The Department of Agriculture (USDA) – Foreign Agricultural Service (FAS)
Office of Capacity Building and Development

Notice of Funding Opportunity (NOFO)
Borlaug Fellowship Program

A. Program Description

Program Overview, Objectives, and Priorities

The Borlaug International Agricultural Science and Technology Fellowship Program (Borlaug Fellowship Program) advances USDA's agricultural research goals of promoting collaborative programs among agricultural professionals of eligible countries, agricultural professionals of the United States, the international agricultural research system, and United States entities conducting research by providing fellowships to individuals from eligible countries who specialize or have experience in agricultural education, research, extension, or other related fields. Fellowships promote food security and economic growth in eligible countries by educating a new generation of agricultural scientists, increasing scientific knowledge and collaborative research to improve agricultural productivity, and extending that knowledge to users and intermediaries in the marketplace. The collaborative nature of the training and research programs not only benefits the Fellow, his or her home institution, and partner country; the U.S. host institution, its professors, researchers, and students; and the global agricultural sector by improving agricultural productivity, systems, and processes in partnering nations through the transfer of new science and agricultural technologies.

USDA will identify Borlaug Fellows based on country-specific topics of importance to international, agricultural trade. USDA then places Fellows with U.S. research institutions for 10-12 week, intensive programs. These programs are expected to contribute to the strategic goals and objectives of the fellow and those institutions through a hands-on experience in a "real-world" agricultural research scenario, providing opportunity for application of research agendas where they can have a direct impact on food security and economic growth in an emerging economy. It is hoped that host institutions will share the knowledge gained through the program in their classroom and extension work with their faculty, students, extension officers, and constituents; and that they will continue to maintain professional contacts with the fellows after their departure from the United States.

Borlaug fellows may be identified in any of the topics listed below:

(A) Risk perception, assessment and management of food enzymes
(B) Low Acrylamide Potential (LAP) in GM Potatoes: 1. Use of CRISPR-Cas9 technology to reduce Acrylamide in GM Potatoes 2. U.S. risk assessment and approval process for GMOs
(C) Biological control agents of plant pest tetranychoid mites, to determine the peculiarities of their distribution and make damage assessment

PLACE OF PERFORMANCE

- The applicant is expected to host fellows at a research facility on their campus in the United States.
- The mentor is expected to make a reciprocal visit of up to two weeks to the fellow's home institution, which may be in a developing country.

EXPECTATIONS:

(1) 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.

(2) 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.

- 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.

(3) Mentor Follow-up Visit

- The mentor visit is a required component of the Borlaug Fellowship Program.
- 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 mentor's travel information must be provided for emergency contact purposes and country clearance (if required by the cognizant 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 feasible. USDA/FAS can assist with coordination prior to the trip.

(4) 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.
- Fellows, including those already in possession of another valid U.S. visa, must still obtain a J-1 visa to participate in the program. Fellows will be refused entry if they arrive in the United States without the appropriate category of visa.

(5) 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.

(6) 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 may not exceed current GSA per diem rates.
- 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.

(7) Emergency Health Insurance

- The host institution will purchase emergency health insurance for the Fellow for the duration of stay, as required for all J-1 Visa holders (22 CFR 62.14).
- 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.

(8) 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. to comply with U.S. Department of Homeland Security requirements
- 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.

(9) 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 as applicable to the Fellow's training program.
- The host institution will ensure the Fellow submits an interim and final report (2-3 pages each) to USDA/FAS before the Fellow leaves the United States.

(10) 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, such as:
  - Explanation and demonstration of local bus/transportation options
  - Explanation of cultural and legal expectations
- USDA will provide a welcome and orientation packet for mentors

Issued By

Foreign Agricultural Service, Office of Capacity Building & Development, Trade & Scientific Exchanges Division, Scientific Exchanges Branch

Catalog of Federal Domestic Assistance (CFDA) Number and Title

10.777
Norman E. Borlaug International Science and Technology Fellowship Program

Notice of Funding Opportunity Title

Borlaug Fellowship Program

NOFO Numbers

USDA-FAS-10777-0700-10.-18-0006; Fellow # 4 Turkey
USDA-FAS-10777-0700-10.-18-0007; Fellow # 3 Turkey
USDA-FAS-10777-0700-10.-18-0008; Fellow # 1 Georgia

Authorizing Authority for Program

The legislative authority for the Borlaug Fellowship Program is provided in Sec. 7139 of the Food, Conservation, and Energy Act of 2008 (PL 110-234), as incorporated in to the National Agricultural Research, Extension, and Teaching Policy Act of 1977, as amended.

Appropriation Authority for Program

Consolidated Appropriations Act, 2017 (PL 115-31)

Program Type

New

B. Federal Award Information

Award Amounts, Important Dates, and Extensions

Available Funding for the NOFO: Each award (for one fellow) is up to $50,000.

Projected number of Awards: 3 per fiscal year (in total)

Number of Project Budget Periods: 1

Projected First Budget Period: N/A

Projected Period of Performance Start Date(s): Subject to the availability of implementer and Fellows.

Projected Period of Performance End Date(s): 18 months after the start date

Extensions are allowable, please see Section H. Additional Information to see how to requests one should the need arise.

Pre-Award costs: Not Allowable

Cost Share or Match requirements: A cost match or cost share is not required.

Funding Instrument

USDA will enter into a cost reimbursable agreement under 7 USC § 3319a with selected universities.

C. Eligibility Information

Eligible Applicants

Proposals may be received from U.S. State Cooperative Institutions or other colleges and universities, including minority serving institutions (MSIs).

A single mentor may not host two fellows simultaneously. Both the PI and mentor must hold positions at an eligible U.S. institution.

Eligibility Criteria

All applicants must have an active registration in the SAM database at www.sam.gov – pending or expired registrants are not eligible. This requirement must be met by the

closing date of the announcement and will not be waived. Please contact the program officer listed if you have questions about this requirement.

In addition to obtaining a DUNS number and registering in SAM, you must also obtain Level 2 eAuthentication to apply for this funding opportunity in ezFedGrants (eFG). You must submit an online form requesting access. Normally you will receive an email within 24 hours of your submission, if your request is approved. After this occurs, you will need to schedule an appointment with an LRA. Once you meet with the LRA, your Level 2 eAuthentication should be granted within 2 to 3 days after that meeting. See Section D of this NOFO for detailed information.

Maintenance of Effort (MOE)

MOE is not allowable.

D. Application and Submission Information

Key Dates and Times

Application Start Date:	05/21/2018
ezFedGrants Posting Date:	05/21/2018
Application Submission Deadline:	06/18/2018 at 11:59PM EST
Anticipated Funding Selection Date:	Approximately 2-3 weeks after the submission deadline, subject to the availability of funding
Anticipated Award Date:	Approximately 2-3 weeks after selection, subject to the availability of funding

Address to Request Application Package

This NOFO represents the full application information.

Applications will be processed through the ezFedGrants portal at https://grants.fms.usda.gov – prospective applicants are encouraged to register for this portal. Applicants that are unable to access the ezFedGrants portal should contact the program manager for alternative submission instructions. Note that if selected, registration is a requirement of performance.

Content and Form of Application Submission

Institutions must be able to host multiple groups over the period of performance and should submit a proposal following the guidelines below:

- Required forms and certifications, including:
  - SF-424 version 2.1, with an OMB Expiration Date of 10/31/2019
  - SF-424A version 1.0, revised July 1997. This should be accompanied by a detailed budget worksheet and a detailed budget narrative (NOTE: A budget narrative must be provided). All line 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. An example budget narrative is included in the appendix, but is not required.
  - AD-3030, revised February 2016
  - AD-3031, revised February 2016
- 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
- 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.

