The Department of Agriculture (USDA) – Foreign Agricultural Service (FAS)
Global Programs

Notice of Funding Opportunity (NOFO)
2021 Norman E. Borlaug International Agricultural Science and Technology Fellowship
Fall Release

NOTE: If you are going to apply for this funding opportunity and have not obtained a Data Universal Numbering System (DUNS) number and/or are not currently registered in the System for Award Management (SAM), please take immediate action to obtain a DUNS Number, if applicable, and then to register immediately in SAM at www.sam.gov. It may take 4 weeks or more after you submit your SAM registration before your registration is active in SAM. Detailed information regarding DUNS and SAM is also provided in Section D of this NOFO, subsection, Content and Form of Application Submission.

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. 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.

A. Program Description

BACKGROUND

Since 2004, the U.S. Congress has made funds available to the Borlaug Fellowship Program to advance 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.

Objectives

USDA identifies Borlaug Participants based on country-specific topics of importance to international agricultural trade. USDA then places Participants 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 Participant and the 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 Participants after their departure from the United States.

SCOPE OF WORK
The selected institution will design and implement a training program to meet the Participant's proposed research goals and objectives to the closest extent possible. The selected institution will also include leadership and communication training to help the fellow better communicate research conducted under their fellowship to policy makers in their respective countries to help implement science based agricultural policies. The Participant's proposed research and training objectives, and full descriptions are in the appendix which can be quickly accessed vis the link in the table:

Fellow specific objectives:

- **Algeria – Leishmaniasis Risk Assessment (Page 19)**
- **Tunisia – Conservation of Tunisian Olives (Page 21)**
- **Bangladesh–Highly Pathogenic Avian Influenza Bioinformatics (Page 23)**
- **Bangladesh – Newcastle Disease Vaccine (Page 25)**
- **Mongolia–Animal Health (Page 27)**
- **Vietnam–Tilapia Aquaculture (Page 29)**
- **Vietnam–Soybean Biotechnology (Page 31)**
- **Turkey– Apomixis in Gene Level (Page 33)**
- **Guatemala – Medfly Gene Editing (Page 35)**

PLACE OF PERFORMANCE

- The applicant is expected to host participants at a research facility on their campus in the United States.
- The Participant is expected to spend two to three days at the USDA in Washington DC at the commencement and at the end of their fellowship program to brief and debrief with key USDA officers. The mentor or PI will be expected to make all necessary travel arrangements as well as accompany the Participant during both trips.
- The mentor is expected to make a reciprocal visit of up to two weeks to the participant's home institution, which may be in a developing country.

Issued By
Foreign Agricultural Service, Global Program, Fellowship Program

Catalog of Federal Domestic Assistance (CFDA) Number and Title
10.777 Norman E. Borlaug Exchanges International Science and Technology Fellowship Program

Notice of Funding Opportunity Title

2021 Norman E. Borlaug International Agricultural Science and Technology Fellowship, Fall Release

NOFO Number
USDA-FAS-10777-0700-10.-21-0002

Authorizing Authority for Program
Sec. 7139 of the Food, Conservation, and Energy Act of 2008 (7 USC 3319j), as amended.

Appropriation Authority for Program
Further Consolidated Appropriations Act, 2020 (PL 116-94)

Announcement Type
New

B. Federal Award Information

Award Amounts, Important Dates, and Extensions

Available Funding for the NOFO: up to $540,000 total with individual awards being up to $60,000 each.

Projected Number of Awards: up to 9

Period of Performance: 24 months

Projected Period of Performance Start Date(s): No later than September 1, 2021.

Projected Period of Performance End Date(s): August 31, 2023.
The award period of performance will begin no later than September 1, 2021. However, the implementor has up to 15 months from the beginning of the award to ensure the Fellow begins his or her fellowship. The Fellow will have up to 3 months to complete the assigned work. Extensions, with or without cost, may be considered; please see Section H.

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 recipients. Program staff will maintain involvement in the administration of the Scientific Exchanges Program.

C. Eligibility Information

Eligible Applicants
State cooperative institutions or other colleges and universities in the United States

A single mentor may not host two Participants simultaneously. Both the PI and the mentor must hold a position 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.

Maintenance of Effort (MOE)
MOE is not allowable.

