**Norman E. Borlaug International Agricultural Science**

**and Technology Fellowship Program**

**(BORLAUG Fellowship Program)**

**FISCAL YEAR 2016 REQUEST FOR EXPRESSIONS OF INTEREST**

**for**

**EAST AND WEST AFRICA*:* FOOD SAFETY AND AFLATOXINS**

**Application Deadline: May 16, 2016**

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**Website:** [**http://www.fas.usda.gov/programs/borlaug-fellowship-program**](http://www.fas.usda.gov/programs/borlaug-fellowship-program)

**Catalog of Federal Domestic Assistance Number (CFDA)** – **10.777**

**USDA Funding Opportunity Number: *BFP-2016-EAST AND WEST AFRICA-FOOD SAFETY AND AFLATOXINS***

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**U.S. DEPARTMENT OF AGRICULTURE**

**FOREIGN AGRICULTURAL SERVICE**

**BORLAUG FELLOWSHIP PROGRAM**

Summary of Award Opportunity

USDA’s Foreign Agricultural Service (FAS) is seeking U.S. universities to host English-speaking agricultural scientists from low and middle-income countries under the Norman E. Borlaug International Agricultural Science and Technology Fellowship Program (Borlaug Fellowship Program).  These Fellows have been competitively selected based on research priorities, academic and professional accomplishments, commitment to Borlaug Fellowship Program goals, and leadership qualities. The Fellow’s proposal and research plan appears at the end of this notice. USDA recommends that the program begin in Fall 2016; however, priority should be given to a time that is appropriate for the Fellow’s proposed research topic. The program’s duration should be 12 weeks unless otherwise indicated.

Each Fellow has a specific research topic.  Here is a summary of the applicants and a brief description of their research topics:

1. Fellow #1 (Male); Kenya; Aflatoxin control in smallholder dairy production in Kenya
2. Fellow #2 (Male); Malawi; Aflatoxin control in ready-to-eat peanut-based products; production of consumer-ready peanut-based products and aflatoxin control
3. Fellow #3 (Female); Malawi; Assessment of current practices and future approaches for aflatoxin contamination in groundnuts
4. Fellow #4 (Female); Tanzania; Regulatory Framework/Policies for Adoption and Safe Use of Biological Control (Aflasafe)
5. Fellow #5 (Male): Rwanda; Characterization of aflatoxin and aflatoxigenic fungi in maize
6. Fellow #6 (Male): Rwanda; Identification and characterization methods of Aspergillus flavus strain; aflatoxin control
7. Fellow #7 (Female): Ghana; Improved food safety testing for bacteria in food
8. Fellow #8 (Female): Ghana; Pesticide residue testing on consumer food

Section IX provides each Fellow’s proposal with background information and research plan.

This notice identifies the Borlaug Fellowship Program deadline, legislative authority, eligibility and proposal requirements, funding restrictions, cost share requirements, allowable and unallowable costs, reporting requirements, program purpose and priorities, focus areas and recommended topics, application and submission information, application review, selection and notification process, agency program contact information, and mailing address.

**Catalog of Federal Domestic Assistance:** This program is listed in the Catalog of Federal Domestic Assistance under 10.777.

**AWARD TYPE:** Cost Reimbursable Agreement for U.S. Universities

**Deadline:** Applications must be received by May 16th, 2016.

**Legislative Authority:** The legislative authority for the Borlaug Fellowship Program is provided in 7 USC 3319J, Pub. L. 95-113, title XIV, §1473G, as added Pub. L. 110-234, title VII, §7139, May 22, 2008, 122 Stat. 1231, and Pub. L. 110-246, §4(a), Title VII, §7139, June 18, 2008, 122 Stat. 1664, 1992. Authority also comes from the National Agricultural Research, Extension, and Teaching Policy Act of 1977 enacted as Title XIV of the Food and Agriculture Act of 1977, 7 U.S.C. 3319(a), 7 U.S.C. 3318(b).

FAS reviews proposed project costs to make certain those costs are reasonable and allowable per applicable federal regulations. This program is subject to the provisions of

2 CFR Part 200, grant, cooperative, joint venture, and cost-reimbursable agreement recipients/cooperators (including, universities, non-profits, States, Cities/Counties, Tribes, for-profits, and foreign organizations) are subject to Title 2 of the Code of Federal Regulations and other legal requirements, including, but not limited to:

1. 2 CFR Part 25, Universal Identifier and Central Contractor Registration
2. 2 CFR Part 170, Reporting Subaward and Executive Compensation Information
3. 2 CFR Part 175, Award Term for Trafficking in Persons
4. 2 CFR Part 180 and Part 417, OMB Guidelines to Agencies on Government wide Debarment and Suspension (Nonprocurement)
5. 2 CFR Part 200, Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, as adopted by USDA through 2 CFR part 400. University indirect costs for cost reimbursable agreements are limited to 10% of direct costs (7 USC 3319a).

Section I: Funding Opportunity Description

1. PROGRAM DESCRIPTION

The Norman E. Borlaug International Agricultural Science and Technology Fellowship Program promotes food security and economic growth by increasing scientific knowledge and collaborative research to improve agricultural productivity.  This program targets promising, early- to mid-career, English-speaking scientists and policymakers from developing or middle-income countries. Fellows spend 8-12 weeks in the United States and work one-on-one with U.S. scientists in their field.  Mentors coordinate the Fellows’ training, and they visit the Fellows’ countries for 5-10 days within 6-12 months after completion of the training in the U.S. to continue collaborative efforts.

During the program, the Fellows learn new research techniques, gain exposure to the latest scientific developments in various fields of agriculture, access fully-equipped laboratories and libraries, and learn about unique public-private partnerships that help fund agricultural research and science.  Equally important, this program provides international scientists and policymakers with opportunities to establish long-term contacts with U.S. scientists and to apply newly gained knowledge from U.S. institutions to their country's research and development programs.

1. PROGRAM Responsibilities OF HOST INSTITUTIONS

**Assignment of a Principal Investigator (Training Coordinator)**

The host institution will designate a contact person as the Principal Investigator (PI) responsible for coordinating all administrative and programmatic arrangements.

**Assignment of a Mentor**

A key component of the program is matching the Fellow with a mentor. The host institution will select an appropriate mentor for one-on-one work with the Fellow for the duration of the program.

**Mentor Roles**

* + The mentor will establish a professional relationship, providing guidance and training in the Fellow’s research and studies.
	+ The mentor will work with the Fellow before arrival to discuss appropriate work plan, site visits, and other arrangements. A work plan should be agreed upon and finalized no later than 2 weeks after the program start date.
	+ The mentor will provide draft of work plan through the PI to USDA/FAS for consultation and approval approximately 2 weeks before the commencement of the program.
	+ The mentor agrees to commit a significant amount of time each week for one-on-one work with the Fellow during the program.
	+ The mentor will continue communicating with the Fellow beyond the end of the program in the U.S. through the mentor visit.
	+ Mentor will submit quarterly progress reports that indicate all program activities conducted (form SF-PPR).
	+ The mentor may assign other faculty members to assist with Fellow’s training and research activities.
	+ Mentor may not be assigned to multiple Fellows during the same time frame.

**Mentor Follow-up Visit**

* + The mentor visit is an essential and unique part of the Borlaug Fellowship Program. The reciprocal visit is required, not optional.
	+ The mentor will work with the Fellow to plan a follow-up visit to the Fellow’s home country. The trip should occur within 6 months to 1 year after the program ends.
	+ The PI should provide USDA/FAS with an agenda for mentor’s travel, including goals and objectives.
	+ The PI **must** consult with USDA/FAS **prior** to finalizing plans or purchasing plane tickets for the reciprocal visit. Mentor’s travel information must be provided for emergency contact purposes and country clearance (if required by the FAS Overseas Office).
	+ The mentor will provide a **trip report** highlighting the trip’s activities and results through the PI to USDA/FAS within 30 days after the visit.
	+ The mentor should plan to meet with the USDA/FAS Attaché or staff from the U.S. Embassy while they are traveling, if feasable. USDA/FAS can assist with coordination prior to the trip.

**Visa**

* USDA/FAS will provide a DS-2019 for the Fellow to request and obtain a J-1 Visa. USDA/FAS will provide instructions to the Fellow regarding the application process, the amount of lead-time needed, and any paperwork required. The visa start and end date will be coordinated with the host institution who will be responsible for purchasing round trip plane tickets for the fellow to come to the U.S. for his or her program.