The SF-424 and SF-424 A can be completed within the ezFedGrants platform. However, the other required forms must be downloaded from the Forms sections on Grants.gov. The Certification regarding Lobbying and the Grants and Agreement Coversheet will be sent to you along with this NOFO.

Unique Entity Identifier and System for Award Management (SAM)
The link below provides information on 2 CFR §25.110. Please read.

https://www.ecfr.gov/cgi-bin/retrieveECFR?gp=1&SID=7a45f973880240465cd255471f1380ef&ty=HTML&h=L&mc=true&n=pt2.1.25&r=PART

FAS is using ezFedGrants to post NOFO's and issue agreements, which is an electronic grants management system. Applicant(s) with electronic access are to submit their applications electronically through:

https://grants.fms.usda.gov

Before you can apply, you must have a DUNS number, be registered in SAM, and have access to the ezFedGrants website).

Applicants are encouraged to register early. Due to recent changes in the SAM platform, the registration process can take 6-8 weeks to be completed. Therefore, registration should be done in sufficient time to ensure it does not impact your ability to meet required submission deadlines.

DUNS number. Instructions for obtaining a DUNS number can be found at the following website: http://www.dnb.com/duns-number.html
The DUNS number must be included in the data entry field labeled "Organizational DUNS" on the Standard Forms (SF)-424 forms submitted as part of this application.

System for Award Management. In addition to having a DUNS number, applicants applying electronically through ezFedGrants must register with SAM. Step-by-step instructions for registering with SAM can be found here:

www.sam.gov

Failure to register with SAM will result in your application being rejected during the submissions process.

ezFedGrants System Access and Electronic Signature

Level 2 eAuthentication. The next step in the registration process is to obtain a Level 2 eAuthentication account that will allow access to the ezFedGrants system. Instructions for getting a Level 2 eAuthentication account can be obtained by emailing ezFedGrants@cfo.usda.gov.

You may also request Level 2 eAuthentication online at:
https://www.eauth.usda.gov/MainPages/index.aspx

If you experience any issues with self-registration or have eAuthentication-related questions, please contact the eAuthenticationHelpDesk for assistance:
By email to eAuthHelpDesk@ftc.usda.gov

Requesting a role in ezFedGrants.
After obtaining eAuthentication, users will need a role in the system. Descriptions of the roles available and instructions on how to request a role can be obtained by emailing ezFedGrants@cfo.usda.gov

You may also go into the link below for instructions on requesting eFG access. The document is called "External Portal Access Request Submission".

https://www2.nfc.usda.gov/FSS/Training/Online/ezFedGrants/access_user_roles.php

Electronic Signature. Applications submitted through ezFedGrants constitute a submission as electronically signed applications. When you submit the application through ezFedGrants, the name of your Signatory Official on file will be inserted into the signature line of the application.

If you experience difficulties accessing information or have any questions please email the Helpdesk at ezFedGrants@cfo.usda.gov.

The Federal awarding agency may not make a Federal award to an applicant until the applicant has complied with all applicable DUNS and SAM requirements and, if an applicant has not fully complied with the requirements by the time the Federal awarding agency is ready to make a Federal award, the Federal awarding agency may determine that the applicant is not qualified to receive a Federal award and use that determination as a basis for making a Federal award to another applicant.

Intergovernmental Review

This program is not subject to E.O. 12372.

Funding Restrictions

This will be a cost reimbursable agreement issued under 7 USC § 3319a. University indirect costs for cost reimbursable agreements are limited to 10% of modified total direct costs (MTDC).

Allowable Costs:

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 (7 USC 3319a).

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 standard or the Closer Connection Exception. Tax treaties might also exist between the U.S. and the Fellow's home country. The only requirement is to complete IRS Form 8843 (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; any stipend or remuneration for the fellow, other than ordinary allowances for meals and supplies; capital improvements; thank

you gifts, and other expenses not directly related to the project are not allowed. “Please note, 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 standard or the Closer Connection Exception. The only requirement is to complete IRS Form 8843 (Sections 1 and 2). These funds are for federal financial assistance; as such no taxes should be withheld from Borlaug Fellows since they are exempt.”

Management and Administration (M&A) Costs:

M&A costs are not allowable.

Indirect Facilities & Administrative (F&A) Costs.

By statute, indirect costs for cost reimbursable agreements cannot exceed 10% of direct costs.

Other Submission Requirements

All applications must be submitted electronically as indicated above.

E. Application Review Information

Application Evaluation Criteria

Prior to making a Federal award, the Federal awarding agency is required by 31 U.S.C. 3321 and 41 U.S.C. 2313 to review information available through any OMB-designated repositories of government-wide eligibility qualification or financial integrity information. Therefore application evaluation criteria may include the following risk based considerations of the applicant: (1) financial stability; (2) quality of management systems and ability to meet management standards; (3) history of performance in managing federal award; (4) reports and findings from audits; and (5) ability to effectively implement statutory, regulatory, or other requirements.

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 number of Fellows and length of the program. The budget should include appropriate cost savings where available and narrative should accompany each line item. Host is strongly encouraged to use the Budget Worksheet provided in this NOFO.

Review and Selection Process

In all cases, the Program Manager will ensure application is submitted on time as specified in this announcement. Also, the Program Manager will ensure the organization is capable of delivering the program/activities as described in the announcement based on the applicant's project narrative.

Qualified applications will be referred to a panel of 2-3 program staff and/or technical experts, and adjudicated among the criteria described above. In general, the highest-rated proposal will be selected, however, FAS may occasionally select out of score order for policy reasons, such as geographic distribution, incorporation of minority-serving institutions, past experience, etc.

Confidentiality and Conflict of Interest

Technical and cost proposals submitted under this funding opportunity will be protected from unauthorized disclosure in accordance with applicable laws and regulations. FAS may use one or more support contractors in the logistical processing of proposals. However, funding recommendations and final award decisions are solely the responsibility of FAS personnel.

FAS screens all technical reviewers for potential conflicts of interest. To determine possible conflicts of interest, FAS requires potential reviewers to complete and sign conflicts of interest and nondisclosure forms. FAS will keep the names of submitting institutions and individuals as well as the substance of the applications confidential except to reviewers and FAS staff involved in the award process. FAS will destroy any unsuccessful applications after three years following the funding decision.

F. Federal Award Administration Information

Notice of Award

Notice of award will be given to the institution via email. This email is not an authorization to begin performance. The notice of Federal award signed by the grants officer (or equivalent) is the authorizing document through electronic means. It should also indicate if there are any pass-through obligations that successful applicants are required to meet upon receiving award funds, including specific timeline requirements.

Administrative and National Policy Requirements

All successful applicants for all grant and cooperative agreements are required to comply with Standard Administrative Terms and Conditions for Overseas Federal Assistance Awards, which can be found on the FAS website:

https://www.fas.usda.gov/grants/general_terms_and_conditions/default.asp

The applicable Standard Administrative Terms and Conditions will be for the last year specified at that URL, unless the application is to continue an award first awarded in an earlier year. In that event, the terms and conditions that apply will be those in effect for the year in which the award was originally made.

Before accepting the award the Recipient should carefully read the award package for instructions on administering the grant award and the terms and conditions associated with responsibilities under Federal Awards. Recipients must accept all conditions in this NOFO as well as any Special Terms and Conditions in the Notice of Award to receive an award under this program.

Reporting

Federal Financial Reporting Requirements. The Federal Financial Reporting Form (FFR), as known as the SF-425, must be submitted semi-annually (the reporting period ending every 6 months after the start date of the agreement) within 30 days of the end of the reporting period, with the final FFR submitted within 90 days of the end of the agreement. The required form is available online at:

https://www.grants.gov/web/grants/forms/post-award-reporting-forms.html#sortby=1

At the top of the website select **FORMS**, and from the drop down box select **POST AWARD REPORTING FORMS**.

