MARS/NDRI/KSU Communications Workshop
Himalaya Hotel, Kathmandu, 2-3 June 2022

Part 3
Dhulikhel Conference Responses Distributed to Workshop Participants (Edited and Summarized)

Nominal Group Questions/Responses from Dhulikhel Workshop Relevant for Consumer Audience Sorted by Issue

Health

How does mycotoxin contamination impact resilience of Nepalese farmers and their families?

Family Quality of Life

- Lower quality of life
- Poor family health
- Affects next generation of family
- Increased child mortality
- Mental stress & psychological impacts
- Reduced work performance

Family finances

- Increased need for health and food aid/starvation food shortage

Job quality – Looks to government for solutions

Who in Nepal needs more information about mycotoxin-associated health problems?

Consumers

- Consumers (household level)
- Consumer activists

Health workers – Health professionals

Education

- School teachers
- Parents

Families

- Consumers (household level)
- Parents
- Pregnant women & mothers and support services

Outreach – Media

What scares you most about mycotoxin contamination?

Note that in addition to the listed items, "Hidden" (unknown) risks are relevant for every subcategory

Health (self or others)

- Malnutrition
- Disease outbreak
- Serious family health problems
- Cancer (especially liver cancer)
- Immune system suppression
- Illness in old age
- Sterility
- Death
- Impaired growth/nutritional outcomes
- Effects on cognitive development

Food Safety/Security

- Threats to food security
- Fear to eat food
- Difficult to mitigate
- Decreased shelf life of food

Family – Intergenerational loss

What information do new mothers and young families in Nepal need to know about the consequences of mycotoxin contamination?

Health

- Mycotoxins are carcinogens
- Mycotoxins take a long time to be detoxified
- Harmful health effects of mycotoxin contamination
- May lead to aflatoxicosis & death
- May lead to liver cirrhosis & liver cancer
- Immune system suppression
- Effect of mycotoxin on child growth and development
- May lead to cognitive impairment
- Leads to stunting
- Low birth weight
- Small newborn head circumference

Economics/financial

- Adverse effects of mycotoxins
- Provide information about discarding contaminated food

Origin/transmission

- Foods, *e.g.*, maize and peanuts, where mycotoxins naturally occur
- Mycotoxins are found in foods that are not dried/stored properly
- Transfer of mycotoxins through breastfeeding

Identify educational means and materials to increase consumer awareness of mycotoxin contamination in domestic and imported foodstuffs.

Education

- School syllabus/curriculum
- Educational series/seminars/ webinars/lectures

Information available or resources to be developed

- Information from trustworthy local body
- Establish resource centers
- Orientation/training for FCHV – Female community health volunteers
- Posters & pamphlets
- Hoarding boards (public posters & bill boards)
- Spiral flip charts
- Visual/video documents
- Quarantine reports

Conventional media

- Radio and TV public service announcements
- Newspapers
- Press media briefs

Social media/internet

- Push messages through SMS & telephone calls
- Audio visual media on YouTube
- Jingles

Public-involved activities

- Stage/street dramas/road shows
- Community based programs
- Community group contacts
- Campaign at retailer level
- Home visits

Identify specific messages that the Nepalese consumer and farmer need to hear about mycotoxins and mycotoxin-contaminated food.

Background information

- Mycotoxins are produced by fungi
- Mycotoxins may be present without visible signs
- Mycotoxin contamination reduction & remediation are possible
- List of crops & associated mycotoxins

Health

- Long term health risks include cancer & liver failure
- Associated with stunting of children
- Diet diversification reduces risk
- Healthy diet important for pregnant women & infants

Harvest & Pre-harvest

- Mycotoxin contamination reduction & remediation are possible
- GAP and available technology can reduce mycotoxin contamination
- Practical measures that can be readily implemented

Drying & Storage

- Save grain from physical and pest damage
- Mycotoxin contamination reduction & remediation are possible
- Improved storage reduces mycotoxin contamination
- Prevent pest infestation of food
- Store food in hermetic containers

Infested grain

- Instructions for dealing with mycotoxins
- Safely dispose of moldy food
- Do not feed infested grain to animals
- Don't buy or sell contaminated grain

Food preparation

- Sort out moldy food – do not eat
- Do not consume contaminated/moldy/discolored food
- Washing & cooking do not destroy mycotoxins
- Instructions on dealing with mycotoxins

Slogans

- Buy carefully, eat healthy
- Global issue, we are in all in this together

Economics

Identify economic risks posed by mycotoxins to Nepalese farmers

Increased costs

Increased health cost

Increased cost for adequate nutrition

Decreased returns

Food security/ malnutrition

Lower quality milk (to sell)

How does mycotoxin contamination impact resilience of Nepalese farmers and their families?

Family Quality of Life

Lower quality of life

Psychological impacts

Family finances

Increased need for health and food aid/starvation food shortage

Reduced work performance

National resilience – Slows economy

Identify methods to reduce mycotoxin contamination in foods sold in local markets

Increased awareness/training

Increased awareness among consumers, retailers and farmers

Consumer awareness to buy properly stored/certified grain

Awareness (PSA) campaigns in markets – pamphlets, posters, street dramas, *etc.*, and information dissemination from mass media

Provide the regulations, policies and information on aflatoxins and their impact on human & animal health

Government inspections/grading/regulation

Proper grading of food

Proper storage containers for food

Labeling and certification

Identify specific messages that the Nepalese consumer and farmer need to hear about mycotoxins and mycotoxin-contaminated food

Background information

Mycotoxins are produced by fungi

Mycotoxins may be present without visible signs

Health

Diet diversification reduces risk

Associated with stunting of children

Pre-harvest & Harvest

Mycotoxin contamination reduction & remediation are possible

Practical measures can be readily implemented

Drying & Storage

Mycotoxin contamination reduction & remediation are possible

Store food in hermetic containers

Prevent pest infestation of food

Improve storage to reduce mycotoxin contamination

Save grain from physical and pest damage

Infested grain

Instructions on dealing with mycotoxins

Don't buy & sell contaminated grain

Safely dispose of moldy food

Safer alternative uses for some mycotoxin contaminated food

Food preparation

Sort out moldy food

Buy carefully, eat healthy

Washing & cooking do not destroy mycotoxins

Instructions on dealing with mycotoxins

Slogans

Sort out moldy food

Buy carefully, eat healthy

Global issue, we are all in this together

Care for food, Care for family

Diet diversification reduces risk

Mycotoxin contamination reduction & remediation are possible

List of crops & associated mycotoxins

What responses might be expected if radio/TV/social media reported that the chilies sold in Kathmandu were contaminated with aflatoxin?

Emotions

- Anger
- Panic
- Worried about health
- Advocacy from consumers' forum

Government action(s)

- Request for investigation
- Strict quarantine (internal & external)
- Pressure government for response
- Ban

Alternatives to consider

- Decrease consumption
- Identify alternatives to chilies
- Find alternative sources for chilies
- Consumers should purchase whole chilies
- Advocacy from consumers' forum
- Ban

Problem description

- Verification of news
- Extent of the problem
- Seek expert guidance
- Understanding of permissible dose of aflatoxin
- Advocacy from consumers' forum

Beyond chilies

- Worry about what else is contaminated
- Spread the news

Post-Harvest

None

Testing, Reporting & Regulation

Identify methods to reduce mycotoxin contamination in foods sold in local markets

Increased awareness/training

- Increased awareness among consumers, retailers & farmers
- Consumer knows to buy properly stored/certified grain
- Awareness (PSA) campaigns in markets – pamphlets, posters, street dramas, *etc.*, and information dissemination from mass media
- Provide the regulations, policies and information on aflatoxins and their impact on human & animal health

Government inspection/grading/regulation

- Proper grading of food
- Proper storage containers for food
- Labeling and certification
- Regular inspection/evaluation by regulatory body
- Regular inspection of stored feedstuffs
- Strict implementation of laws, acts & regulation

What responses might be expected if radio/TV/social media reported that the chilies sold in Kathmandu were contaminated with aflatoxin?

Emotions

- Anger
- Panic
- Worry about what else is contaminated
- Worried about health
- Advocacy from consumers' forum
- Pressure government for response

Government action(s)

- Provide educational materials about mycotoxin
- Request for investigation
- Frequent monitoring, inspections & regulation
- Strict quarantine (internal & external)
- Ban

Problem description

- Verification of news
- Extent of the problem
- Verification of tests
- Seek expert guidance
- Identify the origin of the contaminated product(s)
- Understand the permissible dose of aflatoxin
- Find an alternative sources for chilies
- Advocacy from consumers' forum

Nominal Group Questions/Responses from Dhulikhel Workshop Relevant for Producers, Traders & Distributors Audience Sorted by Issue

Health

How does mycotoxin contamination impact resilience of Nepalese farmers and their families?