**Travel and Transportation**

* The host institution must comply with the Federal Travel Regulations (41 CFR 300 *et seq.)*.
* The host institution will provide round trip, economy class, international airfare from the Fellow’s home to the university.
* The host institution is responsible for arranging and purchasing all domestic travel related to the Fellow’s training program.
* The host institution will provide housing for the Fellow for the duration of the training program, taking into account gender and cultural norms.
* The host institution will pay lodging fees directly. The host institution will not require the Fellow to pay for his or her lodging expenses, whether through reimbursement or advance payment.
* Lodging will include a private bedroom, private or shared bathroom, access to a laundry room, and access to a kitchen with pots, pans, and utensils.
* Basic necessities, such as sheets, towels, and cleaning supplies (if not already provided), will be provided for Fellow’s use. The Fellow should not have to pay for these items.
* Lodging will be within walking distance to the campus/training location or easily accessible by public transportation.
* If public transportation is required to access campus/training location, the host institution will provide the Fellow with a bus pass or proper allowance for transportation expenses.
* When planning lodging options, the host institution should check with the Fellow and account for any special dietary restrictions or preferences.

**Meals and Incidentals (M&IE)**

* The host institution will provide each Fellow with meal and living allowances for the duration of stay.
* Daily M&IE allowance shall be calculated based on current [GSA per diem rates](http://www.gsa.gov/portal/category/21287).
* The host institution can determine the frequency of per diem allotments, but the Fellow **must** receive per diem within the first week of the Fellowship. The PI must inform the Fellow and USDA/FAS immediately if this cannot be accommodated.

**Emergency Health Insurance**

* The host institution will purchase emergency health insurance for the Fellow for the duration of stay, as required for all J1 Visa holders ([22 CFR 62.14](http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=97461c464bead61361ef245ec5c77f7d&rgn=div8&view=text&node=22:1.0.1.7.35.1.1.14&idno=22)).
* The Fellow will not be required to purchase his or her health insurance and then be reimbursed.
* The host institution will educate the Fellow as to what is covered under health insurance policy, especially highlighting that **pre-existing** **medical conditions are** **not covered.**
* The host institution will alert USDA/FAS staff if any health/medical conditions arise during the Fellowship.

**Communication**

* The host institution will initiate contact with the Fellow as soon as possible.
* The host institution will develop the training program in consultation with USDA/FAS and the Fellow.
* The host institution will keep USDA/FAS informed regarding any logistical or program planning.
* The host institution will notify USDA/FAS immediately upon Fellow’s physical arrival and departure from the U.S.
* The host institution will provide USDA/FAS with the Fellow’s temporary U.S. address and phone number, and emergency contact numbers for the PI, mentor, or other appropriate institution personnel. This information is **required** so that Fellow can be reached in the event of an emergency.

**Fellowship Program**

* The host institution will provide educational materials and supplies to each Fellow necessary for their full participation in the fellowship.
* The host institution will pay for all fees related to the Fellow’s training program, such as (but not limited to) technology fees, administrative fees, laboratory fees, etc.
* The host institution will arrange relevant field visits to a local farm, processing plant, private industry, or other related industry as applicable to the Fellow’s training program.
* The host institution will ensure the Fellowsubmits an interim and final report (2-3 pages each) to USDA/FAS before the Fellow leaves the United States. USDA/FAS will provide a report template.

**Orientation**

* The PI/Training Coordinator will communicate directly with the Fellow at least 4-8 weeks **before** his or her arrival in the U.S. to ensure that all pertinent information is provided, including:
* Name and contact information of PI/Training Coordinator
* Name and contact information of mentor
* Institution information, weather information, and clothing needs
* Housing and M&IE allowance
* Program plan and anticipated site visits
* Professional development expectations
* Reminder to bring any necessary prescription medications
* Explain what is and is not covered under emergency health insurance policy (e.g. no pre-existing conditions, no dental, etc.)
* Institution will provide an orientation upon the Fellow’s arrival to acquaint them with campus and community resources:
* Explain and demonstrate local bus/transportation options
* Explain cultural and legal expectations
* USDA will provide a welcome and orientation packet for mentors

**Progress Reports**

* The Principal Investigator or Mentor will submit **quarterly** progress reports. The Principal Investigator or Mentor will use [Performance Progress Report (SF-PPR)](http://www.whitehouse.gov/sites/default/files/omb/grants/approved_forms/sf-ppr.pdf) to submit quarterly progress reports.
* The Principal Investigator or Mentor will submit a final report to USDA/FAS within 30 days after the Mentor visit. USDA/FAS will provide additional guidance and a template for the final report.
* Reports should include the following:
	+ Summary of activities, accomplishments, and any problems encountered or overcome
	+ Photographs, when possible
	+ Completed program evaluations and action plan
* An invoice cannot be paid if a progress report is past due, and will not be paid until the required report has been received.

**Financial Reporting**

* Financial reports will follow the Uniform Administrative Requirements for Grants and Agreements, 2 CFR 215.
* Invoices will use the [Request for Advance or Reimbursement (SF-270).](http://www.whitehouse.gov/omb/assets/omb/grants/sf270.pdf)
* Invoices will be submitted electronically to SF-270InvoicesMailbox@fas.usda.gov and copied to the USDA/FAS program manager and USD/FAS program assistant.
* A summary of expenses that aligns expense totals to the agreement’s budget line items must be included.
* A detailed breakdown of expenses must be included with SF-270. Payment will not be processed without supporting documentation.
* A final invoice must be submitted within 90 days of the end of the period of performance for the agreement.
* Costs must be reported in accordance with the regulations that govern the agreement, and must follow the applicable Federal cost principles 2 CFR 200. The institution cannot be reimbursed for costs that are contrary to the specific terms of the agreement or are outside its scope.
* A [Federal Financial Report (SF-425)](http://www.whitehouse.gov/sites/default/files/omb/assets/grants_forms/SF-425.pdf) must be submitted quarterly and within 90 days of the end of the period of performance for the agreement.
* An invoice cannot be paid if a financial report is past due, and it will not be paid until the required report has been received.

Section II: Award Information

1. ESTIMATE OF FUNDS

Awards are anticipated to range from $25,000 to $40,000 per fellowship. USDA Foreign Agricultural Service will fund agreements for the Borlaug Fellowship Program. For more information on the Borlaug Program, please visit our website at:

<http://www.fas.usda.gov/programs/borlaug-fellowship-program>.

1. START DATES AND PERFORMANCE PERIODS

Activities pursuant to this REI will be for a 2 year period. The estimated start date is on or about July 1, 2016 through June 30, 2018. Fellowships will begin between September 2016 and August 2017, depending on appropriate timing for activities to occur based on any seasonal needs for the program.

1. TYPE OF AWARD

USDA will enter into a cost reimbursable agreement ([7 CFR 3319a](http://www.gpo.gov/fdsys/granule/USCODE-2010-title7/USCODE-2010-title7-chap64-subchapX-sec3319a/content-detail.html)) with State cooperative institutions or other colleges or universities Program staff will maintain involvement in the administration of the Borlaug Fellowship Program.

Section III: Eligibility Information

1. ELIGIBILITY REQUIREMENTS

Proposals may be received from U.S. state cooperative institutions or other colleges and universities and minority serving institutions (MSIs). Proposals from smaller academic institutions, MSIs (in particular American Indian, Alaska Native, Pacific Islander, Hispanic, Asian American, and African American institutions) are especially encouraged to apply.

A proposal from a consortium of organizations must be submitted as a single proposal with one U.S. institution serving as the lead and all other organizations as team members, when applicable. An individual mentor must be identified for each Borlaug Fellow. A single mentor may not host two fellows simultaneously. The Principal Investigator (PI) and mentor must hold a position at an eligible U.S. institution.

1. COST SHARING AND MATCHING REQUIREMENTS
* This program has no statutory formula.
* This program has no matching requirements.
1. FUNDING RESTRICTIONS

This is a cost reimbursable agreement issued under [7 U.S.C. 3319a](http://www.gpo.gov/fdsys/granule/USCODE-2010-title7/USCODE-2010-title7-chap64-subchapX-sec3319a/content-detail.html).

Section IV: Application and Submission Information

1. ADDRESS TO REQUEST APPLICATION PACKAGE

This announcement contains all instructions and links to all forms required to complete the application. All applications must be submitted in a single PDF document. The application deadline is **May 16th 2016**. No mailed or facsimile submissions will be accepted.