Program Performance Reporting Requirements.

Performance Progress Reporting must be submitted semi-annually (the reporting period ending every 6 months after the start date of the agreement) within 30 days of the end of the reporting period, with the final PPR submitted within 90 days of the end of the agreement, and should include details the activities undertaken and progress made during the reporting period.

Program Performance Requirements.

- Ensure that each Fellow completes the Borlaug Fellowship Program Evaluation.
- A brief Fellow final report before the fellow departs the U.S. (Template will be provided).

- The Principal Investigator or Mentor will submit a final report to USDA/FAS within 30 days after the Mentor visit. (Template will be provided).
- The Principal Investigator or Mentor will submit semi-annual progress reports.
- 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/claim cannot be paid if a progress report is past due, and will not be paid until the required report has been received.

Close Out Reporting Requirements.

Within 90 days after the end of the period of performance, or after an amendment has been issued to close out a grant, whichever comes first, recipients must submit a final FFR and final progress report detailing all accomplishments and a qualitative summary of the impact of those accomplishments throughout the period of performance.

After these reports have been reviewed and approved by OCBD, a close-out notice will be completed to close out the grant. The notice will indicate the period of performance as closed, list any remaining funds that will be de-obligated, and address the requirement of maintaining the grant records for three years from the date of the final FFR.

The recipient is responsible for returning any funds that have been drawn down but remain as unliquidated on recipient financial records.

G. Awarding Agency Contact Information

Contact and Resource Information

For all general questions, contact:
Tim Sheehan, Branch Chief
Hours of operation: 9:00 AM – 4:30 PM Eastern Standard Time
Telephone: (202) 690-1940
E-mail address: BorlaugProposals@fas.usda.gov
1400 Independence Ave, SW #3226-South
Washington, DC 20250-1031

H. Additional Information

1. Extensions

Extensions to this program are allowed.

Applicants may request a no-cost extension in order to complete all project activities. The request must be submitted 60 days prior to the expiration of the performance period. Requests for extensions are subject to approval by FAS.

2. Prior Approval

The Recipient shall not, without the prior written approval of the FAS Program Manager, request reimbursement, incur costs or obligate funds for any purpose pertaining to the operation of the project, program, or activities prior to the approved Budget Period/Performance Period.

3. Budget Revisions

a. Transfers of funds between direct cost categories in the approved budget when such cumulative transfers among those direct cost categories exceed ten percent of the total budget approved in this Award require prior written approval by the FAS Program Manager.

b. The Recipient shall obtain prior written approval from the FAS Program Manager for any budget revision that would result in the need for additional resources/funds.

c. The Recipient is not authorized at any time to transfer amounts budgeted for direct costs to the indirect costs line item or vice versa, without prior written approval of the FAS Program Manager.

Appendix A

Borlaug Fellowship Program for Asia and Latin America

Index of Fellowships

Fellow Reference Number	Country	Gender	Fellowship Length (weeks)	Research Focus
4 NOFO: USDA-FAS-10777-0700-10.-18-0006	Turkey	Female	12	Risk perception, assessment and management of food enzymes
3 NOFO: USDA-FAS-10777-0700-10.-18-0007	Turkey	Male	12	Low Acrylamide Potential (LAP) in GM Potatoes: 1. Use of CRISPR-Cas9 technology to reduce Acrylamide in GM Potatoes 2. U.S. risk assessment and approval process for GMOs
1 NOFO: USDA-FAS-10777-0700-10.-18-0008	Georgia	Female	12	Biological control agents of plant pest tetranychoid mites, to determine the peculiarities of their distribution and make damage assessment

Individual Proposals and Action Plans

Fellow # 4 (NOFO#: USDA-FAS-10777-0700-10.-18-0006): **Turkey, Associate Professor at Karamanoglu Mehmetbey University, Food Engineering department. Scientific background is mainly in enzyme science and technology, especially food enzymes. BS, MSc and PhD in Chemical engineering. Got training in food biotechnology and biosafety. Has been research fellow for 6 months at the University of Leeds, UK. Aimed to be a member of soon to be established Turkish "Food Additives Commission".**

Research Proposal

The study of risk perception, assessment and management of food enzymes

1. The goal(s) of the research proposal:-

As the enzyme usage in food industry is raising day by day, the importance of risk perception and safety assessment for food enzymes is also increasing. This is one the main issues of food safety authorities of Europe and in particular, Turkey. Therefore, my purpose is to build a strong background about safety

issues of food enzymes. My scientific studies (MSc thesis, PhD thesis and several research projects) are based on enzyme science and technology and I am keen to enlarge my knowledge in enzyme field.

2. Specific objectives to achieve the goal:-

Based on my MSc and PhD studies, I have a strong background on wild-type plant and microorganism-based enzymes at lab scale. Therefore the first goal of my proposal is to enlarge my theoretical and practical capabilities in enzyme production from genetically modified organisms; plants and microorganisms. At second stage of the fellowship, I expect to conduct risk perception and assessment studies on food enzymes (animal tissues, plant and microorganism-based). Finally, risk management studies on food enzymes will be completed.

I also expect to visit (food) enzyme producer companies. The goal of these visits is to observe industrial applications of GM organisms for enzyme production both at lab scale and large scale, how they are handled in terms of risk assessment and management before and after commercialization.

In addition, with the completion of the fellowship program, I expect be able to teach a new course on risk assessment on food enzymes at graduate level in Karamanoglu Mehmetbey University. It might also be possible that I become a member of Turkish Ministry of Food Agriculture and Livestock Committees and Turkish Biosafety Council, and EFSA.

3. Background information about the research:-

Enzymes are proteins that act as catalysts and they are present in all living things. When one substance needs to be transformed into another, nature uses enzymes to speed up the process. For example, they aid digestion, metabolize and eliminate waste in humans and animals, and play a crucial role in muscle contraction. Enzymes are very efficient catalysts for biochemical reactions. They speed up reactions by providing an alternative reaction pathway of lower activation energy. Enzymes have many different industrial applications: their use in food production, food processing and preservation, washing powders, textile manufacture, leather industry, paper industry, medical applications, and improvement of environment and in scientific research. Among various enzymes produced at large scale are proteases (subtilisin, rennet), hydrolases (pectinase, lipase, lactase), isomerases (glucose isomerase), and oxidases (glucose oxidase). These enzymes are produced using overproducing strains of certain organisms. As per recent estimates, a great majority of industrially produced enzymes are useful in processes related to foods (45%), detergents (35%), textiles (10%) and leather (3%).

Commercial enzymes can be produced from a wide range of biological sources. In the early days, animal and plant sources largely contributed to enzymes. Even now, for certain enzymes they are the major sources. Animal organs and tissues are very good sources for enzymes such as lipases, esterases and proteases. For example, the enzyme lysozyme is mostly obtained from hen eggs. Some plants are excellent sources for certain enzymes-papain (papaya), bromelain (pineapple). However, there are several drawbacks associated with the manufacture of enzymes from animal and plant sources. The quantities are limited and there is a wide variation in their distribution. The most important limitations are the difficulties in isolating, purifying the enzymes, and the cost factor. For these reasons, microbial production of enzymes is preferred.

Microbial enzymes have been utilized for many centuries without knowing them fully. The first enzyme produced industrially was taka-diastase (a fungal amylase) in 1896, in United States. It was used as a

pharmaceutical agent to cure digestive disorders. Microorganisms are the most significant and convenient sources of commercial enzymes. They can be made to produce abundant quantities of enzymes under suitable growth conditions. Microorganisms can be cultivated by using inexpensive media and production can take place in a short period. In addition, it is easy to manipulate microorganisms in genetic engineering techniques to increase the production of desired enzymes.