Family Quality of Life

- Lower quality of life
- Mental stress & psychological impact
- Poor family health
- Increased child mortality

Job quality – Reduced work performance

Who in Nepal needs more information about mycotoxin-associated health problems?

Production chain

- Farmers/producers
- Traders/distributors
- Manufacturers/processors of food & feed

Businesses

- Nepal Food Corporation
- Federation of Nepalese Chamber of Commerce & Industry

Health workers – Health professionals

Outreach – Media

What scares you most about mycotoxin contamination?

Insufficient knowledge and awareness of mycotoxins and their impacts is across all four sub-categories

Financial – Vulnerable farmers

Family – Intergenerational loss

Food Safety/Security – Difficult to mitigate

Health (self or others)

Illness in old age
Difficult to mitigate
Serious animal health problem

Identify educational means and materials to increase consumer awareness of mycotoxin contamination in domestic and imported foodstuffs

Education

School syllabus/curriculum
Educational series/seminars/ webinars/lectures
Adult education programs/farmer field schools

Information available or resources to be developed

Information from trustworthy local body
Establish resource centers
Posters & pamphlets
Hoarding boards (public posters & bill boards)
Spiral flip charts
Visual/video documents
Quarantine reports
Technical bulletins

Conventional media

Radio & TV public announcements
Newspapers
Exhibitions at agricultural fairs
Press media briefs

Social media/internet – Push messages through SMS & telephone calls

Public-involved activities

Community based programs
Audio visual media on YouTube
Campaign at retailer level

Identify specific messages that the Nepalese consumer and farmer need to hear about mycotoxins and mycotoxin-contaminated food

3 ***Background information***

- Mycotoxins are produced by fungi
- Mycotoxins may be present without visible signs
- Mycotoxin contamination reduction & remediation are possible
- Long term health risks include cancer & liver failure
- List of crops and associated mycotoxins

Pre-harvest & Harvest

- Protect crops from fungi
- Biocontrol of mycotoxins
- Do not harvest during rain
- GAP and available technology can reduce mycotoxin contamination
- Practical control measures can be readily implemented
- Instructions on dealing with mycotoxins
- Case study report results
- High fungal growth when crops are not properly dried
- Remove crops from field at maturity & dry immediately

Drying & Storage

- Remove crops from field at maturity and dry immediately
- Prompt, proper drying of crops
- High fungal growth when crops are not properly dried
- Improve storage to reduce mycotoxin contamination
- Store food in hermetic containers
- Prevent physical & pest damage of food

Infested grain

- Instructions on dealing with mycotoxins
- Do not feed infested grain to animals
- Don't buy or sell contaminated grain
- Safely dispose of moldy food
- Safer alternative uses for some mycotoxin contaminated food

Food preparation

- Instructions on dealing with mycotoxins
- Sort out moldy food
- Do not consume contaminated/moldy/ discolored food

Slogans

- Sort out moldy food
- Kill fungi to save grain
- Do not harvest during the rain
- Global issue, we are in this together

Economics

Identify local customs and practices that should change if mycotoxin contamination is to be reduced

Good Agricultural Practices

- Select high quality seed
- Modernize harvest & post-harvest equipment
- Sort & clean grain to remove fungal contamination
- Implement existing laws & regulations

Drying

- Proper drying before storage
- Improve post-harvest practices, *e.g.* solar dryers
- Use moisture meters
- Open field drying
- Artificial heat sources that can be used on cloudy days

Storage

- Proper drying before storage
- Sort & clean grain to remove fungal contamination
- Modernize harvest & post-harvest equipment
- Use moisture meters
- Research on local methods of storage
- Poor storage structures with no protection from the environment
- Poor market facilities – no storage
- Farmers store in open place in piles/heaps
- Clean storage unit routinely

Identify economic risks posed by mycotoxins to Nepalese farmers

Increased costs – 1, 4, 5, 9 & 28

- Increased treatment cost for harvested materials, drying, *etc.*
- Increased cost of production
- Waste disposal cost

Decreased returns – 2, 3, 6-8, 10-13, 15, 17, 19, 23 & 26

- Loss of income (in spite of more effort)
- Decreased productivity
- Reduced product price for farmer
- Crop losses
- Lower quality milk, decreased price
- Seed damage/low quality
- Loss/reduction of market
- Rejection of materials by the international market – non-tariff trade barrier
- Reduced animal performance & vigor
- Loss of feed for animals
- Loss of livestock
- Limited ability to invest in the future
- Complete loss of investment in crop/farm
- Reduced socioeconomic status & credibility
- Pre-harvest contamination negates post-harvest investments

External worries – 14, 21 & 22

Fines and/or jail
Decreased resilience
Middleman falsifies aflatoxin results to lower purchase price
Regulations force farmers to sell good and retain bad commodities
Areas with higher contamination risk losing market access

How do mycotoxins affect the ability of Nepalese farmers to market their crops?

Responses all assume that the farmer is knows mycotoxins can be a problem

Price decreased

Reduced rate of return
Sell crop for a lower price
More bargaining (less leverage) for price in the market
Cannot export
Sell as feed (or other use) instead of food (for lower price)
Lower production/yield

Barriers to sales

Reduced competitiveness
Unable/prohibited from selling
Difficulty selling due to altered physical appearance or lower export quality
Lowers farmer's reputation and/or brand value
Product rejected by buyer after the sale
Weight loss due to fungal growth
Lowered feed quality

Increased marketing expense

Increased costs to sell product
Increased inspections
Must sort grain (at extra cost)
Shorter shelf life – cannot store for longer term (and get a higher price)
New marketing innovations required

How does mycotoxin contamination impact resilience of Nepalese farmers and their families?

Family Quality of Life

Lower quality of life
Inability to cope with natural disaster
Reduced child education, lack of funds for fees

Family finances

Low income
Reduced work performance
Reduced investment capacity
Loss of investment (Loss of savings)
Difficult to obtain loans
Looks to government for solution

National resilience

Slows economy
Labor shortage

Job quality

Reduced work performance
Changes to farming profession and practices
Change in occupation (no longer farming)
Shift to low risk crops (not maize)

Identify methods and incentives to increase the quality of Nepalese agricultural imports

Establish standards

Setting standards for quality in import & domestic markets
Regular evaluation of imports to ensure toxin levels remain low
Labeling of products with contamination levels, including pesticides

Enforce standards

Improved communications with agents and importers
Regulate informal trade
Effective implementation of export/import regulations
Increase efficiency/speed of border checks
Punishment provisions for importers violating standards
Previous certification fraud prevents further imports from source

Limit imports – Import only short supply commodities

Human & physical capacity building – Good packaging and post-harvest handling/ transportation

Incentives – Reduce import duties if the product meets standards (particularly for high demand products)

Identify pre-harvest agricultural practices routinely used by farmers in Nepal that increase mycotoxin contamination

Seed/Variety

Planting a susceptible variety
Repeated use of same variety/cultivar
Use of unhealthy/substandard seeds
No seed treatment
Improper crop spacing

Planting

Not following GAP
Ignoring technical advice
Improper timing of planting of crops

Land management

Not following GAP
Ignoring technical advice
Poor land preparation/soil treatment
Lack of appropriate farm yard manure
Lack of mulching
Little, no or improper fertilizer use
Using contaminated commodities for compost/mulch
Burning crop residue on soil
Poor water quality
No soil testing

Crop management

Not following GAP
Ignoring technical advice
Growing crop where it is not meant to be grown
Improper irrigation
Poor disease and pest management practices
Premature harvest
Late harvest
Harvesting in rainy weather
Damage of crop during cultivation & weeding
Use of chemicals to accelerate ripening
Improper use of pesticides
Livestock grazing crop

Identify postharvest agricultural practices routinely used by farmers in Nepal that increase mycotoxin contamination

Harvesting

Harvesting before ripe
Late harvest
Harvesting irrespective of weather conditions

Drying

Inadequate/improper drying of product
Open drying
Field drying
Unclean drying place
Dampening during heaping

Storage

Storage without sorting
Aggregated collection
Use of traditional storage facilities
No airtight containers for storage
Lack of monitoring during storage
No pest or rodent control
Prolonged storage of grain crops
Storage in damp location
Crops stored on ground/muddy floor
Storage in cold/moist conditions