D. Application and Submission Information

Key Dates and Times

Application Start Date:	November 20, 2020
NOFO Posted Date:	November 20, 2020
Application Submission Deadline:	February 1, 2021 at 11:59PM EST
Anticipated Funding Selection Date:	No later than August 31, 2021
Anticipated Award Date:	No later than September 1, 2021

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

- Required forms and certifications, including:
- SF-424 version, signed by the applicant
- SF-424A version. This should be accompanied by a detailed budget 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. The cost categories should be explained in this manner:
    - **Personnel**: Costs of employee salaries and wages. For each staff person, provide the name (if known), title, time commitment to the project as a percentage of a

full-time equivalent (FTE), annual salary, and grant funded salary. Do not include the costs of consultants. Consultants are to be included under "Contractual."

- **Fringe Benefits**: Costs of employee fringe benefits unless treated as part of an approved indirect cost rate. Provide the method used to calculate the proposed rate amount. If a fringe benefit has been negotiated with, or approved by, a cognizant federal agency, attach a copy of the negotiated fringe benefit agreement. If no rate agreement exists, provide a breakdown of the amounts and percentages that comprise fringe benefit costs such as health insurance, FICA, retirement insurance, taxes, etc. Identify the base for allocating these fringe benefit expenses. (Attach the agreement to the application package.)
- **Travel**: Costs of project-related travel by employees of the applicant organization (do not include costs of sub-contractor or consultant travel). For each proposed trip, provide the purpose, number of travelers, travel origin and destination, number of days, and a breakdown of costs for airfare, lodging, meals, car rental, and incidentals. The basis for the airfare, lodging, meals, car rental, and incidentals must be provided, such as past trips, current quotations, Federal Travel Regulations, etc.
- **Equipment**: Equipment is not permitted for this award. Equipment is defined as any article of nonexpendable, tangible personal property having a useful life of more than one year and an acquisition cost which equals or exceeds the lesser of (a) the capitalization level established by the organization for financial statement purposes, or (b) $5000. For each type of equipment requested, provide a description of the equipment, the cost per unit, the number of units, the total cost, and a plan for use on the project, as well as use or disposal of the equipment after the project ends. An applicant organization that uses its own definition for equipment should provide a copy of its policy or section of its policy which includes the equipment definition.

NOTE 1: Acquisition cost means the net invoice unit price of an item of equipment, including the cost of any modifications, attachments, accessories, calibration and maintenance services, or auxiliary apparatus necessary to make it usable for the purpose for which it is acquired. Ancillary charges, such as taxes, duty, protective in-transit insurance, freight, and installation shall be included in or excluded from acquisition cost in accordance with the organization's regular written accounting practices.

NOTE 2: Prior to the purchase of equipment in the amount of $5000 or more per unit cost, the Recipient must obtain the written approval from FAS, unless the equipment was approved in the initial award. The Recipient shall maintain an annual inventory, which will include a brief description of the item, serial number and amount of purchase for equipment purchased with grant funds, or received under a grant, and having a $5000 or more per unit cost. The inventory must also identify the sub-award under which

the equipment was purchased. Maintenance and insurance will be the responsibility of the Recipient. Title of equipment will remain with the Recipient until closeout when disposition will be provided in writing by FAS within 120 days of submission of final reports.

- **Supplies**: Supplies are tangible personal property other than that included in the equipment category if the acquisition cost is less than the lesser of the capitalization level established by the non-Federal entity for financial statement purposes or $5,000, regardless of the length of its useful life. Specify general categories of supplies and their costs. Show computations and provide other information which supports the amount requested. A computing device is a supply.
- **Contractual**: Costs of all contracts for services and goods that further the work of the project. Sub-contractors, sub-awardees, and/or sub-grantees that do not perform technical work (i.e., landscapers, trash collectors, etc.) These costs belong under other cost categories such as equipment, supplies, construction, other, etc. Include third party evaluation contracts (if applicable) and contracts with secondary recipient organizations.
- Demonstrate that all procurement transactions will be conducted in a manner to provide, to the maximum extent practical, open and free competition. Identify proposed sub-contractor work and the cost of each sub-contractor. Provide a detailed budget for each sub-contractor that is expected to perform work estimated to be $25,000 or more, or 50% of the total work effort, whichever is less.
    - Identify each planned subcontractor and its total proposed budget. Each subcontractor's budget and supporting detail should be included as part of the applicant's budget narrative.
    - Provide the following information for each planned subcontract: a brief description of the work to be subcontracted; the number of quotes solicited and received, if applicable; the cost or price analysis performed by the applicant; names and addresses of the subcontractors tentatively selected and the basis for their selection; e.g., unique capabilities (for sole source subcontracts), low bidder, delivery schedule, technical competence; type of contract and estimated cost and fee or profit; and, affiliation with the applicant, if any.
    - All required flow down provisions in the award must be included in any subcontract.
    - In this section also include subgrantees. Provide information for each planned subgrant. Identify each planned subawardee and its total proposed budget. Include a brief description of the work to be performed

- **Other Direct Costs**: Any other items proposed as direct costs. Provide an itemized list with costs and state the basis for each proposed item.