Genetic changes using recombinant DNA technology can easily be done on microbial cells. Recovery, isolation and purification processes are easy with microbial enzymes than that with animal or plant sources. In fact, most enzymes of industrial applications have been successfully produced by micro-organisms. At present, great majority (80%) of them are from microbial sources. Various fungi, bacteria and yeasts are employed for this purpose.

One of the main industrial fields where enzymes play a key role is the food industry. In fact, enzymes have been used unknowingly in food production, e.g. dough making, for centuries. They can be obtained by extraction from plants or animals or by fermentation from micro-organisms. They are usually purified but may contain varying traces of the other naturally occurring constituents of these three sources. They are normally added to perform a technological function in the manufacture, processing, preparation and treatment of foods. Examples include enzymes used to break down the structure of fruit so that manufacturers can extract more juice, or to convert starch into sugar in alcohol production.

Enzyme technology broadly involves production, isolation, purification and use of enzymes (in soluble or immobilized form) for the ultimate benefit of humankind. In addition, recombinant DNA technology and protein engineering involved in the production of more efficient and useful enzymes are also a part of enzyme technology. Historically enzymes are considered to be non-toxic and not of safety concern for consumers since they are naturally present in food. However, food enzymes produced industrially by extraction from plant and animal tissues, or by fermentation of microorganisms, are assessed for safety.

The importance of risk perception and safety assessment for food enzymes is rising every day because the use of these enzymes is rapidly increasing. According to market reports, global market for industrial enzymes was estimated about $4.2 billion in 2014 and expected to develop at a compound annual growth rate of approximately 7% over the period from 2015 to 2020 to reach nearly $6.2 billion.

EFSA (European Food Safety Authority) is responsible for scientific risk assessment of food in Europe. EFSA has stated that potential human exposure to the food enzyme and to any other constituent or by product of concern should be assessed considering all proposed uses. The risk assessment of food enzymes is carried out by EFSA's Panel on Food Contact Materials, Enzymes, Flavorings and Processing Aids. In parallel to this panel, Turkish Ministry of Food Agriculture and Livestock has announced an open call on 27 September, 2017 regarding the establishment of "Food Additives Commission". The Commission is foreseen to carry out the risk assessment studies based on independent, impartial, transparent and scientific principles for the products subject to authorization procedure, to establish scientific opinion on matters related to food additive, food flavor, food enzymes, processing aids and other substances added to food for technological purposes.

In summary, as the enzyme usage in food industry is raising day by day, the importance of risk perception and safety assessment for food enzymes is also increasing. This is one the main issues of food safety authorities of Europe and in particular, Turkey. My purpose is to build a strong background about safety issues of food enzymes. My scientific studies (MSc thesis, PhD thesis and several research projects) are based on enzyme science and technology and I am keen to enlarge my knowledge in

enzyme field. Therefore, my proposed research topic is "Risk Perception, Assessment and Management of Food Enzymes". By the help of this fellowship, I may be a part of EFSA panels, Turkish Ministry of Food Agriculture and Livestock committee and Turkish Biosafety Committee in the future. By this way, I may be able to make a contribution to food safety efforts by creating independent scientific advice on potential effects of food enzymes to the food chain of Europe and Turkey. It may be also possible that policy makers use this advice as a basis for decision making to address food safety issues.

An important reason for applying for this program is that I have witnessed the success of the previous scholars of Borlaug Fellowship. I personally know Assoc. Prof. Dr. Remziye YILMAZ (Hacettepe University) and Assist. Prof. Dr. Ceren BAYRA; (Karamanoglu Mehmetbey University). I attended the "Food Biotechnology and Biosafety Workshop" held in early October, 2017 in Ankara and met people from Michigan State University. The workshop was very inspiring for me because I figured out that safety studies on GMOs are performed by previous scholars and food enzymes could be the next issue of this program. Therefore, I decided to apply for 2018 Borlaug Fellowship.

4. What to accomplish during the fellowship, how research interests and scientific background relate to the goals of the proposal and how will working with a mentor in the U.S. help to achieve the research goals?

My MSc thesis title is "Isolation, characterization and immobilization of polyphenol oxidases from mulberry (Morus alba) leaf tissues" which covers enzyme production from a waste plant source. The title of my PhD thesis is "Purification, characterization, crystallization and preliminary X-ray structure determination of Scytalidium thermophilum bifunctional catalase and identification of its catechol oxidase activity" which covers microbial enzyme production from a wild-type organism. I have a strong background on enzyme science and technology. Currently, I am a faculty member in Food Engineering Department. Therefore, food enzymes are in the focus of my research. I know that companies and mentor(s) from U.S. have big experience in this field and can help me to learn how to perform the risk assessment and risk management of these enzymes.

5. How will a Borlaug Fellowship contribute to enhanced agricultural productivity economic development, and/or food security in the country?

According to market reports, global market for industrial enzymes was estimated about $4.2 billion in 2014 and expected to develop at a compound annual growth rate of approximately 7% over the period from 2015 to 2020 to reach nearly $6.2 billion. Turkey’s annual enzyme export is about 100 million USD because the amount of enzyme production in our country is insufficient in compare to the need for the enzymes. Especially, enzymes are widely used in our country in food production and most of the imported enzymes are produced from GMOs. Therefore, it is important to know how to assess the risks of these enzymes and how to manage them. Borlaug Fellowship will help me to build a strong background in risk perception, assessment and management of food enzymes.

Turkish Ministry of Food Agriculture and Livestock has announced an open call on 27 September, 2017 regarding the establishment of "Food Additives Commission". The Commission is foreseen to carry out the risk assessment studies for the products subject to authorization procedure, to establish scientific opinion on matters related to food additive, food flavor, food enzymes, processing aids and other substances added to food for technological purposes. By the help of this fellowship program, I aim to make a contribution to Turkish food safety efforts.

Action plan for 12-week fellowship period

PART I

Weeks 1 and 2: Theoretical and practical training on enzymes from genetically modified (GM) plant and microbial sources + 1 technical visit to food enzyme producer company.

Goals: My MSc thesis title is "Isolation, characterization and immobilization of polyphenol oxidases from mulberry (Morus alba) leaf tissues" which covers enzyme production from a waste plant source. The title of my PhD thesis is "Purification, characterization, crystallization and preliminary X-ray structure determination of Scvtalidiumthermophilum bifunctional catalase and identification of its catechol oxidase activity" which covers microbial enzyme production from a wild-type organism. So, I have a strong background on wild-type plant and microorganism-based enzymes at lab scale. Therefore the goal of PART I is to enlarge my theoretical and practical capabilities in enzyme production from genetically modified organisms; plants and microorganisms.

In PART I, I also want to visit a (food) enzyme producer company, mainly GM facility. The goal of this visit is to observe industrial applications of GM organisms for enzyme production both at lab scale and large scale.

PART II

Weeks 3 to 6: Risk perception and assessment studies on food enzymes (animal tissues, plant and microorganism-based) + 1 technical visit to food enzyme producer company (DuPont, if possible)

Goals: A complete risk perception and assessment study on food enzymes will cover:

- Genetic modifications performed
- Manufacturing process
- Compositional and biochemical data
- Findings in the toxicological studies
- Conditions of use

The safety evaluation that apply to all enzyme preparations includes safety evaluation of the production organism, the enzyme component, side activities, the manufacturing process, the consideration of dietary exposure, its potential to cause an allergic reaction. Certain safety concerns that pertain to enzyme preparations derived from genetically modified microorganisms should also be addressed. The genetic material inserted into the genome of the production microorganism and the enzyme preparation should not contain antibiotic inactivating proteins at risky concentrations and no transformable DNA that could potentially contribute to the spread of antibiotic resistance. An enzyme preparation must also comply with the identity and purity specifications, which are established for each enzyme preparation on a case-by-case basis. Toxicological studies are usually performed using the concentrated enzyme prior to the addition of the formulation ingredients.