1. CONTENT AND FORM OF APPLICATION SUBMISSION:

Institutions may submit proposals to host more than one Borlaug Fellow. Institutions interested in hosting one or more Fellows should submit a proposal following the guidelines below:

* Complete [SF-424 Application for Federal Assistance](http://apply07.grants.gov/apply/forms/sample/SF424_2_1-V2.1.pdf) for a single Borlaug Fellow. USDA/FAS cannot accept applications for multiple fellows in a single application.
* Indicate the name of the institution applying to host the Fellows.
* Indicate the country, research interest, and reference number.
* Identify a Primary Investigator.
* Identify a Mentor. A Mentor may not be assigned to multiple Fellows who are in the U.S. at the same time.
* Provide a tentative research plan based on the Fellow’s research proposal and action plan, including topics covered, field visits, and other activities.
* Include a narrative description of the proposed fellowship, how it will be administered, and the role of the university faculty and support staff.
* Provide a summary of relevant institutional capabilities for hosting international scientists and policymakers in the proposed field.
* Briefly describe the research expertise and international experience of the mentor in the Fellow’s field of interest.
* Provide a one to two page curriculum vitae for the mentor and other collaborating researchers involved in the proposed program.
* Identify the expected skills or knowledge to be acquired by the Fellow at the end of the program
* Provide a program budget using [Standard Form -424A- Budget Information Non Construction Programs](http://apply07.grants.gov/apply/forms/sample/SF424A-V1.0.pdf), including a detailed budget worksheet (see page 12).
	+ Provide a budget narrative. All line items should be described in sufficient detail to enable FAS to determine that the costs are reasonable and allowable for the project in accordance with federal regulations.
* If attendance at the World Food Prize in Des Moines, Iowa during October 2016 is feasible, then the Fellowship may be extended one additional week, not to exceed 13 weeks, to ensure the Fellow receives up to 12 weeks of training.
	+ - If attending the World Food Prize, the budget should include time and funding for the Fellow and Mentor to attend. An adjustment to the Fellow’s M&IE must be made for the time spent in Iowa.
* Complete [AD-3030, Representations Regarding Felony Conviction and Tax Delinquent Status for Corporate Applicants](http://www.ocio.usda.gov/document/ad3030).
* Complete [AD-3031, Assurance Regarding Felony Conviction or Tax Delinquent Status for Corporate Applicants](http://www.ocio.usda.gov/document/ad3031)
* Complete the Host University Administrative Checklist on university administrative policies
* **Submit all application materials as attachments to a single email.**
	+ The primary document submitted in response to this REI with all information requested should be titled *Statement of Work.*
	+ Include all application information that is not a specific form in a single PDF document.

Successful applicants will be required to submit all relevant national certifications and compliance documents prior to awards being issued.

Host University Administrative Checklist

Please complete the following checklist concerning the university’s policies on providing per diem funds to exchange visitors. This information is for USDA internal use only and does not determine your eligibility to serve as a host institution.

|  |  |  |
| --- | --- | --- |
| **Host University Policies** | **YES** | **NO** |
| Will the mentor listed in the proposal be present for the majority of the fellowship?  |  |  |
| Will the mentor be able to spend time meeting with fellow individually each week? |  |  |
| Will the university be able to provide per diem within the first week of the Fellow’s arrival? |  |  |
| Will the university be able to provide fully furnished lodging with kitchen facilities? |  |  |
| Does the university withhold federal tax on the participants’ per diem and housing?\* If so, you must list this expense as a separate line item on the budget. |  |  |

\*Note that Borlaug Fellows (as trainees, *not* students) are considered EXEMPT INDIVIDUALS under the IRS Substantial Presence Test for tax purposes. The exemption falls under one or both of the following categories: either the [Foreign Government-Related Individuals](http://www.irs.gov/Individuals/International-Taxpayers/Exempt-Individuals-Foreign-Government-Related-Individuals) standard or the [Closer Connection Exception](http://www.irs.gov/Individuals/International-Taxpayers/Exempt-Individuals-Foreign-Government-Related-Individuals). The only requirement is to complete [IRS Form 8843](http://www.irs.gov/pub/irs-pdf/f8843.pdf) (Sections 1 and 2). No taxes should be withheld from Borlaug Fellows since they are exempt.

|  |
| --- |
| **Budget Worksheet** |
| **Host Institution:**  |  |
| **Estimated Dates:**  |  |
| **REI#/Country/Fellow#** |  |
| **SF-424 Category** | **Line Items** | **Rate** |  | **Days** | **Subtotal** |
|  | **Fellow's Logistical Expenses** |  |  |  |  |
| TRAVEL/Housing | 1. Lodging |  |  |  |  |
| TRAVEL | 2. Meals and Incidentals |  |  |  |  |
| OTHER | 3. Federal Tax |  |  |  |  |
| TRAVEL | 4. Medical Insurance  |  |  |  |  |
| TRAVEL | 6. Local Transportation  |  |  |  |  |
| TRAVEL | 7. Airfare - International  |  |  |  |  |
| TRAVEL | 8. Airfare - Domestic (If Applicable)  |  |  |  |  |
|  |  |  | **Subtotal** |  |
|  | **Fellow's Professional Development** |  |  |  |  |
| TRAVEL | 1. Field Tours  |  |  |  |  |
| SUPPLIES | 2. Educational Materials and IT Expenses  |  |  |  |  |
| SUPPLIES | 3. Shipping Materials |  |  |  |  |
|  |  |  | **Subtotal** |  |
|  | **Host Institution Fees** |  |  |  |  |
| PERSONNEL  | 1. Training Coordinator (Salary) |  |  |  |  |
| FRINGE BENEFITS | 1.b. Training Coordinator (Fringe Benefits) |  |  |  |  |
| PERSONNEL | 2. Mentor Fee |  |  |  |  |
| FRINGE BENEFITS | 2.b. Mentor (Fringe Benefits) |  |  |  |  |
| SUPPLIES | 3. Laboratory Expenses |  |  |  |  |
|  |  |  | **Subtotal** |  |
|  | **World Food Prize Symposium (Oct. 2016; If Applicable)** |  |  |  |  |
| TRAVEL | 1. Domestic Transportation  |  |  |  |  |
| TRAVEL | 2. Lodging  |  |  |  |  |
| OTHER | 3. Conference Fee  |  |  |  |  |
|  |  |  | **Subtotal** |  |
|  | **Mentor Follow up Activity (5-10 Days)**  |  |  |  |  |
| TRAVEL | 1. Mentor Airfare – International |  |  |  |  |
| TRAVEL | 2. Mentor Domestic In-Country Travel (If Applicable) |  |  |  |  |
| TRAVEL | 3. Lodging |  |  |  |  |
| TRAVEL | 4. Meals & Incidentals |  |  |  |  |
| SUPPLIES | 5. Supplies for Trainings/Workshops |  |  |  |  |
|  |  |  | **Subtotal** |  |
|  |  | **Total Program Costs** |  |
| INDIRECT | **Indirect Costs/Overhead (10%)** |  |
|  |  | **Total Request** |  |

1. SUBMISSION DEADLINES and TIMES

Submit all application materials in a single email. The following forms are required: SF-424, SF-424A, AD-3030, and AD-3031. Include all application information that is not a specific form in a single PDF document.

Funding opportunities will be advertised via the USDA/NIFA listserv. All proposals must be submitted to the email address below with all required forms. Proposals not submitted to the application email address by the stated deadline will not be accepted.

* Borlaug Fellowship Program Email: BorlaugFellowships@fas.usda.gov
1. FUNDING RESTRICTIONS

Allowable Costs:

To help in this review and to expedite the award process, budgets must include a narrative detailing all line items. The categories listed below are examples of some of the more common items found in project budgets. All items should be described in sufficient detail that would enable FAS to determine that the costs are reasonable and allowable for the project per federal regulations.

1. **Salaries and Fringe Benefits:**

Requested funds may be allocated toward salaries, fringe benefits, or the combination thereof. No more than 20% of the requested funds may be allocated toward salaries, consultant fees, fringe benefits, or the combination thereof. Only individuals that hold positions at eligible U.S. institutions should be listed in this category.

**2. Travel:**

For domestic travel, provide the purpose of the travel and information used in calculating the estimated cost, such as the destination, number of travelers, and estimated cost per trip. There are several restrictions associated with traveling on federal funds. In most cases, airfare must be purchased in economy class from a U.S. carrier. Travelers must also adhere to federally mandated domestic per diem guidelines. Additional information may be found in the circulars listed in the “Legislative Authority” section of this announcement.

**3. Supplies:**

All personal property excluding equipment, intangible property, and debt instruments as defined in this section.

