Banke), Tufts University and partners

Mars Global Food Safety Center: collaborations on lab design, capacity building, research, intervention identification, and funding

ISPA: multi-mycotoxin/mycology analysis: pilot snapshot

Romer: mycotoxin kit and equipment donation

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SAWBO
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FOR THE REDUCTION OF
POST-HARVEST LOSS

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Helen Keller International: Dale Davis and team
Nepal Academy of Science and Technology: Jaishree Sijapati and team
Tribhuvan University: KC Gopal and team
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Australia: Commonwealth Scientific and Industrial Research Organisation: Ross Darnell
Italy: Institute of Sciences of Food Production: Antonio Logrieco and team
Romer Labs, China
Nutrition Innovation Lab, Tufts Univ.: Patrick Webb, Shibani Ghosh, Robin Shrestha & team

USAID
FROM THE AMERICAN PEOPLE

Support for the past project.

MARS
MARS Global Food Safety Center

Support for this workshop, and past project.

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- **Government of Nepal** support and participation
- **Mars:** Funding under the Mars Food Safety Alliance: Bob Baker, Guangtao Zhang, Justina Raggett
- **Nepal Development Research Institute:** In-country lead, Jaya Gurung, Nirmala Pandey
- **Kansas State University:** John Leslie, Jeff Morris, Jagger Harvey
- **Core Stakeholders**

MARS

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