Handling

Inadequate moisture measurement
Milling contaminated grain
Inappropriate transportation
Unhygienic handling
Contamination with other contaminated products
Contaminated with soil
Poor packaging of products

Identify methods to reduce mycotoxin contamination in foods sold in local markets

Increased awareness/training

Increased awareness among consumers, retailers and farmers

Consumer awareness to buy properly stored/certified grains

Train small farm growers – farm to market

Awareness campaigns (PSAs) in market areas – pamphlets, posters, street dramas, *etc*., and information dissemination from mass media

Provide the regulations, policies and information on aflatoxins and their impact on human & animal health

Grain treatment

Ammoniation

O_3 treatment

Quarantine

Incentives/Subsidies

Subsidize price of storage bins

Incentives for proper storage

Provide incentives to market suppliers and vendors who comply with SOPs

Storage facilities

Proper storage containers for food

Hermetic sealed storage bags

Storage locations with regulatory management for suppliers

Regular cleaning of storage sites in local markets

Promote small-scale household storage facilities for women

Reduced humidity storage

Moisture monitoring tools

Use pesticides (fungicides & insecticides) at regular intervals

Stacking of bags

Government inspection/grading/regulation

Proper grading of food

Labeling & certification

Proper monitoring & regular inspection/evaluation by regulators

Regular inspection of stored feedstuffs

Strict implementation of laws, acts & regulation

Develop SOPs for markets for supplier & vendors

Develop sampling strategy for markets (suppliers & vendors)

What/when/where should screening for mycotoxins occur?

Screening could occur anytime and anywhere, with the frequency increasing whenever an epidemic occurs, or the conditions for one are present.

Epidemic – All local outbreaks

Preharvest/farm

At/on farm

Before harvest

Storage & Drying

Before and during drying

During storage

Government/ trade interaction

Test grain from households, selling points & market stores

Point of sale from traders to processors

Customs checkpoints

Processing of plant material

In grain factories before processing

Animal feed before packaging

Processed food

Processing of animal material – Animal products at processing plant

What scares you most about mycotoxin contamination?

Note that in addition to the listed items, "Hidden" (unknown) risks are relevant for every subcategory

Financial

Vulnerable farmers

Economic losses, especially for farmers

Reduced international trade

Decreased shelf life of food

Food Safety/Security

Threats to food security

Fear to eat food

Loss of major crop or variety

Health (self or others)

Difficult to mitigate

Serious animal health problem

Identify specific messages that the Nepalese consumer and farmer need to hear about mycotoxins and mycotoxin-contaminated food

Background information

Mycotoxins are produced by fungi

High fungal growth when crops are not properly dried

Mycotoxins may be present without visible signs

Mycotoxin contamination reduction & remediation are possible

Practical measures that can be readily implemented are available

Case study report results

List of crops & associated mycotoxins

Pre-harvest & Harvest

Protect crops from fungi
GAP and available technology can reduce mycotoxin contamination
Biocontrol of mycotoxins
Do not harvest during the rain
Remove crops from field at maturity and dry immediately

Drying & Storage

Mycotoxins may be present without visible signs
High fungal growth when crops are not properly dried
Prompt, proper drying of crops
Improve storage to reduce mycotoxin contamination
Store food in hermetic containers
Prevent physical & pest damage to food

Infested grain

Instructions on how to deal with mycotoxins
Do not feed infested grain to animals
Don't buy or sell contaminated grain
Safely dispose of moldy food
Safer alternative uses for some mycotoxin contaminated food

Food preparation

Sort out moldy food
Instructions on dealing with mycotoxins

Slogans

Sort out moldy food
Kill fungi to save grain
Do not harvest during the rain
Global issue, we are in this together

Identify training needed in the Nepalese work force to provide adequate monitoring of mycotoxin contamination

Mycotoxin/fungal detection and analysis

GAP – Good Agricultural Procedures
Laboratory management
Data collection, analysis & interpretation
Database
Toxin analysis & detection
Qualitative analysis
Risk mapping

Preventive/reduction/remediation measures

Biocontrol
Methods & materials for storage of food commodities
Harvest SOPs
Post-harvest & storage SOPs
Laboratory management
Data collection, analysis & interpretation
Record keeping & data entry
Database
Risk mapping
Qualitative analysis
Quality control
Sampling & subsampling for testing
Risk communication
Laws & regulations

Food safety

610 Toxicity of mycotoxins
Safe handling of products
Good manufacturing processes (GMP)
Quality control
Laboratory management
615 Data collection, analysis & interpretation
Record keeping & data entry
Database
Qualitative analysis
Sampling & subsampling for testing
620 Laws and regulations

Health effects

Toxicity of mycotoxins
Risk communication
625 Data collection, analysis & interpretation
Record keeping & data entry
Database
Laws & regulations

630

Identify positions in Nepal where training about mycotoxins, their detection, and their impact is important

Civil society

635 Farmers/Farming association staff
Media

Government

Local leaders
640 Planning officials
DFTQC officials
Ministry of Ag/Livestock staff
Extension officers
Customs & quarantine officers
645 Research center staff
Nepal Food Corporation officials

Private sector

Traders/store keepers
650 Ag businesses – traders & processors
Private sector laboratories

Laboratories & scientists

Animal feed laboratory
655 Metropolitan & provincial laboratories

Post-harvest

Identify local customs and practices that should change if mycotoxin contamination is to be reduced

Good Agricultural Practices

- Harvest fully mature grain
- Irregular harvest time
- Modernize harvest & post-harvest equipment
- Poor sorting practices
- Sort and clean grain to remove fungal contamination
- Shell corn before storing

Drying

- Proper drying before storage, *e.g.*, solar dryers
- Open field drying
- Artificial heat sources that can be used on cloudy days

Storage

- Poor storage structure, no protection from the environment
- Poor market facilities – no storage
- Farmers store in open place in heaps and piles
- Research on local storage methods
- Develop hermetic storage systems
- Inspect storage units for fungal growth
- Routinely clean storage units
- Sort and clean grain to remove fungal contamination
- Shell corn before storing
- Proper drying before storage
- Use moisture meters
- Unhygienic processing
- Modernize harvest & post-harvest equipment
- Improper packaging materials

Identify postharvest agricultural practices routinely used by farmers in Nepal that increase mycotoxin contamination

Harvesting

- Harvesting before ripe
- Late harvest
- Harvesting irrespective of weather conditions

Drying

- Inadequate/improper drying of product
- Open drying
- Field drying
- Unclean drying place
- Dampening during heaping

Storage

Use of traditional storage facilities
No airtight containers for storage
Storage without sorting
Aggregated collection
Lack of monitoring during storage
No pest or rodent control
Prolonged storage of grain crops
Storage in damp location
Crops stored on ground/muddy floor
Storage in cold/moist conditions

Handling

Inadequate moisture measurement
Milling contaminated grain
Inappropriate transportation
Unclean drying place
Unhygienic handling
Contamination with other contaminated products
Contaminated with soil
Poor packaging of products

Identify facilities and training needed in Nepal to reduce post-harvest mycotoxin contamination

Training/education

Training on Good Agricultural Practices (GAP)
Training for Agricultural coordinators & farmers on mycotoxins and post-harvest practices (drying & storage)
Train government engineers on cost-effective post-harvest equipment
Training on moisture measurement
Training on packaging
Technical training for field level staff
Posters with awareness information
Extension messaging on radio
Extension manuals
Sites for technology demonstration and training

Biocontrol – Local production of AflaSafe

Dryers

Large scale hot air dryer facility required
Subsidies for buying storage bags & renting drying facilities
Distribution of low cost dryers
Mobile SME's providing drying and storing technology

Storage

Warehouses at community level
Subsidies for buying storage bags & renting drying facilities
Mobile SME's providing drying & storing technology
Storage facilities at local level
Better storage in humid areas

Labs/Facilities

Testing labs at the local level
Sites for technology demonstration and training
Sorting/grading facilities
Establish cold-storage facilities
Treatment facility for contaminated product

What/when/where should screening for mycotoxins occur?