For the purpose of toxicological evaluation, enzyme preparations used in food processing can be grouped into five major classes:

1. Enzymes obtained from edible tissues of animals commonly used as foods
2. Enzymes derived from microorganisms that are traditionally accepted as constituents of foods or are normally used in preparation of foods
3. Enzymes derived from microorganisms that are less well known.

Safety assessments for enzymes belonging to classes 1-3 will be the same regardless of whether the enzyme is added directly to food or is used in an immobilized form. Separate situations should be considered with respect to the enzymes described in classes 4- 5.

With the completion of the risk perception and assessment studies on food enzymes iin PART II, I will have a strong background on the subject. I will be able to teach a new course on risk assessment on food enzymes at graduate level in Karamanoglu Mehmetbey University. In addition, I will have a potential to become a member of Turkish Ministry of Food Agriculture and Livestock Committees and Turkish biosafety council and EFSA

PART III

Weeks 7, 8, 9 and 10: Risk management studies on food enzymes

In PART II of the action plan, risk perception and assessment studies, which cover collecting and analyzing of existing research/data and providing scientific advice to risk managers, will be completed. Risk management, which is the process of weighing policy alternatives to accept, minimize or reduce assessed risks and to select and implement appropriate options, is about making decisions or setting legislation about food safety. The primary goal of the management of risks associated with food is to protect public health by controlling such risks as effectively as possible through the selection and implementation of appropriate measures.

There are four components of risk management frameworks:

1. Preliminary risk management activities
2. Evaluation of risk management options
3. Implementation of the risk management decision
4. Monitoring and review

In Europe, EFSA is responsible for scientific risk assessment of food and risk managers are European Commission, Member State Authorities and The European Parliament. In Turkey, Turkish Ministry of Food Agriculture and Livestock and Turkish Biosafety Council are responsible for food safety risk assessment and management activities.

With the completion of the risk management studies on food enzymes in PART III, I will have a strong background on the subject. I will have a potential to become a member of Turkish Ministry of Food Agriculture and Livestock Committees and Turkish Biosafety Council where I may contribute to risk management activities on food enzymes.

PART IV

Week 11& 12: Summing and discussing of the results; proposing the possible recommendations. And planning publishing articles jointly and discussing possible future collaboration.

Fellow # 3 (NOFO #: USDA-FAS-10777-0700-10.-18-0007): **Turkey, Associate Professor at Kastamonu University, Department of Genetics and Bioengineering. BA in biology, MSc and PhD in Molecular Biology and Genetics.**

Research Proposal

Evaluation of Low Acrylamide Potential (LAP) in GM Potatoes: 1. Use of CRISPR-Cas9 technology to reduce Acrylamide in GM Potatoes 2. U.S. risk assessment and approval process for GMOs

1. The goal(s) of the research proposal:-

To evaluate the Low Acrylamide Potential (LAP) GM Potatoes

2. Specific objectives to achieve the goal:-

The objectives of my research activity can be classified as 3 main parts.

A. Application of biotechnology in agriculture
B. To examine possible ways to overcome acrylamide problem via biotechnology
C. To understand technology behind LAP GM potatoes
D. To take an education about CRISPR-Cas9 technology and to examine possible usage of this technology for obtaining of LAP potatoes

Understanding of biotechnology policies and regulatory framework

E. To take training about biotechnology policies and regulatory framework in national and global context
F. To understand environmental, food and feed safety approaches in the context of biotechnology
G. To understand international laws and regulations related to biotechnology
H. To understand risk assessment related to LAP GM potatoes
I. To learn risk communication issues for biotech crops

Transferring skills and experience in my country

J. To transfer obtained skills and experience related with CRISPR-Cas9 technology and regulatory policies, regulatory framework, international laws and regulations of GM crops.
K. Preparation of postgraduate course associated with benefits versus risks of genetically modified plants, LAP GM potatoes and recent risk assessment regulations in USA and Turkey.
L. Organizing workshops, seminars, speeches on these issues. (The program will be covered the following topics:
M. Introduction to GMO risk assessment
N. Introduction to newly produced GM foods
O. Legal framework of GMO risk assessment process in United States, Europe and Turkey

P. Risk assessment process of the GMO viewpoint from molecular and toxicological aspects
Q. Risk communication applied to food and feed safety
R. The USA and Europe approaches of post market monitoring.

3. Background information about the research:-

3.1. Abstract

Acrylamide, a chemical that is probably carcinogenic in humans and has neurological and reproductive effects. It forms from a reaction between reducing sugars (e.g., glucose and fructose) and an amino acid (asparagine, Asn) during high-temperature cooking and processing of common foods. Food is the major source of acrylamide exposure for people in the general population. The major food sources of acrylamide are French fries and potato chips; crackers, bread, and cookies; breakfast cereals; canned black olives; prune juice; and coffee. Children consume nearly three times more acrylamide than adults on a per kg body weight basis.

Although they offer improved yields, enhanced nutritional value, longer shelf life, and resistance to drought, frost, or insect pests, all GMs should be appraised as case-by-case approach. In this proposal, I will try to indicate my biotechnological ideas to eliminate detrimental effect of acrylamide. For this purpose, I will firstly understand technology behind LAP GM potatoes. I have already known that RNAi gene silencing technology is used for production of LAP GM potatoes. However, I have some unspecified points in my mind. For example; how the researchers would determine genes which were responsible for production of low levels of asparagine and reducing sugars during development of LAP GM potatoes? Are there any alternative genes to reduce asparagine and reducing sugars levels in potato? Therefore, to find answer such questions, it would be better to figure out technology of LAP GM potatoes.

Secondly, it will be also aimed to take an education about CRISPR-Cas9 technology. This RNA guided genome editing technology has broadened the agricultural research area, bringing in new opportunities to develop novel plant varieties with deletion of detrimental traits or addition of significant characters. During the specified period of my fellowship program, I will try to learn details of the technology and search possible usage of CRISPR-Cas9 technology to develop new generation LAP potatoes. So, I will find an opportunity to see applications of biotechnology in agriculture and to perceive global overview of biotechnology.

The U.S. Department of Agriculture (USDA) and Food and Drug Administration (FDA) has already approved LAP GM potatoes which have been commercially produced and sold in markets. Through this fellowship program, I will also have a chance to evaluate and understand policy, laws, regulations, risk assessment, risk management, risk communication, environmental biosafety, biodiversity and food and feed safety issues for all GM products. The long-term objective of this proposal is to overcome detrimental effect of acrylamide problem using biotechnology approach such as RNAi and CRISPR-Cas9 technologies, possible application of CRISPR-Cas9 technology to produce new generation LAP potatoes, to transfer obtained skills and experience related with this novel genome editing technology in my country and to learn details of regulatory policies, regulatory framework, laws and regulations of GM products for international and US levels.