**4. Other Direct Costs:**

Other Direct Costs are those anticipated charges not included in other budget categories, including materials and supplies, lab fees, publication costs, reasonable consultant fees, computer services, sub-awards (the level of detail required for the sub-award budget is the same as the recipient organization), equipment rental, facility rental, conferences and meetings, speaker fees, honorariums.

**5. Indirect Costs:**

Indirect Costs may not exceed 10% of direct costs.

**6. Tax Withholding:**

Borlaug Fellows (as trainees, *not* students) are considered EXEMPT INDIVIDUALS under the IRS Substantial Presence Test for tax purposes. The exemption falls under one or both of the following categories: either the [Foreign Government-Related Individuals](http://www.irs.gov/Individuals/International-Taxpayers/Exempt-Individuals-Foreign-Government-Related-Individuals) standard or the [Closer Connection Exception](http://www.irs.gov/Individuals/International-Taxpayers/Exempt-Individuals-Foreign-Government-Related-Individuals). Tax treaties might also exist between the U.S. and the Fellow’s home country. The only requirement is to complete [IRS Form 8843](http://www.irs.gov/pub/irs-pdf/f8843.pdf) (Sections 1 and 2). No taxes should be withheld from Borlaug Fellows since they are exempt.

Unallowable Costs:

General purpose equipment (no particular scientific, technical, or programmatic purpose) and scientific equipment exceeding $5,000 or more; entertainment; capital improvements; thank you gifts, and other expenses not directly related to the project are not allowed.

1. OTHER SUBMISSSION REQUIREMENTS

All applications must be submitted electronically as indicated above.

Section V: Application Review Information

All proposals are carefully reviewed by USDA/FAS Program Officers and other FAS staff against the criteria listed below, including others who are experts in a particular field, as appropriate.

1. REVIEW CRITERIA
* **Technical Expertise and Experience (40 points):** Mentor must have appropriate technical background to provide the desired, advanced training. If necessary, other appropriate collaborating scientists should be identified to meet any of the objectives which the mentor cannot address. Mentor’s experience and knowledge of relevant agricultural conditions within the Fellow’s country or a similar location will be considered as appropriate. The trainer’s experience with international training and adult-education will also be considered.
* **Overall Program (35 points):** The overall program plan and design should be relevant to the Fellow’s objectives background. The program plan should be thorough, and it should help achieve the desired post-program deliverables and the Fellow’s research goals and objectives. Relevant agricultural practices within the region of the university will be considered as appropriate. Relevant university resources should be identified. Additional resources/organizations should be identified as appropriate. Site visits and meetings should be meaningful to the content of the program, if included.
* **Budget (25 points):** The proposed budget should be appropriate for the length of the program. The budget should include appropriate cost savings where available. Salary and fringe benefits expenses should not be excessive.
1. REVIEW AND SELECTION PROCESS

Other factors may also be taken into consideration such as regional diversity and MSI status in the review process. After review by appropriate offices, it is expected that all applicants will be notified within 2 months after the closing date for applications.

Section VI: Award Administration Information

1. AWARD NOTICES

Applicants should expect to be contacted by program staff for clarification and additional discussion on any budget related issues before final determination of successful applicants. Any notification by the program office regarding the selection of an institution is not an authorization to begin performance. No pre-award costs can be charged. The notice of award signed by the Deputy Administrator of USDA/FAS/OCBD is the authorizing document. This document will be sent by electronic mail to the university. Both parties must sign this document before the agreement is in force. Unsuccessful applicants will be notified of the status of their application by email.

1. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

Certifications regarding debarment Suspension, Drug Free Workplace, Felony Conviction and Tax Delinquent Status, and other national administrative assurances and policies are required. The cooperator must adhere to administrative requirements, cost principles, and audit requirements as contained in 2 CFR Part 200, Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards.

1. REPORTING REQUIREMENTS:

Primary Investigators are required to submit mid-term and final Fellow’s performance reports on the U.S. portion of the Borlaug Fellowship. A final mentor’s visit report including a final evaluation should be submitted no later than 30 days after the completion of the mentor visit.

* Financial reports will use SF-425.
* Progress Reports will use SF-PPR.
* Invoices will use SF-270.

Section VII: Agency Contact

Applicants can direct questions or request help before the deadline for submission of the application for these funding opportunities via the contact information below:

* Borlaug Fellowship General Email: BorlaugFellowships@fas.usda.gov
* Borlaug Africa: Karen Uetrecht, (202) 690-3359 or Karen.Uetrecht@fas.usda.gov
* Borlaug Eastern Europe: Ed Gerard, (202) 690-1983 or Edward.Gerard@fas.usda.gov
* Borlaug Asia/Latin America: Sarah Librea, (202) 720-2018 or Sarah.Librea@fas.usda.gov

Section VIII: Other Information

The USDA Borlaug Fellowship Program began in 2004. More than 750 Fellows from 64 countries have been trained to date. Additional program information is available at <http://www.fas.usda.gov/programs/borlaug-fellowship-program>.

Related Requests for Expressions of interest will be distributed by region and topic including: Asia, Eastern Europe, Latin America, North Africa, East/ Sub-Saharan Africa. This will be posted on the NIFA listserv.

Section IX: Borlaug Fellow Proposal and Research Plan

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| **No.**  | **Country** | **Proposal Summary** |
| [**Fellow 1**](#Fellow1) | **Kenya** | Aflatoxin control in smallholder dairy production systems in Kenya |
| [**Fellow 2**](#Fellow2) | **Malawi** | Aflatoxin control in ready-to-eat peanut-based products |
| [**Fellow 3**](#Fellow3) | **Malawi** | Assessment of current and future approaches for aflatoxin contamination in groundnuts |
| [**Fellow 4**](#Fellow4) | **Tanzania** | Regulatory Framework/Policies for Adoption and Safe Use of Biological Control (Aflasafe) |
| [**Fellow 5**](#Fellow5) | **Rwanda** | Characterization of aflatoxins and aflatoxigenic fungi isolated from maize in different Agro-Ecological Zones of Rwanda |
| [**Fellow 6**](#Fellow6) | **Rwanda** | Identification of Aspergillus flavus strains and control methods aimed at understanding the differences between various strains of Aspergillus flavus and methods used during the characterization process |
| [**Fellow 7**](#Fellow7) | **Ghana** | Comparison of the effectiveness of traditional and novel rapid methods for the enumeration and detection of microorganisms in different foods |
| [**Fellow 8**](#Fellow8) | **Ghana** | Determination of Pesticide Residues in Vegetables Using the Gas chromatograph (GC) or Gas chromatograph - Mass Spectrum (GC-MS). |

Fellow #1 (Male); Kenya; Aflatoxin control in Smallholder Dairy Production in Kenya

Kenya is one of the largest producers of dairy products in Africa and has the highest per capita milk consumption in Africa. Dairy production also plays an important role in food and nutrition security in Kenya and it is a major source of domestic and export income for Kenya. The industry supports livelihoods of a large part of the Kenyan population. It is among the top five commodities in the Kenya with great potential for investment. Dairy industry is classified as one of largest economic sub-sectors within the agricultural sector and its growth is driven by demand for milk and milk production as a result of increase in population, urbanization and household income. Despite this enormous potential, the dairy sector is dominated by smallholder production systems which are faced with various constraints, ranging from inadequate and low quality feed resources, poor animal husbandry practices and low quality of animal genetics among others. Supply of good quality milk has also remained a challenge and milk is often wasted before it can get processed.

Livestock feeds are a critical element in achieving sustainable livestock production however; livestock feed supply in Kenya is constrained by low quality and seasonality of raw materials, inadequate knowledge on feed formulation, high cost of production and inadequate regulation of the industry. Consequently, farmers have shifted to homemade rations mainly made from crops residues and industrial by-products in form of silage and stored hay. Some of the challenges that exist in the utilization of various feed-stuffs include availability of nutrients, presence of pest control products, biological hazards, veterinary drug residues, toxic compounds and inadequate information on nutritional composition and methods of utilization.

In recent years, food especially dairy products have received a lot of attention due to safety concerns. Some of the concerns include the occurrence of avian flu, disease causing infectious agents like Brucella, industrial contaminants, heavy metals, mycotoxins, dioxins, pesticides, growth promoters and veterinary drugs. Some of these disease-causing agents are associated with feed-stuffs. Consequently there is need to establish and strength the various mechanisms being applied by smallholder farmers in control of aflatoxin which is mainly associated with livestock feed-stuffs.