Screening could occur anytime and anywhere, with the frequency increasing whenever an epidemic occurs, or the conditions for one are present

Epidemic – All local outbreaks

Preharvest/farm – At/on farm

Government/ trade interaction

Point of sale from traders to processors

Customs checkpoints

Storage & Drying

During storage

Before and during drying

Processing of plant material

In grain factories before processing

Processed food

Animal feed before packaging

Processing of animal material – Processed food

Identify specific messages that the Nepalese consumer and farmer need to hear about mycotoxins and mycotoxin-contaminated food

Background information

Mycotoxins are produced by fungi

Mycotoxins may be present without visible signs

Practical control measures can be readily implemented

Safely dispose of moldy food

Mycotoxin contamination reduction & remediation are possible

List of crops & associated mycotoxins

Case study report results

Pre-harvest & Harvest

GAP and available technology can reduce mycotoxin contamination

Do not harvest during the rain

Protect crops from fungi

Remove crops from field at maturity and dry immediately

Drying & Storage

Improve storage to reduce mycotoxin contamination

Store food in hermetic containers

Save grain from physical & pest damage

Infested grain

Do not feed infested grain to animals

Don't buy or sell contaminated grain

Safely dispose of moldy food

Safer alternative uses for some mycotoxin contaminated food

Food preparation

Sort out moldy food

Slogans

Kill fungi to save grain

Do not harvest during rain

Instructions on dealing with mycotoxins

Global issue, we are all in this together

Identify training needed in the Nepalese work force to provide adequate monitoring of mycotoxin contamination

Mycotoxin/fungal detection and analysis

Toxicity of mycotoxins

GAP – Good Agricultural Procedures

Laboratory management

Toxin analysis & detection

Data collection, analysis & interpretation

Qualitative analysis

Risk mapping

Preventive/reduction/remediation measures

Harvest SOPs

Post-harvest & storage SOPs

Methods & materials for storage of food commodities

Safe handling of products

Laboratory management

Data collection, analysis & interpretation

Record keeping & data entry

Database

Sampling & subsampling for testing

Qualitative analysis

Risk mapping

Laws and regulations

Food safety

Toxicity of mycotoxins

Safe handling of products

Good manufacturing processes (GMP)

Laboratory management

Sampling & subsampling for testing

Quality control

Record keeping & data entry

Database

Laws & regulations

Testing, Reporting & Regulation

Identify methods to make current regulations of mycotoxins more effective.

Community awareness & policy implementation are required across all areas

Civil society

- Improve accessibility of information
- Improved collaboration/coordination amongst stakeholders, including public/private partnerships

Effective regulation

- Regular sampling & testing of crops
- Strict regulation with fines & punishment

Establish standards

- Update/expand/amend standards
- Set standards for more commodities
- Harmonize regulations with US, EU & international levels

Government policy & politicians

- Develop national action plan
- Enact legislation at provincial & local levels
- Policy advocacy
- Involve farmers & consumers in policy making

Managing contaminated materials

- Availability of proper storage facilities
- Alternative uses for commodities exceeding contamination limits
- Compulsory disposal of unusable commodities
- Insurance

Identify methods and incentives to increase the quality of Nepalese agricultural imports

Establish standards

- Develop & implement verification system/compulsory certification
- Strict quarantine measures

Enforce standards

- Improved communications with agents and importers
- Regulate informal trade
- Develop roster of firms supplying good and poor quality products
- Reduce import duties if the product meets standards (particularly for high demand products)
- Increase efficiency/speed of border checks
- Collaborate with custom officials/police/administrative staff
- Effective implementation of import/export regulations
- Punishment provisions for importers violating standards

Human & physical capacity building

- Increased consumer awareness
- Increased training for staff on import quality issues
- Good packaging & post-harvest handling/transportation

Identify methods to reduce mycotoxin contamination in foods sold in local markets

Increased awareness/training – Provide the regulations, policies & information on aflatoxins and their impact on human & animal health

Incentives/Subsidies

- Subsidize storage bin price
- Incentives for proper storage
- Provide incentives to market suppliers & vendors who comply with SOPs

Storage facilities

- Storage locations with regulatory management for suppliers
- Proper storage containers for food
- Moisture monitoring tools

Government inspections/grading/regulation

- Proper grading of food
- Labeling & certification
- Develop SOPs for markets for suppliers & vendors
- Develop sampling strategy for markets (suppliers & vendors)
- Regular inspection/evaluation by regulators
- Regular inspection of stored feedstuffs
- Strict implementation of laws, acts & regulations
- Quarantine

What/when/where should screening for mycotoxins occur?

Screening could occur anytime and anywhere, with the frequency increasing whenever an epidemic occurs, or the conditions for one are present

Epidemic – All local outbreaks

Preharvest/farm

Before harvest

At/on farm

Storage & Drying – During storage

Government/ trade interaction

National surveys every 5 years

Test grains from household, selling points & market stores

Point of sale from traders to processors

Customs checkpoints

Processing of plant material

In grain factories before processing

Animal feed before packaging

Processed food

Processing of animal material

Animal products at processing plant

Human and livestock urine & blood

Processed food

Identify positions in Nepal where training about mycotoxins, their detection, and their impact is important

Civil society – Farmers/Farming association staff

Government

Planning officials

DFTQC officials

Customs & quarantine officers

Ministry of Ag/Livestock staff

Extension officers

Private sector

Ag businesses – traders & processors

Private sector laboratories

Laboratories and scientists

Research center staff

Animal feed laboratory

Metropolitan & provincial laboratories

Private sector laboratories

Nominal Group Questions/Responses from Dhulikhel Conference Relevant for Health Professionals Audience Sorted by Issue

Health

Who in Nepal needs more information about mycotoxin-associated health problems?

Health workers

- Health professionals
- Veterinarians

Government – Civil workers

Families – Pregnant women & mothers and support services

Outreach – Development partners: NGOs, WFP, FAO, WHO, *etc.*

What information do new mothers and young families in Nepal need to know about the consequences of mycotoxin contamination?

Health

- Mycotoxins take a long time to be detoxified
- Mycotoxins are carcinogens
- Transfer of mycotoxins in animal products (milk, meat)
- Adverse effects of mycotoxin contamination
- Exposure may lead to aflatoxicosis & death
- Liver cirrhosis & liver cancer may result
- Immune system suppression
- Effects of mycotoxin contamination on child growth & development
- Leads to stunting
- May lead to cognitive impairment
- Low birth weight
- Small newborn head circumference

Origin/transmission

- Transfer of mycotoxins through breastfeeding
- Transfer of mycotoxins in animal products (milk, meat)
- Foods, *e.g.*, maize and peanuts, where mycotoxins naturally occur
- Mycotoxins are found in foods that are not dried/stored properly

What do health care providers in Nepal need to know about mycotoxin contamination and its consequences?

Health impacts

- Knowledge about health implications
- Permissible levels
- Target/vulnerable group
- Cross cuts multiple issues

Accurate/reliable & up-to date

- Proper knowledge about mycotoxins
- Precautions to take
- Permissible levels

Sources/contributing factors

- Source of contamination
- Critical seasons/weather conditions
- Major commodities prone to mycotoxins

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

By crop/commodity

Animal feed – cattle & buffalo
- 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
- Trichothecenes
- Zearalenone

Meat
- Aflatoxin

Milk and other dairy products
- Aflatoxin
- Ochratoxin

Peanuts (ground nuts)
- Aflatoxin

Potato
- Aflatoxin (storage)
- Trichothecenes

Rice (storage)
- Aflatoxin

Spices
- Aflatoxin
- Ochratoxin

Tree nuts
- Aflatoxin

Wheat
- Aflatoxin (storage)
- Ergot
- Trichothecenes
- Zearalenone

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

Identify specific messages that the Nepalese consumer and farmer need to hear about mycotoxins and mycotoxin-contaminated food

Background information
- Mycotoxins are produced by fungi
- Mycotoxins may be present without visible signs
- Mycotoxin contamination reduction & remediation are possible
- Practical measures can be readily implemented
- Case study report results
- List of crops and associated mycotoxins

Health
- Diet diversification reduces risk
- Healthy diet for pregnant women and infants
- Long term health risks including cancer & liver failure
- Associated with stunting of children

Food preparation & storage
- Instructions on dealing with mycotoxins
- Sort out moldy food & dispose of safely
- Washing and cooking do not destroy mycotoxins
- Prevent pest infestation of food

Don’t buy or sell contaminated grain

Slogans

Sort out moldy food
Buy carefully, eat healthy
Care for food, Care for family
Global issue, we are in this together
Don’t buy or sell contaminated grain

Economics

Identify economic risks posed by mycotoxins to Nepalese farmers

Increased costs

Increased health costs, including national system
Increased cost for adequate nutrition
Behavior change cost

Decreased returns

Decreased resilience
Food insecurity/malnutrition
Lower quality milk, decreased price

External worries – Decreased cognitive function

Post Harvest

None

Testing, Reporting & Regulation

None

Nominal Group Questions/Responses from Dhulikhel Conference Relevant for Educators, Trainers & Researchers Audience Sorted by Issue

Health

Who in Nepal needs more information about mycotoxin-associated health problems?