3.2. Introduction

Researchers at the Swedish National Food Administration and Stockholm University in the early 2000s reported acrylamide levels from a variety of fried and oven-baked foods and linked its formation to high cooking temperatures traditionally associated with certain carbohydrate-rich foods. Acrylamide forms primarily from a reaction between reducing sugars (e.g., glucose and fructose) and free Asn made naturally in foods, including potatoes, when carbohydrate-rich foods are heated at temperatures above 120 °C. Based on the results of toxicology studies in laboratory animals and potential neurotoxicity, regulatory authorities in the United States, the World Health Organization, and Canada have collectively expressed concerns about the negative impact of acrylamide on human health. Specifically, the U.S. Food and Drug Administration (FDA) Guidance for Industry on Acrylamide in Foods states that "reducing acrylamide levels in foods may mitigate potential human health risks from exposure to acrylamide." To generate low acrylamide potential (LAP) GM potatoes, conventional varieties were transformed with a plasmid designed to introduce improvements in potato characteristics such as reduced free asparagine. Potato plants with the desired traits were obtained through *Agrobacterium* mediated transformation with the pSIM1278 plasmid which comprises two expression cassettes inserted into a transformation plasmid. The first cassette uses gene silencing to reduce expression of the *asparagine synthetase-1* gene (*Asn1*) and the *polyphenol oxidase-5* gene (*Ppo5*). The second cassette is designed to reduce expression of the *starch associated* gene (*R1*) and the *Phosphorylase-L* gene (*PhL*). So, the pSIM1278 construct acts by effectively reducing synthesis of Asn, which contributes to reduced acrylamide levels in cooked potatoes. Actually, one of my research area is related with plant genetic transformation. I have worked on production of genetically modified plants to examine function of different genes associated with abiotic stress tolerance for many years. I received my M.Sc. and Ph.D. in 2005 and 2011 at Middle East Technical University (METU), respectively. My M.Sc. thesis was focused on 'Optimization of Regeneration and *Agrobacterium* Mediated Transformation of Sugar beet (*Beta vulgaris* L.)'. In that study, genetic transformation of the Turkish sugar beet variety was achieved using *Agrobacterium* method. In my Ph.D. thesis, I have focused on microarray techniques and gene expression analysis in plants. I have examined Nac type transcription factors genes under different abiotic stress conditions in Turkish wheat varieties. After graduation, I have established molecular biology, transcriptomics and bioinformatics research laboratories at the Kastamonu University in 2013. My current research activity is concentrated on discovery of new genes and gene families in plant genomes using bioinformatics methods, the analysis of expression of these genes by transcriptomic approaches under different stress conditions and lastly the cloning and functional analysis of these genes. Therefore, I have selected a special topic connected with Low Acrylamide Potential (LAP) GM Potatoes. LAP potatoes utilize RNAi gene silencing technology to regulate the expression of the genes responsible for production of lower levels of asparagine and reducing sugars, which decreases the potential formation of acrylamide. If I will be selected as Borlaug fellowship, I want to learn possible usage of CRISPR-Cas9 technology to obtain LAP potatoes. The CRISPR-Cas9 is a unique technology that enables geneticists to edit parts of the genome by removing, adding or altering sections of the DNA sequence. Like RNAi silencing, this new technology has also great potential for production of LAP potatoes. So, I want to take training and courses to understand this unique technique during my fellowship program. After, I will try to optimize and use this technology for my laboratory. I have been aware of difficulties of CRISPR-Cas9 and realized that it is very difficult to understand and use it in a limited fellowship program. However, I will find an opportunity to initiate this new technology in my laboratory.

In Turkey, there was a misunderstanding about GM plants and foods when looking from risk management and the risk communication perspectives. However, this situation has been rapidly changed after increase in perception of risk assessment strategy of GM crops. In 2013, The Turkish

Council of State has cancelled to import of two genetically modified corn varieties MON810 and MON810x88017. However, The Turkish Biosecurity Council had allowed the import and use as animal feed of 22 GM corn and soy varieties including these two GM crops. The Turkish Biosecurity Council has prepared detail risk assessment report for each individual GM crops in which comparison between GM crops and their conventional safe counterpart were examined in manner of scientific view. After this decision, the perception of public for GE crops has been dramatically changed. In this research opportunity, it is aimed to understand technology behind LAP GM potatoes, to search alternative ways for production of LAP potatoes, to take an education about CRISPR-Cas9 technology and to examine possible usage of this technology for obtaining of LAP potatoes. So, I will find a chance to see applications of biotechnology in agriculture and to perceive global overview of biotechnology. From the view of LAP potato, I will make a search for biotechnology policies and regulatory framework in USA and global context during program period. LAP potatoes have already been approved by The U.S. Department of Agriculture (USDA) and Food and Drug Administration (FDA) and found them to be just as safe and nutritious as other types of potatoes currently on the market. So, LAP potatoes will become a case study for me to understand policy, laws, regulations, risk assessment, risk management, risk communication, environmental biosafety, biodiversity and food and feed safety issues. Therefore, my proposal can provide me for understanding of healthy risk problems of acrylamide and overcoming of this potential threat with increase in awareness and usage of LAP potatoes. Moreover, I deeply believe that CRISPR-Cas9 technique will be used for production of LAP potatoes in future. Therefore, I want to train myself and will transfer obtained skills related with CRISPR-Cas9 technology in my country. Finally, I will obtain some information about regulatory policies, risk analysis, risk assessment and risk communication issues of biotechnology crops.

4. What to accomplish during the fellowship, how research interests and scientific background relate to the goals of the proposal and how will working with a mentor in the U.S. help to achieve the research goals?

This research opportunity will improve my understanding of GM products especially LAP GM potatoes as well as their risk assessment and regulatory policies. The postgraduate course will be also organized in Kastamonu University. This postgraduate course will strengthen the human potential in risk analysis of GMOs both quantitatively and qualitatively for my country. I will also improve myself different issues such as CRISPR-Cas9 technology, biotechnology policies and regulatory framework. I hope, I will be trained on following main points:

- Understanding of latest scientific developments in various fields of agriculture and biotechnology.
- Learning to initial steps of CRISPR-Cas9 technology.
- Contribution of biotechnology in agriculture.
- Importance of regulations and arrangements in agricultural biotechnology.
- The assessment tools available to regulators.
- Minimum requirements for approval of GMs.
- Examination assessment tools which are available for regulators.
- Communication between regulators, producer and public for safety of biotech products.
- As a scientist, learning how to communicate science issues with general public/consumers
- Helping people to make more informed judgements about the food safety hazards and risks they face in their lives.

5. How will a Borlaug Fellowship contribute to enhanced agricultural productivity economic development, and/or food security in the country?

During 12-weeks Borlaug Fellowship Program in United States, I will gain experience about LAP GM potatoes, its technology, development, farming, usage in industry and CRISPR-Cas9 technology which in turn will help shape positively decision related to LAP GM potatoes. At the end of the scholarship, I will better understand various issues surrounding the use and management of agricultural biotechnology globally and learn to regulatory policies, regulations, laws and risk assessment of GM plants so as to apply it to Turkey.

Action plan for 12-week fellowship period

Table 1: 12 weeks-schedule for proposed research activities.

Weeks	Location	Proposed Activity
1	University Part 1	• Orientation • Training on technology behind LAP GM potatoes.
2	University Part 1	• Laboratory training on quantification analysis of acrylamide and glucose, fructose, asparagine using LC-MS and HPLC methods, respectively.
3	University Part 1	• Laboratory training on CRISPR-Cas9 technology.
4	University Part 1	• Laboratory training on CRISPR-Cas9 technology.
5	University Part 1	• Laboratory training on CRISPR-Cas9 technology.
6	SM-1	• Visiting LAP GM potatoes producers including technology companies and university laboratories.
7	SM-2	• Meeting with LAP GM potatoes farmers and NGOs (the non-governmental organizations).
8	SM-3	• Visiting Food Industry Groups which use LAP GM potatoes.
9	SM-4	• Attending to course or meeting related with policies, regulations, technology-transfer, commercialization, environmental and food and feed safety, communication and regulatory framework in a national and global context.
10	SM-5	• Interview with the government agencies like USDA, EPA, FDA to learn details of food safety, risk assessment, risk

	University Part 2	management and risk communication issues. • Training on regulatory policies, regulations and laws of LAP GM potatoes, as a case study. • Learning to available information related with internationally agreed protocols including EU and U.S. approaches.
11	University Part 2	• Training on risk assessment on LAP GM potatoes, as a case study. • Learning to risk analysis protocols in US, EU and Codex.
12	University Part 2	• Meeting with faculty members to make collaboration for new projects and researches.