My participation to Borlaug fellowship program aims to strengthen my knowledge and skills in different aspects of a sustainable dairy value chain, its relationship from ‘farm to folk’, emerging challenges and opportunities due to urbanization, climate change, decreasing resources and consumers demand. In addition, I envisage being exposed to international best practices from the American dairy systems which will bring innovations that are socially, economically and ecologically balanced to Kenyan beef industry. This will be useful in addressing the challenges of high cost of production, inadequate and low quality forage, poor market infrastructure, high post-harvest losses and biological hazards to dairy products. My research objective for this fellowship is establish the aflatoxin control mechanisms in smallholder dairy production systems in Central Kenya. I am to achieve this objective through assessment of the level of awareness on aflatoxin among the smallholder dairy farmers, identification of different aflatoxin control

mechanisms implemented by smallholder dairy farmers, and determining the impacts of the aflatoxin control mechanisms on cost of production and milk safety.

Research action plan

Week 1: Arrival at host institution and preparatory modular coursework

Week 2: Literature study and finalization of research plan

Week 3: Literature study

Week 4: develop the methodology and preparation of materials

Week 5-7: Preparation of materials and data collection

Week 8-11: Data analysis

Week 12: Report writing and final presentation

Fellow #2 (Male); Malawi; Aflatoxin Control in Ready-to-Eat Peanut-Based Products

The goal of my research is to ensure provision of safe and quality food to the population of Malawi, specifically to the many consumers of peanut paste (Chiponde). More specifically, to quantify the magnitude of the aflatoxin problem for industries producing peanut paste in the country, assess levels of aflatoxin contamination in peanut paste imported in to the country, identify gaps and challenges in the industry on proper management of mycotoxin contamination, and identify solutions to addressing the gaps and challenges.

Malawi is a country in southern Africa with a population of about 14 million people. The backbone of Malawi’s economy is agriculture, which employs about 90% of the population. Agriculture contributes more than 35% of the country’s gross domestic product (GDP) and accounts for almost 85% of the export earnings, (Mkumbila, et al, 2007). Food safety with its emphasis on food quality in the developing countries of Africa is an issue which frequently must be balanced by issues of food security with their emphasis on sufficiency of supply, (Shephard, G.S, 2003). The population in Malawi is at greater risk of exposure to mycotoxins due to consumption of maize flour, rice and ground nuts, all prone to mycotoxin contamination. Currently in Malawi there is scant data regarding aflatoxin contamination in maize and ground nuts. Also most people in urban areas and villages are not aware of the effects of consuming mycotoxin contaminated food.

Previous studies, Matumba, et al. 2009, Monyo et al. 2009 and Mwalwayo, 2013 (unpublished) on the prevalence of mycotoxins in the country have concentrated much on the prevalence of aflatoxin in raw peanuts, maize and rice. This study is going to focus on peanut butter, a product made from groundnuts. Aflatoxin contamination in groundnuts has been documented in a lot of studies in Malawi and several interventions in the past have been put in place to reduce the aflatoxin problem by such institutions and organizations as NASFAM, ICRISAT, Ministry of Agriculture, etc. It has been observed however that even with these interventions in place, aflatoxin contamination in ground nuts is still a problem, actually as put by the USDA, aflatoxin contamination is avoidable. While these interventions concentrated on controlling contamination on the farm level, very little has been done on managing the contaminated produce. A preliminary study on prevalence of aflatoxin in peanut paste produced by local industries in Malawi for the period covering 2014 - 2015 has shown alarming levels of aflatoxin contamination.

It is also noted that the industry has a challenge in managing the contamination as shown by the high levels of contamination in the peanut paste product available on the market. This research therefore is hoping to obtain data from the industry perspective, understand what they do and how they do it to reduce the aflatoxin contamination in their products, the challenges they are facing in trying to reduce the contamination and identify the gaps within their set ups that hinder on efforts to reduce the problem. An understanding of the above will help to come up with interventions to curb the aflatoxin problem and ensure provision of a safe and quality product to peanut paste consumers.

The results generated from my research will be a big step to ensuring provision of safe and quality food to the Malawi population. Healthy people means healthy nation and hence a vibrant working force that will work to grow the economy of Malawi and ensure provision of enough good safe food and even in excess for export to the world.

Research Action Plan

Weeks 1- 3

Samples collected for analysis:

1.1 Buy peanut paste samples produced by local industries on the market (10 samples/company)

1.2 Testing samples for aflatoxin

2.1 Buy on the market selected peanut paste samples imported into the country (10 samples/company)

2.2 Testing samples for aflatoxin

3.1. Administer a questionnaire on aflatoxin contamination management and challenges to 5 major peanut paste producing companies

4.1 Work out possible solutions and challenges as identified in 3 above

4.2 Work out a plan with selected industry to implement solutions in 4, 1. above

Weeks 4

3.1 Documentation of gaps and challenges

Weeks 8 - 10

4.0 Write work plan for result implementation

5.0 Data analysis and report compilation

Weeks 11-12

* 1. Report Writing

Fellow #3 (Female); Malawi; Assessment of Current Practices and Future Approaches for Aflatoxin Contamination in Groundnuts

The goal of this research is to assess the knowledge, attitude and identify the practices contributing to fungal growth and aflatoxin contamination in groundnuts or peanuts (Arachis hypogaea L.) Through administering a questionnaire, my specific research objectives are; to capture the knowledge gap among producers, assess attitude towards food contamination and food safety, identify practices done from pre-harvest to post-harvest that contribute to fungal growth and contamination, and to share the findings with stakeholders through outreach program and publications.

Arachis hypogaea L is an important crop worldwide ranking sixth and thirteenth among oil and food crops, respectively. In Malawi, it is a crop which provides nutrition security supplementing maize. Groundnuts used to rank third as cash crop after tobacco and tea in the early 90s before its decline due to failure to comply with aflatoxin test on international market. In 2005, 42% by volume of Malawi’s groundnuts were rejected due to non-compliance; nevertheless, it remains an important source of income locally (Monyo Introduction to Groundnut (et al., 2012). Comparing the market share between 2004 to 2009 vs 2010 to 2014, it has shrunk from 21% to 8 % (Brent Edelman and Noora-Lisa Aberman MASSP POLICY NOTE April 2015) in high enforcement regions such as European Union (EU). Most of the exports are informal to low enforcement areas.

Aflatoxins are toxic metabolites produced by different species of toxicogenic fungi, called mycotoxins (Giniani Carla Dors et al., 2009). Exposure of aflatoxin to humans and animals can occur at any stage of food chain in both agricultural and non-agricultural environments. Mycotoxin contamination is a quality indicator of pre-harvest, post-harvest and storage problems. Mycotoxin contamination poses a unique challenge to food safety (Park et al., 2015). Susceptible commodities such as groundnuts get contaminated along the food chain. Food safety management systems such Hazard analysis Critical Control points (HACCP) have been useful in managing the risks associated with pathogenic microorganisms. Before implementation of effective HACCP programme thorough study should be done to identify the critical points that need special attention in order to minimize contamination. Knowledge, attitude and practices relating to microbial growth need to be assessed. Having a HACCP programme that has incorporated the aforementioned along the food chain will help improve food safety, nutritional value of food product, seed viability, seed quality, health risks associated with mycotoxins and improve on exports since most grains and cereals fail to pass aflatoxin test.

Aflatoxin – Case of Malawi’s groundnut (peanut)

In 1997, National Association of Smallholder Farmers (NASFAM) emerged with a goal to intensify diversification of crops to spread the risk of overdependence on Tobacco. Malawian groundnuts despite their confectionary characteristic are losing market due to aflatoxin contamination among other things. Until the mid-1990s groundnut was a key export crop. The Aflatoxin problem is mainly considered in trade barrier context but the food safety concern has received little attention (Daily times, local newspaper, September 23 2014). According to the

Malawi Programme for Aflatoxin Control (Mapac) lack of quality management in groundnut chain contributes to the higher levels of fungal contamination and Aflatoxin. Economic growth, concerns in relation to the negative impacts of aflatoxins in groundnut exports is currently the driving force pushing for improvements at pre-harvest and postharvest levels. According to the survey done by Matumba et al. 2014, “A survey of the incidence and level of aflatoxin contamination in a range of locally and imported processed foods on Malawian retail market in Lilongwe city, Malawi” all groundnut based baby foods had aflatoxin above the EU maximum tolerable level. A similar study was conducted in our laboratory on “assessment of aflatoxin in groundnut flour from different producers found in various areas around Blantyre city, Malawi” (unpublished results) where the results were in agreement with Matumba et al., above EU maximum tolerable levels ( 0.686- 2113.7 ppb). Government and development partners in Malawi are actively engaging with groundnut farmers to reduce aflatoxins throughout the value chain. Interventions include farmer training on soil management, planting, and post-harvest processing and consumer awareness campaigns to increase demand for low-aflatoxin groundnut.