Education

- School teachers
- Universities

Outreach

- Extension workers
- Development partners: NGOs, WFP, FAO, WHO, *etc.*
- Media
- Agricultural researchers/scientists & associations/councils

What information do new mothers and young families in Nepal need to know about the consequences of mycotoxin contamination?

Health

- Mycotoxins are carcinogens
- Mycotoxins take a long time to be detoxified
- Harmful health effects of mycotoxin contamination
- Immune system suppression
- Aflatoxicosis may lead to death
- Liver cirrhosis & liver cancer may result
- Effect of mycotoxins on child growth and development
- Small newborn head circumference
- Leads to stunting
- Low birth weight
- Exposure may lead to cognitive impairment
- Transfer of mycotoxins in animal products (milk, meat)

Economics/financial

- Adverse effects of mycotoxins
- Dissemination of info about discarding contaminated food/feed
- Economic aspects on terms of treatment
- Health hazards to livestock

Origin/transmission

Foods, *e.g.*, maize and peanuts, where mycotoxins naturally occur

Mycotoxins are found in foods that are not dried/stored properly

Transfer of mycotoxins through breastfeeding

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

By crop/commodity

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Eggs
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Finger millet
- Zearalenone

Infant formula
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Lentil nuggets (snack food)
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Maize
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- Trichothecenes
- Zearalenone

Meat
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Milk and other dairy products
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Potato
- Aflatoxin (storage)
- Trichothecenes

Rice (storage)
- Aflatoxin

Spices
- Aflatoxin
- Ochratoxin

Tree nuts
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Wheat
- Aflatoxin (storage)
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- 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

Identify educational means and materials to increase consumer awareness of mycotoxin contamination in domestic and imported foodstuffs

Education
- School syllabus/curriculum
- Educational series/seminars/webinars/lectures
- Adult education programs/farmer field schools

Information/resources available or to be developed
- Information from trustworthy local body
- Establish resource centers
- Orientation/training for FCHV – Female community health volunteers
- Posters & pamphlets
- Hoarding boards (public posters & bill boards)
- Visual/video documents
- Quarantine reports
- Technical bulletins
- Spiral flip charts

Conventional media
- Newspapers
- Exhibitions at agricultural fairs

Social media/internet

Audio visual media on YouTube

Jingles

Public-involved activities

Community based programs

Community group contacts

Campaign at retailer level

Home visits

Identify critical information about mycotoxins to be included in general educational curricula in Nepal

Mycotoxin/fungal detection and analysis

Introduction to mycotoxin types and fungi

Analysis of mycotoxins & identification of fungi

Mycotoxin detection methodologies

Co-occurrence of mycotoxins & their health effects

Preventive/reduction/remediation measures

Factors affecting mycotoxin contamination

Traditional & local practices that accelerate contamination

Mitigation & prevention measures

Hygiene & sanitation

Storage practices

Use of fungicides

Pest control

Food safety

Types of food susceptible to mycotoxin contamination

Co-occurrence of mycotoxins & their health effects

Factors affecting mycotoxin contamination

Traditional & local practices that accelerate contamination

Ways to remain safe from mycotoxins

Hygiene & sanitation

Storage practices

Do not eat moldy foods

Use of fungicides

Pest control

Health effects

Risks & effects of mycotoxins

Safe levels of exposure for humans & livestock

Ways to remain safe from mycotoxin

Effect of mycotoxins on susceptible groups (pregnant, AIDS, *etc.*)

Economics

Identify economic risks posed by mycotoxins to Nepalese farmers

External worries

- Food insecurity/malnutrition
- Middleman falsifies aflatoxin results to lower purchase price

How do mycotoxins affect the ability of Nepalese farmers to market their crops?

Responses all assume that the farmer is knows mycotoxins can be a problem

Increased marketing expense

- Increased inspections
- New marketing innovations required
- Increased diversity of crops grown
- Increased need for drying & proper storage facilities

Identify methods to make current regulations of mycotoxins more effective

Community awareness and policy implementation are required across all areas

Civil society

- Improve accessibility of information
- Strengthen extension program
- Inclusion in university curricula
- Human resource development (number & capacity)
- Targeted research & development
- Improved collaboration & coordination amongst stakeholders, including public/private sector cooperation
- Capacity building at local & provincial levels

Effective regulation

- Develop monitoring guidelines
- Establish certification programs

Identify pre-harvest agricultural practices routinely used by farmers in Nepal that increase mycotoxin contamination

Seed/Variety

- Planting a susceptible variety
- Use of unhealthy/substandard seeds
- Repeated use of same variety/cultivar

Planting

Not following GAP
Ignoring technical advice
Improper timing of planting
No seed treatment
Improper crop spacing

Land management

Not following GAP
Ignoring technical advice
Lack of mulching
Lack of appropriate farm yard manure
Using contaminated commodities for compost/mulch
Poor land preparation/soil treatment
Little, no or improper fertilizer use
Burning crop residue on soil
Poor water quality
No soil testing

Crop management

Not following GAP
Ignoring technical advice
Growing where crop is not meant to be grown
Damage of crop during cultivation and weeding
Improper irrigation
Poor disease & pest management practices
Premature harvest
Late harvest
Harvesting in rainy weather
Using chemicals to accelerate ripening
Improper use of pesticides
Livestock grazing crop

Identify methods to reduce mycotoxin contamination in foods sold in local markets

Increased awareness/training

Consumer awareness to buy properly stored/certified grains
Train small farm growers – farm to market
Awareness campaigns (PSAs) in market areas – pamphlets, posters, street dramas, *etc.*, & information distribution from mass media

Grain treatment

Ammoniation
O_3 treatment

Storage facilities

Moisture monitoring tools
Use pesticides (fungicides & insecticides) at regular intervals
Promote small-scale household storage facilities for women

Government inspections/grading/regulation

Proper grading of food
Develop sampling strategy for markets (suppliers & vendors)
Develop SOPs for markets for suppliers & vendors

Identify positions in Nepal where training about mycotoxins, their detection, and their impact is important

Government

- Ministry of Education staff
- Ministry of Health staff
- Ministry of Ag/Livestock staff
- Metropolitan & provincial laboratories
- Research center staff
- NARC scientists
- Extension officers
- Agricultural scientists
- Agriculture & health professionals

Private sector

- Agricultural scientists
- Agriculture & health professionals
- Junior & senior laboratory technicians
- Animal feed laboratory
- Seed producers
- Private sector laboratories

Laboratories and scientists

- University faculty & scientists
- NARC scientists
- Junior & senior laboratory technicians
- Research center staff
- Agricultural scientists
- Agriculture & health professionals
- Pathology & nutrition experts
- Researchers in mycotoxins
- Animal feed laboratory
- Private sector laboratories
- Metropolitan & provincial laboratories

Post-Harvest

Identify local customs and practices that should change if mycotoxin contamination is to be reduced

Awareness Program

- Awareness program for local farmers on harvest, drying & storage

Seed

- Select resistant varieties
- Select high quality seed

Drying & Storage

- Improve post-harvest practices, *e.g.*, solar dryers
- Research on local storage methods
- Modernize harvest & post-harvest equipment

Identify facilities and training needed in Nepal to reduce post-harvest mycotoxin contamination

Training/education

- Training for Agricultural coordinators & farmers on mycotoxins and post-harvest practices (drying & storage)
- Training on Good Agricultural Practices (GAP)
- Training on conducting surveys & data analysis
- Training on use of weather data for risk mapping
- Train government engineers on cost-effective post-harvest equipment
- Training on moisture measurement
- Training on packaging
- Low understanding of the (mycotoxin) problem
- Little (or no) technical support
- Technical training for field level staff
- Awareness building for policy makers
- Orientation/training for media
- Extension messaging on radio
- Extension manuals
- Post-harvest graduate program at university
- Mycotoxin information in university curriculum
- Training of lab technicians
- Posters with awareness information
- Sites for technology demonstration and training

Risk mapping

- Training on use of weather data for risk mapping
- Weather station establishment in each district

Labs/Facilities

Testing labs at the local level
Weather station establishment in each district
Testing lab at national level
Additional NAST facilities
Upgrade animal nutrition lab at NARC
Sites for technology demonstration and training

Identify specific messages that the Nepalese consumer and farmer need to hear about mycotoxins and mycotoxin-contaminated food