***** Details are shown below in Suggested Meetings (SM) part.

Suggested Meetings

A. **University Part 1:**

Training on technology behind LAP GM potatoes and CRISPR-Cas9 technology
According to the laboratory condition of the university, I will find an opportunity to make a practice related with quantification analysis of acrylamide, glucose, fructose, asparagine using LC-MS and HPLC methods and CRISPR-Cas9 technology. For further project proposal, these trainings will be crucial.

B. **SM Parts**

SM-1: Visiting LAP potatoes producers including technology companies or university laboratories.

J. R. Simplot Company has a department called as Simplot Plant Sciences whose researchers developed first LAP GM potatoes in 2006. They published a manuscript entitled with 'Improving potato storage and processing characteristics through all-native DNA transformation (Rommens, C.M., Ye, J., Richael, C. and Swords, K. (2006) J. Agric. Food Chem. 54, 9882–9887.). In that study, they showed that simultaneous silencing of two tuber-expressed genes in starch degradation, which encode water dikinase R1 and amyloplast-targeted phosphorylase-L, led to a decrease in the accumulation of glucose and fructose by approximately twofold. Reduced browning of processed products from these modified tubers correlated with an approximately two- to threefold decrease in acrylamide levels. Two years later, same group (Simplot Plant Sciences) published a second manuscript called as 'Low-acrylamide French fries and potato chips' (Rommens, C. M., Yan, H. , Swords, K. , Richael, C. and Ye, J. (2008), Plant Biotechnology Journal, 6: 843-853. doi:10.1111/j.1467-7652.2008.00363.x). In this study, they indicated that an alternative approach for the production of low-acrylamide French fries and potato chips was described that did not alter their sensory characteristics. This new method was based on the tuber-specific silencing of two genes in asparagine biosynthesis, and reduced the concentration of free asparagine by up to 95%.

Therefore, visiting to J.R. Simplot Company which has firstly developed LAP GM potatoes called as Innate potatoes will be good experience for me to address following statements.

- Learning to technology behind LAP GM potatoes
- Examination of problems and advancements during development of LAP potatoes
- Learning to possible usage of CRISPR-Cas9 technology for development of new LAP potato varieties.

In addition to private sector, plant geneticists have also developed LAP GM potatoes. One of the distinguished scientist is Jiming Jiang, who developed a promising new kind of potato that helps cut acrylamide. He is working at Department of Plant Biology in Michigan State University as a MSU Foundation Professor. In 2011, Prof. Jiang and his research group published a study entitled with 'Developing cold-chipping potato varieties by silencing the vacuolar invertase gene' (Wu, L., Bhaskar, P.B., Busse, J.S., Zhang, R.F., Bethke, P.C., and Jiang, J.M. (2011) Crop Sci. 51: 981-990.). They have demonstrated that silencing of the potato vacuolar acid invertase gene *VInv* can prevent reducing sugar accumulation in cold-stored tubers. Using this approach, they developed *VInv* silencing lines using RNA interference (RNAi) from four potato cultivars grown currently for potato chip production in North America. Accumulation of reducing sugars during cold storage was reduced by ~93% or more in all RNAi lines that had >90% reduction of *VInv* transcript. Potato chips produced from these lines were light colored and significantly lower in acrylamide than controls.

Therefore, visiting to laboratory of Prof. Jiang will be wonderful opportunity for me to meet him, to understand development of LAP GM potatoes deeply and to discuss difficulties and points to be considered during research.

SM-2: Meeting with LAP potatoes farmers.

J.R. Simplot Company has many retail locations throughout the western United States. According to climate conditions and location, one of the location can be selected for visiting farmers to discuss LAP GM potatoes farming.

- Face with farmers and discuss following issues:
    - Discussion of benefits and drawbacks of growing LAP GM potatoes
    - Discussion of yield and production of LAP GM potatoes
    - Handling of mass production

SM-3: Visiting Food Industry Groups which use LAP GM potatoes.

J.R. Simplot Company has a branch called as Simplot Food for the commercial kitchen. Based on the Simplot direction, one company will be selected for observation of usage of LAP GM potatoes in industry.

- Handling of downstream process and marketing
- Possible advantages and disadvantages of usage of LAP potatoes in foods
- Comparison of LAP GM potatoes and non-GM potatoes in terms of food additives

SM-4: Attending to course or meeting related with policies, regulations, technology-transfer, commercialization, environmental and food safety, communication and regulatory framework in a national and global context.

I have a plan to attend a course or meeting which provides detail information related with biotechnology research, policies and regulations, management, and public outreach components as well as biotechnology related trade issues. So, I will gain an experience associated with various aspects of agricultural biotechnology including environmental, food and feed safety issues, various topics surrounding the use and management of agricultural biotechnology globally.

SM-5: Interview with the government agencies like USDA, EPA, FDA to learn details of food and feed safety, risk assessment, risk management, risk communication issues, regulatory policies, regulations and laws.

According to the location of the university, I will interview with one of government agencies such as USDA, EPA, FDA. USDA has a visitors center. EPA has one headquarters in Washington, DC and ten regional offices across the USA. FDA has Science & Research Section. So, I will have a chance to visit one of these government agencies to train myself about usage, safety, risk analysis issues, regulatory policies, regulations and laws of GM products. In addition, I will also improve myself about food and feed safety risk communication issues. I will increase my understanding among various food and feed safety stakeholders regarding the rationale behind the decisions taken to assess hazards and manage food and feed safety risks and will help people to make more informed judgements about the food safety hazards and risks they face in their lives.

C. **University Part 2:**

Training on regulatory policies, regulations and laws and Meeting with faculty members to make collaboration for new projects and researches

I will acquire knowledge about various aspects of agricultural biotechnology including environmental biosafety and food safety issues. So, I will have an experience for taking right decisions on genetically engineered crops and products. I will evaluate beneficial and harmful impact of GE crops on both agriculture, environment and human health. I will also have an idea associated with examination, evaluation, approval process and validation processes of biotech product by FDA. Lastly, I will find a chance to make a comparison between USA and Turkey's Biosafety Laws.

I will make a discussion with university faculty members to establish new collaborations for preparing a new project proposal which would be related with CRISPR-Cas9 technology for development of safe biotech products or new generation LAP potatoes.

Fellow # 1 (USDA-FAS-10777-0700-10.-18-0008): **Georgia, Associate Professor at Agricultural University of Georgia, Institute of Entomology; head of the arthropods Laboratory. Work in biology, ecology and taxonomy of tetranychoid mites. Took part in the regulation of entomological collection at the Agricultural University of Georgia. MSc in biology and PhD in zoology. Has been post-doctoral fellow at Ibaraki University, Japan.**

Research Proposal

Investigate biological control agents of plant pest tetranychoid mites, to determine the peculiarities of their distribution and make damage assessment

1. The goal(s) of the research proposal:-
The goal of the project is to study natural enemies of pest Tetranychoid mites and to use them to the pest controlling.

2. Specific objectives to achieve the goal:-

2.1. Investigation of the most distributed and dangerous species of Tetranychoid mites and their biological control agents.
2.2. Monitoring of spatial and temporal distribution of the Tetranychoid mites and their natural enemies.
2.3. To identify conservation ways for the natural enemies those are already adapted to the habitats.
2.4. Assessment of the damage caused by Tetranychoid mites

3. Background information about the research:-
3. 1. Pest tetranychoid mites:

The plant parasitic Tetranychoid mites (Tetranychoidea Donnadieu, 1985) represent major pests of agricultural crops throughout the world, they can be found on many vegetables, fruit trees, berries, ornamental plants and vines. They cause serious problems of agricultural plants in many countries.