During this fellowship I anticipate to accomplish among other things, faster and cheaper methods of detecting aflatoxin which we can use right at the farm, designing scientific questionnaires, improve scientific knowledge and skills which can be applied to produce low aflatoxin groundnut. My research interests backed by my scientific background have always been to see Malawi not only food and nutrition secure but also economically stable through expansion on exports. This study will just contribute towards this vision because producers will be taught different ways of controlling contamination. The mentor will guide me in achieving the objectives highlighted above and will be a supervisor at each at every stage.

Borlaug fellowship will expose me to more knowledge and advanced skills of managing contamination, moreover through interaction with other participants and the mentor will learn how other countries are managing aflatoxin, lesson will be learnt and applied in Malawi. These will contribute to production of low aflatoxin groundnut which will pass through aflatoxin test, motivating more producers to produce more and safer product, increasing productivity and ensuring food safety security and at the same time boosting the economy from household level to national level.

Research Action Plan

Week 1- orientation and laboratory introductions. Outcome- acquaint myself with the university staff and laboratory

Week 2- Attend lectures on state of aflatoxin- global perspective. Outcome- gather as many literature as possible on the topic above

Week 3 -Lecture on aflatoxin and trade barrier- Africa as case study. Outcome- gather literature on same

Week 4- Field visits and sample collection. Outcome - learn sampling techniques

Week 5- Aflatoxin rapid test on the farm. Outcome- learn how to conduct rapid farm test

Week 6- Sample preparation for aflatoxin test in the laboratory. Outcome is to understand sample preparation

Week 7- Determination of aflatoxin using HPLC and other techniques. Outcome- to understand how HPLC and other techniques work.

Week 8- Designing scientific questionnaire to capture all relevant data. Outcome- draft questionnaires for mentor to check.

Week 9 How to compile and report results. Outcome- report results obtained from field samples

Week 10- Lecture on scientific publication writing

Outcome- draft a paper based on results obtained from the field.

Week 11- Lecture on HACCP. Outcome - understand HACCP as a tool of food safety

Week 12 How to train farmers or producers on control of contamination from the field to the end user. Outcome- Demonstration designed by trainer and assessed by mentor.

Fellow #4 (Female); Tanzania; Regulatory Framework/Policies for Adoption and Safe Use of Biological Control (Aflasafe)

The goal of my research is to develop a model for functioning regulatory framework/policies for adoption and safe use of biological controls technology. Specific objectives include: Building Capacity and desk research on regulatory framework from different countries adopted Aflasafe, biopesticides and any other biological control technology, training on specific technical transfer of knowledge and practical technique of biocontrol to the end user, and developing model for comprehensive legal and regulatory framework that support adoption and safe use of biological control technologies.

Agriculture sector is the largest sector in Tanzania economy which accounts for 52 percent of GDP and 47 percent of all exports and employs about 80% of Tanzanians. Agriculture is characterized by low productivity and suboptimal crop quality which leads to seasonal household and community food insecurity. An important element of food security is that food is adequate, safe and nutritious. There is a common myth that the poor in developing countries do not care about food safety and that governments should focus more on food availability, but food safety is a key element in food security and one of the health and economic problem facing Tanzania. Food might be available but if it is not safe it poses health concerns to consumers. Threat to food safety includes contamination with bacteria, parasites, pesticides and antibiotic residues and naturally occurring toxins like aflatoxins. Aflatoxins are small molecules, natural toxin produced as secondary metabolites by fungi Asperigillus flavus and Asperigillus. parasiticus. A.flavas and A.parasiticus infestation causes aflatoxin Contamination in Tanzania main staple food which includes maize, cassava, milk, nuts, rice, legumes etc. Aflatoxin is calsssified as a class I carcinogen by the world health organization (WHO) for both human and animals. Prolonged consumption of aflatoxins contaminated food staff (Chronic aflatoxicosis) can lead to liver cancer, immunosuppression, stunting among infants and young children.

Contamination can occur any time from pre harvest to storage and is not adequately controlled and/regulated in the country due weak regulatory environment, inadequate laboratory facilities and experts to monitor food and feed products and little or no awareness on the effects posed by aflatoxins contamination. As a result large population of Tanzanians consumes unacceptable levels of the toxins through their daily diets including infants under two years of age. Studies on farm diary sector and breast milk demonstrated high levels of contaminations in cows and breast milk. The most cost effective and efficient way of reducing aflatoxins in food is good agricultural practices which begins at production through sound post-harvest handling and storage practices. Good agricultural practices includes timely harvesting of crops, appropriate drying and storage methods to discourage the growth of fungi and bacteria and innovative technologies such as biological control. Biocontrol reduce pre harvested aflatoxin contamination in crops based on application of competitive non toxigenic strains to soil around developing crops in the field

The competent authority responsible for the registration of Aflasafe is Tanzania Pesticide Research Institute (TPRI). Registration must be done prior scale up from pilot field but currently

there are no standards for registration, production, trade and commercialization of biocontrol in Tanzania. Although Tanzania government has put in place policies and legal frameworks that encourage increased production in agriculture, e.g. Tanzania’s national policy on biotechnology (2010) which emphasizes the technology’s potential to enhance the country’s food security and trade position but there is lack of policies and legislations that encourage use of biological control agents or biopesticides. It is expected that biological controls registered as biopesticides but bio pesticides are currently regulated using the same procedures with chemical pesticides which is under Plant Protection Act of 1997. Plant protection act of 1997, biotechnology policy 2010, and environmental management act does not provide specific policy statements on biopesticides or biocontrols. Therefore in collaboration with relevant stakeholders like TPRI; Tanzania commission for science and technology (COSTECH), Vise President Office (VPO) and TFDA there is a need to develop legal and regulatory framework that includes regulations, guidelines and manuals to ensure safe use of biocontrols products before the bioproducts are ready for market or our researcher’s efforts will be in vain. Transfer of this technology to the end user (farmers) requires (COSTECH) a principal advisor of the government on all matters relating to scientific research and technology development in the country, whose mandate is to coordinate and promote Technology.

Adoption of biological control technology requires among others functioning legal and regulatory framework which is not in place in case of Tanzania. Capacity Building of relevant stakeholders for the development of a functioning policy/ legal and regulatory framework need to be taken into consideration for smooth adoption and safe use of biocontrols. This is the reason I’m applying for this research training with the target of developing a model for a functioning regulatory framework/policies for adoption and safe use of biological controls technology

Biocontrol research to develop Aflasafe are on the ground and the products are expected to be registered as biopesticides but adoption of biopesticides in Tanzania has been low, only five are full registered while two are still under experimentation. Adoption of biological control technology requires among others functioning legal and regulatory framework which is not in place in case of Tanzania. I'm applying to this opportunity to make use of experience and expertise from USA to facilitate adoption of biological controls technology in Tanzania and in East Africa region in general.

Research Action Plan

1st week Orientation.

2nd&3rd week; Capacity building on Regulatory framework of USA, Europe and how it facilitates the adoption of biological control

4th week; Visit and learn from competent authorities responsible for registration of biopesticides, biocontols

5th&6th week; Leaning different models for Specific technical transfer of knowledge

7th week; Hands on lab Technique of biological control to get the feel of hard work of scientists and understand the negative/positive impacts of the proposed policies/regulatory framework

8&9&10th week; Developing model for comprehensive legal and regulatory framework

11th&12th week; Brainstorming on the collaboration mode, proposing list of activities to ensure that Tanzania east African region in general develop acceptable legal framework, model for awareness raising on Aflatoxin etc.

Fellow #5 (Male): Rwanda; Characterization of Aflatoxin and Aflatoxigenic Fungi in Maize

The goal of my research is to contribute to the characterization of aflatoxins and aflatoxins fungi in Rwanda, My specific objectives are: 1) characterization of aflatoxins in different food staples (maize, peanuts, milk) and feed from 5 Agro-Ecological Zones of Rwanda 2) characterization of fungi producing aflatoxins in maize, peanuts and feed from 5 Agro-Ecological Zones of Rwanda, and 3) assessment of aflatoxins’ risk factors related to the agricultural practices in Rwanda.