Background information

Mycotoxins are produced by fungi
High fungal growth when crops are not properly dried
Mycotoxins may be present without visible signs
Safer alternative uses for some mycotoxin contaminated food
Mycotoxin contamination reduction & remediation are possible
Practical measures can be readily implemented
List of crops and associated mycotoxins
Case study reports

Health

Diet diversification reduces risk
Healthy diet for pregnant women & infants

Pre-harvest & Harvest

GAP and available technology can reduce mycotoxin contamination
Protect crops from fungi
Do not harvest when raining
Remove crops from field at maturity and dry immediately

Drying & Storage

Prompt, proper drying of crops
Improve storage to reduce mycotoxin contamination
Prevent physical & pest damage of grain
Store food in hermetic containers

Food preparation and management

Instructions for dealing with mycotoxins
Washing & cooking do not destroy mycotoxins
Sort out moldy food & dispose of safely
Don't buy or sell contaminated grain
Do not feed infested grain to animals

Slogans

Sort out moldy food
Kill fungi to save grain
Global issue, we are in this together

Identify training needed in the Nepalese work force to provide adequate monitoring of mycotoxin contamination

Mycotoxin/fungal detection & analysis

Toxicity of mycotoxins
GAP – Good Agricultural Procedures
Laboratory management
Data collection, analysis & interpretation
Record keeping & data entry
Toxin analysis & detection
Microbial analysis
Statistics

Preventive/reduction/remediation measures

Toxicity of mycotoxins
Harvest SOPs
Post-harvest & storage SOPs
Methods & materials for storage of food commodities
Laboratory management
Data collection, analysis & interpretation
Record keeping & data entry
Database
Sampling & subsampling for testing
Qualitative analysis
Statistics
Risk mapping
Risk communication
Laws & regulations

Food safety

Toxicity of mycotoxins
Safe handling of products
Good manufacturing processes (GMP)
Quality control
Sampling & subsampling for testing
Methods & materials for storage of food commodities
Laboratory management
Data collection, analysis & interpretation
Record keeping & data entry
Database
Qualitative analysis
Statistics
Risk communication
Impact assessment
Laws & regulations

Health effects

Toxicity of mycotoxins
Awareness of impacts on human health & nutrition
Data collection, analysis & interpretation
Record keeping & data entry
Database
Qualitative analysis
Statistics
Risk communication
Impact assessment
Laws & regulations

Testing, Reporting & Regulation

What resources do leaders and government officials need to be able to respond to a mycotoxin "crisis"?

Background information

- Up to date information on magnitude, determinants and impact of the crisis
- Up to date information on prevention & mitigation measures
- Regular monitoring & evaluation
- Repository of information on previous mycotoxin crises & measures taken

Policy and protocols – Trained policy makers

Capacity development

- Orientation for leaders and government officials on preventative mitigation measures
- Technical/human resource development
- Institutional development

Emergency crisis response capacity

- Crisis/emergency manual, contingency plan & strategic plan
- Collaboration among local, provincial & national governments
- Access to mass communication with targeted information
- Response team
- Funding

Response options – Decontamination system

Verification capacity

- Physical infrastructure, including laboratories
- Ability to test food & feed
- Vehicles
- Research back up

Identify positions in Nepal where training about mycotoxins, their detection, and their impact is important

Civil society – Farmers/Farming association staff

Government

- Ministry of Ag/Livestock staff
- Ministry of Education staff
- Ministry of Health staff
- Metropolitan & provincial laboratories
- NARC scientists
- Extension officers
- Research center staff
- Agricultural scientists

Private sector

Agricultural scientists

Animal feed laboratory

Laboratories and scientists

University faculty & scientists

Senior & junior laboratory technicians

NARC scientists

Research center staff

Metropolitan & provincial laboratories

Animal feed laboratory

Agricultural scientists

Researchers in mycotoxins

Pathology & nutrition experts

Agriculture & health professionals

Nominal Group Questions/Responses from the Dhulikhel Conference Relevant for Policy Makers & Regulators Audience Sorted by Issue

Health

How does mycotoxin contamination impact resilience of Nepalese farmers and their families?

Family Quality of Life

- Poor family health
- Increased child mortality
- Lower quality of life
- Mental stress & other psychological impacts
- Increased need for health & food aid/ starvation food shortage
- Change in food habits
- Reduced work performance
- Inability to cope with natural disaster

Family finances

- Reduced work performance
- Looks to government for solution
- Reduced child education, lack of funds for fees

Who in Nepal needs more information about mycotoxin-associated health problems?

- Health professionals
- Government of Nepal/policy makers and implementers
- Families, pregnant women & mothers, and health support services
- Development partners: NGOs, WFP, FAO, WHO, *etc.*
- Media
- Universities, agricultural researchers/ scientists & associations/councils

What resources do leaders and government officials need to be able to respond to a mycotoxin "crisis"?

Emergency crisis response capacity

- Funding
- Collaboration among local, provincial & national governments
- Crisis/emergency manual, contingency plan & strategic plan
- Response team
- Effective communication team & system
- Access to mass communication with targeted information
- Ability to test food and feed
- Reserves of contamination-free food
- Doctors and medicine ready

Capacity development

- Orientation for leaders and government officials on preventative mitigation measures
- Technical/human resource development

Background information

- Up to date information on magnitude, determinants & impact of the crisis
- Up to date information on prevention & mitigation measures
- Regular monitoring & evaluation
- Repository of information on previous mycotoxin crises and measures taken

Policy and protocols

- Trained policy makers
- Policy and legal regulation, formulation & implementation

Identify methods and goals for inter-ministry collaboration on problems associated with mycotoxins.

Success in many areas requires exposure to and assistance from international partners.

Government Structure & Facilities

- Central and provincial platforms and labs for a multi-sector mycotoxin analysis team
- Specialist committee with representatives from Ministry of Health, Ministry of Agriculture, NARC and DFTQC – federal and provincial levels
- Formation of a mycotoxin mitigation body
- Develop Terms of Reference for different layers
- Adequate budget allocation for infrastructure (*e.g.*, warehouses & cold storage) and innovative technologies
- High level talks between ministries with joint planning and programming

Planning

- National Action Plan for mycotoxins integrated into existing MSNP
- Prioritize policies for mycotoxin management
- Develop Terms of Reference for different layers
- Design and implement a crisis communications plan
- Establish joint goals to reduce mycotoxin risks identified through research & development projects

Programs

- One Health approach to minimize impact of mycotoxins
- Operational guidelines and data collection/management at federal & provincial levels
- SOPs for management of mycotoxins
- Joint organization of workshops (such as this one)
- Joint capacity building, training, outreach and awareness programs

Activities

Regular updates of mycotoxin risk map & monitoring of hot spots

Joint publication of relevant documents

Human resource development

Regular training from each ministry at school and college level

Specialized training curriculum for relevant sectors

Economics

Identify economic risks posed by mycotoxins to Nepalese farmers

Increased costs

- Increased cost of production
- Increased cost of food for adequate nutrition
- Increased health cost, including national system
- Increased treatment cost for harvested materials, drying, harvesting, *etc.*
- Behavior change cost
- Waste disposal cost

Decreased returns

- Crop losses & decreased productivity
- Reduced product price for farmer
- Loss of income (in spite of more effort)
- Decreased resilience
- Food insecurity/malnutrition
- Loss/reduction of market
- Rejection of materials in international market – non-tariff trade barriers
- Areas with higher contamination risk losing market access

External worries

- Middleman falsifying aflatoxin results to negotiate lower price when buying
- Regulations forcing farmers to sell good and be left with bad to consume

How does mycotoxin contamination impact resilience of Nepalese farmers and their families?

Family Quality of Life

- Poor family health
- Lower quality of life
- Increased child mortality
- Increased need for health and food aid/starvation food shortage
- Inability to cope with natural disaster

Family finances

- Low income
- Reduced work performance
- Reduced investment capacity
- Loss of investment (loss of savings)
- Difficult to obtain loans
- Looks to the government for solution

National resilience

- Slows economy
- Labor shortage
- Loss of national strategic grain reserve stocks

Job quality

- Reduced work performance
- Shift to low risk crops (not maize)
- Change in occupation (no longer farming)
- Labor shortage

Identify methods to make current regulations of mycotoxins more effective.