Biological control successfully used in many countries controlling living organisms such as mites, insects and weeds. Biological control of tetranychoid mites with natural enemies do not precede in Georgia till nowadays. There are not studied biological control agents of pest mites in economically important agricultural crops. So that it's essential to investigate natural enemies and use them against the tetranychoid mites.

3. 2. Tetranychoid mite life cycle and damage
The understanding of Tetranychoid mite life cycles, their population development and outbreaks requires knowledge of many factors. These factors include the biotic potential of the species, the influence of meteorological factors, the relative susceptibility of hosts, competition between mite species, structural and chemical adaptation each kind of mite, pathogens and predators (Jeppson; Keifer; Baker. 1975).

Some species of pest Tetranychoid mite pass the winter as eggs laid on plant canes and trunks. Eggs hatch in spring and the young microscopic nymphs begin to feed on young foliage. Some of them

overwinter as fertilized females under the bark or in other sheltered areas in agricultural crops. When warmer weather arrives in spring the females begin to feed and deposit eggs.

Tetranychoid mite can produce around six to eightoverlapping generations each season in Georgia, and all stages can be found at any time during the summer months. Tetranychoid mite females are capable of producing 200 or more eggs and development can be rapid during warm weather. Spider mite populations can, therefore, explode rapidly under favorable conditions. Tetranychoid mites life cycle and quantitative dynamics are in direct relation with the conditions of the environment. The changing of the temperature and humidity determine tetranychoid mite reproduction, development and number of generation in the natural and agricultural ecosystems.

Mites feed by rupturing leaf cells with a pair of needle-like stylets (chelicerae) and the leaves become yellowish, bronzed, or whitened. Both adults and nymphs feed by piercing individual leaf cells and removing the fluid contents. Healthy plants can tolerate moderate numbers of spider mites, which will cause chlorotic spots on the leaves. Heavy feeding results in brown leaves that fall prematurely; reducing photosynthetic activity and vigour. Heavy feeding damage can delay ripening of fruit. The large amount of webbing produced is also a cosmetic problem for fruits and vegetables.

3. 3. Biological Control

Biological control of pests and management of disease are very important for a complete agriculture system. Spider mites are the most important pests of agricultural crops in many regions of the world. The main action for the management of spider mites is the preservation of beneficial species. Many natural enemies help to control pest mite populations. Pesticides should only be applied when necessary and only to parts where the populations of pest mites are sufficiently high. Whenever possible select materials that are least damaging to non-target species. Numbers of beneficial organisms sometimes are higher and represent the alternative sources of prey.

Several species of predatory mites (Metaseiulus, Typhlodromus and Amblyseius species) feed on spider mites and their eggs. The predatory mite can be quite effectively reducing all development stages of spider mite. This mite is translucent to light amber, pear shaped, and quite active. Predatory mites are very sensitive to a range of pesticides (http://www.ipm.ucdavis.edu/).

A number of spiders and predatory insects feed on spider mites or their eggs. Many species, such as the minute pirate bug (Orius tristicolor), are generalist predators that do not specialize on mites, while others such as the aptly named spider mite destroyer - Stethorus picipes, are very effective predators that feed almost exclusively on mites. Stethorus picipes is a small, dark species of ladybeetle with a slightly hairy appearance. The elongate bodies of the larvae are also nearly black in colour with a body covered with numerous hairs. At least four species of predatory thrips can be found in vineyards; adults of three of these are black, while the fourth, the six-spotted thrips, Scolothrips sexmaculatus, is pale with dark spots on the wings. All 4 species feed on spider mites, and healthy numbers of these predators are usually associated with low populations of their prey. The western flower thrips is considered a pest of grapes, but it is also known to feed on the eggs of spider mites. The effectiveness of this predator depends upon its ability to increase its population size as the season progresses. Disruptive sprays applied early will reduce the survival of the beneficial species (http://www.ipm.ucdavis.edu/).

Biological enemies are very important agents in reducing and regulation of populations of injurious plant-feeding mites in natural ecosystems, but in agroecosystems where applied the acaricides, the quantitative dynamic is in correlation with the quality and frequency of applied chemicals (Jeppson;

Keifer; Baker, 1975).

4. What to accomplish during the fellowship, how research interests and scientific background relate to the goals of the proposal and how will working with a mentor in the U.S. help to achieve the research goals?

My working field is tetranychid mites, their biology, ecology and taxonomy, I have experience in the identification of tetranychoid mite's species but I have never worked on the assessment of damage and the control measures (biological, cultural or chemical) of pest mites.
During the training course I expect to be introduced to the general principles of integrated pest management, damage assessment and determination of economic injury level (EIL) and economic threshold (ET) according to the modern standards.

I will have opportunity to get Information about the management strategies and official guidelines for monitoring of tetranychoid mite, using pesticides and nonpesticide alternatives and the exact time when the treatments are necessary for managing pests.

5. How will a Borlaug Fellowship contribute to enhanced agricultural productivity economic development, and/or food security in the country?

In Georgia there is no Biological Control Laboratory, so that during the scholarship I have to work with experienced scientists and study new things in this field. After the training course I can use this knowledge to develop science-based pest management programs that are economically and environmentally sustainable and socially appropriate, protect human health and the environment by reducing risks caused by pests; establish the progressive methods in the pest management practices in order to protect viticulture from the pests in Georgia.

Action plan for 12-week fellowship period
Week I
Objective Title: The prepared working plan will be passed and adjusted the together the scholarship mentor; the place of working will be equipped; the literature review of the studying field.

Expected result: Prepared working place; adjusted plan of working; Completed design of research; collected literature about the topic.

Week II
Objective Title: Field work in the agricultural land. Training of field monitoring and assessment of pests damage.
Expected result: Collecting materials of pest tetranychoid mites and their natural enemies

Week III
Objective Title: Field work in the agricultural land. Training of field monitoring and assessment of pests.
Expected result: Collecting materials of pest tetranychoid mites and their natural enemies

Week IV
Objective Title: Sorting of the material for further treatments. Identification of pest and predators species. Expected result: Exemplars of pest tetranychoid mites and their natural enemies

Week V
Objective Title: Preparing of the temporary and permanent slides.
Start rearing of the Pest Tetranychoid mites and their natural enemies in Laboratory conditions Temporary and permanent slides.
Expected result: Life exemplars of pest mites and beneficial organisms.

Week VI
Objective Title: Rearing of the Pest Tetranychoid mites and their natural enemies in Laboratory conditions Life exemplars of Pest mites and beneficial organisms.

Week VII
Objective Title: Biological control experiment of Tetranychoid mites in Laboratory. Expected result: Multiplied pest mites and biological control agents.

Week VIII
Objective Title: Biological control experiment of Tetranychoid mites in Laboratory Expected result: Multiplied pest mites and biological control agents.

Week IX
Objective Title: Biological control experiment of Tetranychoid mites in Laboratory Expected result: Multiplied pest mites and biological control agents.

Week X
Objective Title: Determine the important Biological control agents. Expected result: Biological Control Agents.

Week XI
Objective Title: Summarizing of the research results.
Expected result: Lists of the identified species, their distribution according the main habitats.

Week XII
Objective Title: Results of the survey. Finishing of the project.
Expected result: Final Report and Presentation

Equipment and Chemicals

1. Climate rooms for the rearing of pest and predators.
2. The different temperature and humidity Incubators for determination of the best conditions of rearing.
3. Chemicals: Hoyer's medium (distilled water, Arabic Gum, Chloral hydrate, Glycerine) for preparing permanent slides.
4. Concave and ordinary glass slide for permanent and temporary slide preparation.
5. Plastic bags for the material collecting.
6. Plastic boxes, songs and tissue papers for the species rearing.
7. Glass hose plants for the pest mites rearing.