The mycotoxins particularly aflatoxins are public health importance because they are highly carcinogenic and mutagenic. They are also associated with immunosuppression, reduced nutrient absorption and stunting of infants, and are lethal in high doses. The human exposure is the result of ingestion of contaminated foods, or indirectly from consumption of food of animal origin previously exposed to aflatoxins in feeds (eg. dairy products and eggs) (IARC, 2002). The aflatoxins are produced by aflatoxigenic Aspergilli spp. among others, A. flavus produces Aflatoxin (AF) B1 and AFB2 whereas A. parasiticus produces AFG1, AFG2, AFB1 and AFB2 (Iqbal et al., 2013) as well as AFM1 a metabolite of AFB1 found in milk (Prandini et al., 2007).

In addition to the health concerns, aflatoxins can restrict African trade by reducing the commercial value of contaminated crops (Zain E. Mohamed, 2010). For example, it was estimated that tightening European regulations would further reduce African groundnut exports by USD670 million annually. While Africa contributed more than 90% of the supply to international market for peanuts during the 1960s, the implementation of strict aflatoxins regulations by EU and other countries have brought down the contribution to less than 5% (Xiong & Beghin,

Rwanda has put in place programs of crop intensification, particularly cereals to ensure the achievement of food security and poverty alleviation. On the other hand, maize provides an excellent substrate for toxigenic mold growth responsible of aflatoxin production. The maize is a leading food crop in Rwanda, accounting for 60 percent of cereals produced in the country. The production of this important staple in Rwanda has risen steadily since 2005 with over 500,000 tons of grain produced in 2011 (NISR, 2012). While there is lack of data on aflatoxins in Rwanda, we note that in the sub-region, where data are available, as in Kenya (Owaga et al.,2011), Tanzania (Rushunju et al., 2013) and Uganda (Ismail et al., 2003), aflatoxins pose a serious problem to the public health (Kang’ethe EK and Lang’a KA, 2009; Johnni H. Daniel et al., 2011). In 2005, aflatoxicosis has been observed in Kenya with 317 cases of acute hepatic failure in eastern Kenya while 125 cases died of illness after consuming maize contaminated with aflatoxins (Lauren Lewis et al., 2005). Recently, I conducted research in Bioscience in Eastern and Central Africa – International Livestock Research Institute (BecA-ILRI) in Nairobi (Kenya) where 93.4 percent of samples collected in main retails markets of Kigali were found to be above the European Union (EU) safe limits of 2 parts per billion (ppb) and 100 percent of animal feed samples contained more than 100 ppb set by US Food Drug and Administration (FDA) (Nishimwe et al., article in preparation). The absence of published data on the prevalence of aflatoxins in Rwanda raises the possibility of underestimating the present risk, and missing opportunities to reduce the risk of aflatoxin contamination. It also places a constraint on design of policies to control contamination and limits the growth of commercial markets and trade in maize from the country.

During this fellowship, I am expecting to be trained with advanced techniques in aflatoxin detection and prevention under a mentor in the U.S. In return, with the background I have in toxicology and food safety, I will implement these skills in my University and contribute to the food security and safety in Rwanda.

The agriculture is the cornerstone of the Rwandan economy with a third of national GDP. The aflatoxin contamination of crops requires a development and research policy. The outcomes from the research should be translate into practical ways which can bridge the gap between research and the development of safe food and feed and policy; at the end of the day contributing to the development of Rwanda. Through the Borlaug fellowship, more skills in aflatoxins detection and prevention will be gained. The implementation of those skills will contribute to the aflatoxin reduction in crop. By reducing the aflatoxin level in crops, not only do we increase their added value to international markets but also the population consumes safe crops without aflatoxins.

Research Action Plan

Week 1 - 2: Installation and formalizing the documents and familiarizing with laboratory facilities

Week 3-7: Introduction to the aflatoxin analysis techniques (ELISA, fluorometry, HPLC, LC-MS/MS)

Week 8-11: Introduction to fungi characterization (culture media, PCR, Sequencing)

Week 12: report redaction

Fellow #6 (Male): Rwanda; Identification and Characterization Methods of Aspergillus flavus Strain; Aflatoxin Control

The goal of my research proposal is to study Identification (using morphological, molecular and chemical methods) of Aspergillus flavus strains, their ability to produce aflatoxins and control methods. My specific research objectives are: 1)to study methods used for fungal characterisation and related practical work, 2) to conduct research on aflatoxin control methods to determine their efficacy, and 3) to study methods for aflatoxin analysis in different samples

I have been working on an USAID funded project entitled “Mycotoxin contamination in Rwanda: quantifying the problem in maize and cassava in households and markets, and sensitization of targeted stakeholders based on a cost-benefit analysis". We worked in collaboration with other institutions such as Rwanda Standards Board, University of Rwanda and the International Institute of Tropical Agriculture with the following objectives: to quantify mycotoxin in maize and cassava in rural households and markets, to establish a prevalence database that can guide mycotoxin risk assessment and risk mapping activities in the country and hence strengthen standards and regulation mechanisms, to sensitize stakeholders in Rwanda about occurrence of aflatoxins, allowing aflatoxin mitigation strategies that are most cost-effective. I coordinated the data and sample (maize, cassava nad groundnuts) collection exercise from November, 2013. Samples were sent to Nigeria for microbial analysis and other were sent to the Center for Analytical Chem. [IFA-Tulln], Austria) for mycotoxin analysis. In May 2015, I organised a workshop to present the results to the partners and some recommendations were established for further studies and actions.

I wish to improve my knowledge regarding aflatoxins, fungi that produce these toxin and understand control methods that can be applied in Rwanda. My background as a food scientist and as a person who worked on mycotoxin project in my country, I am well equipped to achieve the goal of my proposal. My mentor in the US is certainly an expert with many years of experience in the area of mycotoxin and food safety, I hope that I will learn more from him to improve my skills and knowledge. The knowledge acquired from this training will benefit not only myself but also Rwanda by improving food safety and economic development. I will continue collaborating with my mentor after the completion of the training to guide me in my future work on the mitigation of aflatoxin in Rwanda.

Rwanda is a small, land-locked country with limited natural resources and a modest mining industry. The population has grown at a rate of 2.6% in the last ten years, reaching a total of 10.8 million and a population density of 416 in 2012, the highest in Africa. From a tragically-low starting point in 1994, Rwanda has achieved extraordinary results in two decades. Thanks to strong economic growth in the last 10 years, poverty has declined but it remains high in rural areas. The agriculture sector is the backbone of the Rwandan economy but it remains rudimentary. The government is investing a lot of resources to improve agricultural productivity by distributing improved seeds, fertilisers, and the required extension assistance. Priority crops have been identified and are grown intensively in agro-ecological zones where they perform well. Crops involved in the Crops Intensification Program

(CIP) include: maize, wheat, beans, cassava, banana and Irish potato. These efforts resulted into high yields and subsistence farming is being transformed into market oriented farming.

The adoption of export oriented economic growth will require the production of safe products (free from toxins) that are competitive on the national and international markets. Aflatoxin is the most potent mycotoxin as it may affect child development, cause cancer, suppress the immune system and death. The contamination of certain crops such as maize by aflatoxin producing fungi may start in the field. Pre-harvest grain contamination is aggravated when the crop is wounded by birds, mammals, insects or when exposed to drought stress. The amounts of aflatoxin produced at pre-harvest stage are lower compared to those in stored produce but may lead to negative economic consequences when the prevailing conditions in the field are favourable for fungal growth and toxin production. There is need to start the control of aflatoxin from the field by adopting good agricultural practices but also by improving postharvest practices such drying and storage to minimize all risks of contamination.The European Union and United States have set acceptable maximum limits for aflatoxins and other mycotoxins in order to protect their population, hence, countries envisaging to export their produce into those countries need to comply with their regulations. Aflatoxin is the most potent mycotoxin, my training will focus on aflatoxin control methods, understanding the aflatoxin producing fungi and methods used for aflatoxins analysis in different samples. My organisation (Rwanda Agriculture Board) encourages its employees to work closely with farmers; upon my return to Rwanda, I will try to involve them in my interventions and I hope skills and knowledge acquired from the 2016 Borlaug Fellowship Program will contribute to enhanced agricultural productivity, food security, food safety and economic growth in Rwanda.

Research Action Plan

The research outcomes:

- Methods used for fungal characterisation documented;

- The aflatoxin control methods documented for further analysis in Rwanda; - The best approaches/methods recommended for adoption;

- Methods used for aflatoxins analysis learnt and understood

- The research findings published as paper and/or leaflets.