Community awareness and policy implementation are required across all areas

Civil society

- Improved collaboration/coordination amongst stakeholders, including public/private sector collaboration
- Human resource development (number and capabilities)
- Capacity building at local and provincial levels
- Improve extension program
- Targeted research & development

Standards with effective regulation & surveillance

- Update/expand/amend standards
- Regular sampling and testing of crops
- Develop monitoring guidelines
- Label mycotoxin contamination level
- Check imports
- Strict regulation with fines & punishment
- Harmonize regulations with US, EU & international levels
- Set standards for more commodities

Government policy & politicians

- Policy advocacy
- Develop national action plan
- Enact legislation at provincial & national levels

Managing contaminated materials

- Availability of proper storage facilities
- Alternative uses for commodities exceeding contamination limits
- Insurance
- Compulsory disposal of unusable commodities

Identify methods and incentives to increase the quality of Nepalese agricultural imports.

Establish & enforce standards

- Identify risks associated with imports
- Regulate informal trade
- Increase efficiency/speed of border checks
- Strict quarantine measures
- Import only short supply commodities
- Label products with contamination levels, including pesticides
- Reduce import duties if the product meets standards (particularly for high demand products)

Human & physical capacity building

- Improved communication with agents & importers
- Good packaging & post-harvest handling/ transportation

Identify pre-harvest agricultural practices routinely used by farmers in Nepal that increase mycotoxin contamination.

Seed/Variety

- Planting susceptible variety
- Planting unhealthy/substandard seeds
- No seed treatment

Agronomic practices

- Improper irrigation
- Poor disease & pest management practices
- Growing crop where it is not meant to be grown
- Use of chemicals to accelerate ripening
- Little, no or improper fertilizer use
- Improper use of pesticides
- Using contaminated commodities for compost/mulch

Identify methods to reduce mycotoxin contamination in foods sold in local markets.

Increased awareness/training for consumers, retailers & farmers

- Publicize regulations, policies & information on aflatoxins and their impact on human & animal health
- PSAs through mass media and in market areas – pamphlets, posters, street dramas, *etc.*
- Consumer awareness to buy properly stored/certified grains
- Strict implementation/enforcement of existing laws & regulations

Grain treatment – Through drying, ammoniation, O_3 or quarantine

Incentives/Subsidies

- Subsidize price of storage bins
- Provide incentives for proper storage
- Incentives for market suppliers & vendors who comply with SOPs

Storage facilities

- Storage sites managed to comply with regulations
- Small scale storage facilities for women
- Proper storage containers for food
- Hermetic sealed storage bags
- Moisture monitoring tools
- Reduce/remove humidity in stores
- Routine cleaning of storage sites
- Routine use of pesticides (fungicides & insecticides)
- Bag descriptions & stacking protocols

Government inspections/grading/regulation

- Proper grading, labeling & certification of food
- Standard sampling strategy for markets (suppliers & vendors)
- SOPs for markets for supplier & vendors
- Proper monitoring & regular inspections/ evaluations

What/when/where should screening for mycotoxins occur?

Screening could occur anytime and anywhere, with the frequency increasing whenever an epidemic occurs, or the conditions for one are present.

Preharvest – On farm

Postharvest – Before, during and after drying and storage

Processing of plant and animal material

In processing plants, before processing
Animal feed before packaging
Processed food, when ready to sell

Government/ trade interactions

Customs checkpoints
Test grain from household, selling points & market stores
Food products from market inspections
National surveys every 5 years
Point of sale from traders to processors
Accredited laboratory with HPLC/ Fluorometry/LCMS/MS

Identify methods that could be used in Nepal to reduce the amount or effects of mycotoxin contamination of animal feed

Preharvest

Control contamination thru GAP
Biocontrol, *e.g.*, AflaSafe
Breed for resistance to mycotoxins

Feed treatments & additives

Ammoniate or ozonate feed
Add toxin binders
Add enzymes to degrade mycotoxins
Add lactic acid bacteria that degrade mycotoxins

Feed processing

Proper harvesting, drying, storage & packaging
Grade & sort raw materials before compounding
Implement HACCP in feed compounding
Properly clean compounding machine used to make feed
Dilute contaminated feed with clean feed, if legal
Discard, don't feed contaminated feed

Diversify/alter animal diet

Diversify feed ingredients
Proper silage preparation
Feed more hay & forage with less concentrates

Government actions

- Updated quality standards for feed & raw materials
- Subsidies for clean feed programs
- Monitor animal feed in market
- Lab testing facilities at provincial level

Information/outreach

- PSA awareness campaign
- Promote good post-harvest practices
- Make farmers aware of effects
- Mycotoxin contamination in feed database

Identify positions in Nepal where training about mycotoxins, their detection, and their impact is important

Government

- DFTQC officials
- Extension officers
- Local leaders
- Planning officials
- Ministry of Education staff
- Customs & quarantine officers
- Ministry of Health staff
- Metropolitan & provincial laboratories
- Ministry of Ag/Livestock staff

Laboratories & scientists

- NARC scientists
- Research center staff
- Agriculture & health professionals

Identify methods and goals for inter-ministry collaboration on problems associated with mycotoxins

All aspects benefit from exposure to, interaction with, & assistance from international partners

Government structure

- Specialist committee with representatives from Ministry of Health, Ministry of Agriculture, NARC and DFTQC – federal and provincial levels
- Prioritize policies for mycotoxin management
- High level talks between ministries
- Formation of a mycotoxin mitigation body
- Integrate mycotoxin issues into the existing MSNP II
- Design and implement a crisis communications plan
- Develop Terms of Reference for different layers

Facilities

- Adequate budget allocation for infrastructure (*e.g.*, warehouses & cold storage) and innovative technologies

Central & provincial platforms & labs for a multi-sector mycotoxin analysis team

Planning

One Health approach to minimize impact of mycotoxins

Joint goal to reduce mycotoxin risks

Prioritize policies for mycotoxin management

National Action Plan for mycotoxins

Integrate mycotoxin issues into existing MSNP II

Design & implement a crisis communications plan

Develop Terms of Reference for different layers

Programs & activities

Joint planning and programming

Regular updates of mycotoxin risk map

Plan for regular monitoring of hot spots

SOPs for management of mycotoxins

Operational guidelines & data collection/management at provincial and federal levels

Joint awareness & outreach programs

Joint publications of related documents

Joint training & capacity building

Joint organization of workshops (such as this one)

Human resource development

Post Harvest

What/when/where should screening for mycotoxins occur?

Screening could occur anytime and anywhere, with the frequency increasing whenever an epidemic occurs, or the conditions for one are present.

Preharvest – On farm

Postharvest – Before, during and after drying and storage

Processing of plant and animal material

- In processing plants, before processing
- Animal feed before packaging
- Processed food, when ready to sell

Government/trade interactions

- Customs checkpoints
- Test grain from household, selling points & market stores
- Food products from market inspections
- National surveys every 5 years
- Point of sale from traders to processors
- Accredited laboratory with HPLC/ Fluorometry/LCMS/MS

Identify methods and goals for inter-ministry collaboration on problems associated with mycotoxins

All aspects benefit from exposure to, interaction with, & assistance from international partners

Government structure

- Joint goal to reduce mycotoxin risks
- One Health approach to minimize impact of mycotoxins
- High level talks between ministries
- Specialist committee with representatives from Ministry of Health, Ministry of Agriculture, NARC and DFTQC – federal and provincial levels
- Integrate mycotoxin issues into the existing MSNP II
- Formation of a mycotoxin mitigation body
- Develop Terms of Reference for different layers
- Design & implement a crisis communications plan

Facilities

- Central and provincial platforms and labs for a multi-sector mycotoxin analysis team
- Adequate budget allocation for infrastructure (*e.g.*, warehouses & cold storage) and innovative technologies

Planning

Joint planning & programming

National Action Plan for mycotoxins

Integrate mycotoxin issues into the existing MSNP II

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Programs & activities

Operational guidelines & data collection/management at provincial & federal levels

Human resource development

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Joint publications of related documents

Joint training & capacity building

Joint outreach & awareness programs

Testing, Reporting & Regulation

Identify methods to make current regulations of mycotoxins more effective

All activities benefit from community awareness and policy implementation

Government policy & politicians

- Policy advocacy
- Involve farmers & consumers in policy making
- Develop national action plan
- Enact legislation at local & provincial levels
- Human resource development (number & capabilities)
- Improve extension program

Civil society

- Improved collaboration/coordination amongst stakeholders, including public/private sector collaboration
- Capacity building at local & provincial levels

Establish standards with effective regulation & increased surveillance

- Update/expand/amend standards
- Establish regulatory limits for six major mycotoxins
- Regular sampling & testing of crops
- Develop monitoring guidelines
- Check imports
- Identify consistent violators
- Improve accessibility of information
- Establish certification programs that label mycotoxin contamination level
- Harmonize regulations with US, EU & international levels
- Standardization of toxicity measures
- Set standards for more commodities

Managing contaminated materials

- Insurance
- Compulsory disposal of unusable commodities
- Alternative uses for crops exceeding contamination limits

Identify methods and incentives to increase the quality of Nepalese agricultural imports

Establish standards

- Set standards for quality in import & domestic markets
- Develop & implement verification system/compulsory certification
- Develop & implement SOPs with agencies of exporting countries

Enforce standards

- Improved communication with agents & importers
- Label products with contamination levels, including pesticides
- Effective implementation of export/import regulations
- Regulate informal trade
- Reduce import duties if the product meets standards (particularly for high demand products)
- Develop roster of firms supplying good and poor quality products
- Previous certification fraud prevents further imports from source
- Punishment provisions for importers violating standards
- Increase efficiency/speed of border checks
- Establish and equip holding yard
- Strict quarantine measures
- Import only short-supply commodities

Human & physical capacity building

- Increased consumer awareness
- Good packaging & post-harvest handling/transportation
- Increased training for staff on import quality issues
- Capacity improvement for quarantine (Laboratory & human resources)

Identify methods to reduce mycotoxin contamination in foods sold in local markets.

Publicize regulations, policies & information on aflatoxins and their impact on human & animal health

Grain treatment – Through drying, ammoniation, O_3 or quarantine

Incentives/Subsidies

- Subsidize price of storage bins
- Provide incentives for proper storage
- Incentives for market suppliers & vendors who comply with SOPs

Storage facilities

- Proper storage containers for food
- Moisture monitoring tools
- Storage sites managed to comply with regulations

Government inspections/grading/regulation

- Food grading, labeling & certification
- SOPs for market suppliers & vendors
- Regular inspections/evaluations
- Strict implementation/enforcement of existing laws & regulations

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What resources do leaders and government officials need to be able to respond to a mycotoxin "crisis"?

Background information

- Up to date information on magnitude, determinants & impact of the crisis
- Regular monitoring and evaluation
- Up to date information on prevention & mitigation measures

Capacity development

- Orientation for leaders and government officials on preventative mitigation measures
- Technical/human resource development
- Institutional development

Policy and protocols

- Trained policy makers
- Implementation of plan/policy/regulations

Emergency crisis response capacity

- Funding
- Collaboration among local, provincial & national governments
- Crisis/emergency manual, contingency plan & strategic plan
- Response team
- Effective communication team & system
- Access to mass communication with targeted information
- Decontamination system
- Doctors & medicine ready

Verification capacity

- Ability to test food & feed
- Physical infrastructure, including labs
- Vehicles
- Research back up

Identify positions in Nepal where training about mycotoxins, their detection, and their impact is important

Government

- DFTQC officials
- Customs & quarantine officers
- Planning officials
- Ministry of Education staff
- Ministry of Health staff
- Ministry of Ag/Livestock staff
- Local leaders
- Metropolitan & provincial laboratories

Laboratories & scientists

- Lab technicians
- Pathology & nutrition experts
- Agriculture & health professionals
- Private sector laboratories

Identify methods and goals for inter-ministry collaboration on problems associated with mycotoxins

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Government structure

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- Specialist committee with representatives from Ministry of Health, Ministry of Agriculture,
- High level talks between ministries NARC and DFTQC – federal and provincial levels
- Integrate mycotoxin issues into the existing MSNP II
- Form a mycotoxin mitigation body
- Develop Terms of Reference for different layers

Planning

- Joint goal to reduce mycotoxin risks
- Joint planning & programming
- One Health approach to minimize impact of mycotoxins
- Prioritize policies for mycotoxin management
- National Action Plan for mycotoxins
- Integrate mycotoxin issues into the existing MSNP II
- Develop Terms of Reference for different layers
- Joint research & development projects
- Design & implement a crisis communications plan

Programs and activities

SOPs for management of mycotoxins

Operational guidelines and data collection/management at provincial and federal levels

Human resource development

Joint training & capacity building

Joint organization of workshops

Joint outreach & awareness programs

Joint publications of related documents

Regular updates of mycotoxin risk map

Plan for regular monitoring of hot spot

Nominal Group Questions/Responses for Questions from Dhulikhel Conference for Use in Day 2 Discussions

Identify sources of information on mycotoxin contamination in Nepal. Make two votes. In one case list the five most trusted sources and in the other the five least trusted sources.

Most trusted sources listed by most trusted cluster, and then most trusted source within a cluster. Three groups. Two groups. One group. **(Total – groups/individuals/scoring; Mean – groups/individuals/scoring)**

Mass media (6/20/63; 2.00/6.67/21.00)

- Newspaper 3/13/47
- Radio 2/6/14
- Billboards 1/1/2

Government (12/39/122; 1.63/4.88/15.25)

- Government publications and press releases 2/9/30
- Disease outbreaks diagnosed by accredited reference laboratories 2/8/26
- Expert opinions/talks 2/7/14
- Health reports 2/3/9
- Suspected outbreaks reported by experts 1/5/16
- Education training courses 1/4/14
- Technical reports 1/2/8
- Agricultural extension 1/1/5

Experts in field (16/51/153; 1.60/5.10/15.30)

- Research centers and universities 3/8/17
- Disease outbreaks diagnosed by accredited reference laboratories 2/8/26
- Scientific journals 2/7/30
- Expert opinions/talks 2/7/14
- Health reports 2/3/9
- Peer-reviewed articles 1/5/20
- Suspected outbreaks reported by experts 1/5/16
- Laboratory data 1/3/10
- Professional bodies/groups 1/3/3
- Technical reports 1/2/8

Education (7/13/30; 1.40/2.60/6.00)

- NGOs & their reports 2/4/10
- Workshops & seminars 2/3/13
- Education training courses 1/4/14
- Flyers & leaflets 1/1/2
- Newsletters 1/1/1

Social media and personal contacts (4/5/18; 1.00/1.25/4.50)

- Social media, including YouTube & similar apps 1/2/5
- Consumers 1/1/5
- Social mobilizers 1/1/5
- Farmers 1/1/3

Least trusted sources listed by least trusted cluster, and then least trusted source within a cluster

Mass media (6/14/38; 1.50/3.50/9.50)
- Newspaper 3/8/23
- Radio 1/2/7
- Billboards 1/2/4
- Street actors 1/2/4

Social media and personal contacts (10/42/133; 1.43/6.00/19.00)
- Social media, including YouTube & similar apps 3/17/61
- Farmers 2/5/19
- Friends 1/6/20
- Consumers 1/5/12
- Anecdotal quotes 1/4/10
- Social mobilizers 1/4/9
- Local community gathering, *e.g.*, tea shop 1/1/2

Education (5/10/29; 1.25/2.50/7.25)
- NGOs & their reports 2/5/12
- Workshops & seminars 1/3/11
- Education training courses 1/1/5
- Flyers & leaflets 1/1/4

Government (5/9/29; 1.00/1.80/5.80)
- Leaders' speeches 1/5/18
- Education training courses 1/1/5
- Government publications and press releases 1/1/3
- Expert opinions/talks 1/1/2
- Health reports 1/1/1

Experts in field (5/5/9; 1.00/1.00/1.80)
- Scientific journals 1/1/2
- Expert opinions/talks 1/1/2
- Peer-reviewed articles 1/1/2
- Professional bodies/groups 1/1/2
- Health reports 1/1/1

Identify people/positions to be involved in a communications team for a mycotoxin "crisis".

Listed in terms of weighting within a class (most important first). Classes are not weighted relative to one another.

Communicators

Media staff (3/12/36)
Extension workers (2/7/22)
Social media experts (1/3/10)
One spokesman (1/3/8)
Science communication experts (1/2/9)

Subject matter experts

Researchers & research institutions (3/10/26)
Extension workers (2/7/22)
Subject matter/mycotoxin experts (2/6/17)
Dieticians (1/1/2)
Ag & vet centers (1/1/2)
Medical officers (1/m/m)
Academics (1/m/m)

Government officials

Politicians: Agriculture & Health ministers (3/5/20)
Politicians: Local representatives & heads of municipalities (2/8/24)
Extension workers (2/7/22)
Related government departments (1/5/21)
Security/local authorities (1/1/2)
DFTQC officials (1/m/m)

Civil society

Farmer's federation (2/7/23)
NGOs/UN agencies (2/4/10)
Consumers/consumer activists/consumer groups (2/2/2)
Farmers & traders (2/m/m)
Civil society network (1/3/6)
Teacher's associations (1/1/2)