Week 1: Introduction and orientation

Week 2: Development of the research proposal

Week 3: Development of the research proposal

Week 4: Presentation of the research proposal

Week 5: Introduction to methods used for fungal characterisation and practical work

Week 6: Introduction to methods used for fungal characterisation and practical work

Week 7: Introduction to aflatoxin control methods and practical work

Week 8: Introduction to aflatoxin control methods and practical work

Week 9: Analysis of aflatoxins in different samples

Week 10: Analysis of aflatoxins in different samples

Week 11: Report writing

Week 12: Presentation of the lessons learnt during the training

Fellow #7 (Female): Ghana; Improved Food Safety Testing for Bacteria in Food

The goal of my research is to determine whether there are any differences between the effectiveness of traditional methods and novel rapid methods for the detection of Salmonella and enumeration of Escherichia coli in different food types. The specific research objectives are to determine the effect of a food type on the effectiveness of a microbiological test method, and to determine the effectiveness of a particular microbiological test method in a particular food type.

A lot of research done in Ghana on street foods, which are highly patronized, have revealed that some of the street foods contain various microorganisms (pathogens and other bacteria) in high numbers which cause illnesses and sometimes death to the consumer. In Ghana, some of the most frequent causes of food-borne illnesses and death are the bacteria Salmonella and Escherichia coli. When foodborne illnesses occur, economic costs are huge and diverse. Costs are incurred for treatment and recuperation as well as investigation and documentation of the outbreak. In addition, a food business can collapse due to the loss of trust in the safety of its products besides legal costs. Furthermore, products from Ghana sometimes fail in quality checks during exports and therefore Ghana is not able to trade effectively with other developed nations. The need for reliable test methods and valid test results is crucial for the control and improvement of Food Safety in Ghana and also for economic development for Ghana through global trade.

Currently in Ghana, traditional methods are used for the detection and enumeration of microorganisms in food. However, these methods are time-consuming and may be insensitive in detecting some organisms. Now, there is a rise in the development of several novel and rapid methods for the enumeration and identification of micro-organisms in foods because rapid detection of pathogens and other microbiological contaminants in food is critical for ensuring the safety of consumers. Despite the advantages that these novel and rapid methods have over the traditional methods, assessment of rapid methods has revealed that their effectiveness depends on the type of food. My research will be a comparative study with different food matrices to determine the effectiveness of novel rapid methods versus traditional methods for the detection of Salmonella and enumeration of Escherichia coli in foods. Basically, my research will use both traditional and novel rapid methods for the detection of Salmonella in four different types of foods to compare the effectiveness of the two methods in detection of Salmonella in the different food types. In addition, my research will also use both traditional and novel rapid methods to enumerate Escherichia coli in four different food types to compare the effectiveness of the two methods in the enumeration of Escherichia coli in the different food types.

As the head of a microbiology testing laboratory, I would like to know more about rapid testing methods since my laboratory only uses traditional testing methods. If I am granted the fellowship, I hope to acquire new skills and knowledge in the use of novel rapid methods for the detection and enumeration of microorganisms in foods. Mentoring is an important aspect to career development and as such, it is my strongest belief that a mentor in the US will teach me new ways of doing things since he/she will know more about both traditional and novel rapid methods, their advantages as well as their limitations.

Ghana is positioning itself to be a competitor in the international food trade for more economic development. However, global food trade relies heavily on certificates of analysis which provide reliable test results. A Borlaug Fellowship will help me to acquire the needed skills to improve how I test foods for microorganisms to ensure that the results are reliable and acceptable worldwide. This will help Ghana to compete favorably in the global market for more economic gains.

Research Action Plan

Week 1: Arrival and orientation at Host Institution / Laboratory. Expected outcome is to get to know my host institution and the people I will be working with.

Week 2: Familiarisation with new equipment and laboratory protocols. Expected outcome is to get to know more about the host laboratory’s protocols and how equipment are operated in the laboratory.

Weeks 3 - 4: Use of both traditional and novel rapid methods to detect Salmonella and enumerate E. coli in a Poultry product. Expected outcome is to know which of the two methods is more effective in detection of Salmonella and enumeration of E. coli in a Poultry product.

Weeks 5 - 6: Use of both traditional and novel rapid methods to detect Salmonella and enumerate E. coli in a Dairy product. Expected outcome is to know which of the two methods is more effective in detection of Salmonella and enumeration of E. coli in a Dairy product.

Weeks 7 - 8: Use of both traditional and novel rapid methods to detect Salmonella and enumerate E. coli in a Fish product. Expected outcome is to know which of the two methods is more effective in detection of Salmonella and enumeration of E. coli in a Fish product.

Weeks 9 - 10: Use of both traditional and novel rapid methods to detect Salmonella and enumerate E. coli in a Cereal product . Expected outcome is to know which of the two methods is more effective in detection of Salmonella and enumeration of E. coli in a Cereal product.

Weeks 11 - 12: Report writing and submission. Expected outcome is to have a complete report of the research I have conducted at the Host Institute/laboratory.

Week 12: Departure to home country.

Fellow #8 (Female): Ghana; Pesticide Residue Testing on Consumer Food

The aim of the research is to assess the safety of vegetables on the Ghanaian open market with respect to the levels of pesticide residues. The main objectives are; a) investigate the levels of pesticide residue in the vegetables using the gas chromatography (GC) and or gas chromatography – mass spectrophotometer (GC-MS), and b) Evaluate the effect of household processes such as washing, peeling, cooking etc on reduction of pesticide residue.

Pesticides are deliberately released into the environment to control insects, weeds, and plant diseases that interfere with maximum plant growth, development, yields and marketability of crops, thereby ensuring sustainability of food production and availability of food all year round. Pesticide residue refers to the chemicals that are left on food crop after spraying. In Ghana, pesticide use has increased overtime and is particularly pronounced in the production of high value cash crops and vegetables. Vegetables contain valuable food ingredients, which can be successfully utilized to build up and repair the body. Most of Ghana’s vegetables are exported to Europe and these vegetables are analysed for pesticide residue to ensure they comply with EU standards before export. The problems are that; vegetables sold on the open Ghanaian open market are not assessed for pesticide residue and these vegetables are irrigated with untreated wastewater from the urban drains. These activities make the vegetable unwholesome and unhealthy since these vegetables may contain residues and pathogens above the WHO threshold. Furthermore some exporters, in their bid to meet increased demand on their EU market may add produce from the open market, whose source of irrigation may be suspect. This has cost Ghana a lot of foreign exchange losses and even sanction on the exportation of vegetables. To be able to solve these problem my institution, the Water Research Institute is interested in monitoring pesticide residue in vegetables on our local market. The institute has gas chromatography (GC) and or gas chromatography – mass spectrophotometer (GC-MS) which it uses for these analysis. To ensure the results and outcome of monitoring meet international standards one need to get some training from experts in the field. This is my reason for applying for this fellowship.

I hope to learn how to use the GC and GC-MS correctly to help me in my day to day research activities in my home country. I am a research scientist with the organic laboratory of the environmental chemistry, sanitation and engineering division of the CSIR Water Research Institute. Currently I have experience in basic techniques in operation and maintenance GC, GC-MS and High Performance Liquid Chromatography (HPLC). My research interest is to analyse residues in the environment, such as pesticide residues, polycyclic aromatic hydrocarbons (PAHs), Polychlorinated Biphenyls, Total Petroleum Hydrocarbons and Benzene, Toluene, Ethylbenzene and Xylene (BTEX). Working with a mentor will help improve my expertise.

The knowledge gained from the fellowship will help me in the monitoring of vegetable from the market and also teach vegetable farmers on how to improve their knowledge on pesticide application in order to reduce residue levels. Vegetables are among the export commodities in Ghana and also an important component in the dietary requirement of the Ghanaian populace. Quality Pesticide residue analysis will help to increase the export viability of Ghanaian

vegetables due to food safety guaranteed. This will in turn increase the Country’s foreign exchange earnings and boost the vegetable production thereby increasing economic growth.

Research Action Plan

Week 1 Orientation

Week 2 Meeting with my mentor and discussing the right way of handling pesticide and pesticide residue analysis and selecting sampling

Week 3 Hands-on on how to use the GC, GC-MS and other instrument laboratory that I may use for my project.

Week 4 Standard preparation, running and plotting of calibration curves.

Week 5 Sampling techniques use by the host laboratory and their extraction methods

Week 6 Going to the selected sampling sites, doing the actual sampling and analysis.

Week 7-8 Identification of peaks and data analysis.

Week 9-10 Report writing

Week 11 Discussions.

Week 12 Closing ceremony.