    - **Indirect Costs**: 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).
- If applicable, complete and submit the SF-LLL Disclosure of Lobbying.
- A project narrative that includes the following elements:
    - Indicate the name of the institution applying to host the Fellow;
    - Indicate the training topic;
    - Provide a tentative training plan based on the training interests listed in the statement of work, including topics to be covered, possible field visits and other activities;
    - Please include a narrative description of the proposed training, 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 Participants in the applicable topic(s);
    - Briefly describe the expertise and international experience of the recipient in the group's field of interest and various countries;
    - Demonstrate understanding of cultural context and needs of the trainees;
    - Identify the expected skills or knowledge to be acquired by the Participants at the end of the program;
    - Briefly demonstrate flexibility in training plan to account for potential program changes and the ability to respond to unforeseen circumstances;
    - Include a quality assurance plan. This should include information on how unforeseen problems that can arise will be addressed.

The SF-424 and SF-424A can be completed within the ezFedGrants platform. However, the other required forms must be downloaded from the Forms sections on Grants.gov or will be sent to you upon request to the program officer(s) named in Section G.

Please be aware that OMB Memorandum 18-24: Strategies to Reduce Grant Recipient Reporting Burden has been approved. Various required forms needed to apply for Federal Financial Assistance no longer need to be completed individually at time of application. They are covered in the Financial Assistance Certifications Report.

Effective January 1, 2020, the Financial Assistance Certifications are a common set of certifications and representations required by Federal statutes or regulations in accordance with the grant's guidance under Title 2 of the Code of Federal Regulations (2 CFR 200.208 Certifications and Representations). Those non-Federal entities who intend to apply for, or are already recipients of Federal grants or agreements, must read and agree to the corresponding certifications and representations. Registrants who reply yes to the following question are required to keep these certifications and representations current, accurate, and complete as part of their entity registration.

FAS will verify in SAM.gov that the proper certifications are completed, and if they have not been, you will be contacted and directed to do so. Your award will not be issued until the proper forms are completed within the SAM.gov portal.

Unique Entity Identifier and System for Award Management (SAM)

Each applicant is required to:

(i) Be registered in SAM (https://www.sam.gov) before submitting its application;
(ii) Provide a valid DUNS number in its application; and
(iii) Continue to maintain an active SAM registration with current information at all times during which it has an active Federal award or an application or plan under consideration by a Federal awarding agency.

The Federal awarding agency may not make an 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.

FAS is using ezFedGrants, which is an electronic grants management system. Applicant(s) with electronic access are required to submit their applications electronically through the ezFedGrants portal. Before you can apply, you must have a DUNS number, be registered in SAM, and have access to the ezFedGrants website at https://grants.fms.usda.gov

Applicants are encouraged to register early. The registration process can take approximately four 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

If you experience any issues with self-registration or have eAuthentication-related questions, please contact the eAuthenticationHelpDesk for assistance:

By email to eAuthHelpDesk@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.

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.

Intergovernmental Review
For state or local entities in the United States, an intergovernmental review may be required for U.S. domestic entities only. Applicant(s) must contact their State's Single Point of Contact (SPOC) to comply with the State's process under Executive Order 12372 (see https://www.archives.gov/federal-register/codification/executive-order/12372.html) Name and addresses of the SPOCs are maintained at the Office of Management and Budget's home page at:

https://www.whitehouse.gov/wp-content/uploads/2019/02/SPOC-February-2019.pdf

Funding Restrictions
Generally, funds may not be used in any manner that is prohibited by 2 CFR Part 200 and 2 CFR Part 400 or this funding opportunity notice.

Compensation for personal services (whether classified as personnel, contractual services, or any other form) may not exceed the pro-rated equivalent of Step III of the Executive Schedule. For calendar year 2019, this is $176,900 per year; $680.38 per day; or $85.05 per hour. Non-monetized fringe benefits are generally excluded from this ceiling, however, a federally-negotiated fringe benefits rate agreement may be required if fringe benefits appear to be unusually high.

FAS agreement funds may only be used for the purpose set forth in the award and must be consistent with the statutory authority for the award. Agreement funds and non-monetary support may not be used for matching contributions for other federal grants or cooperative agreements, lobbying, or intervention in federal regulatory or adjudicatory proceedings. Federal employees are prohibited from serving in any capacity (paid or unpaid) on any proposal submitted under this program. Federal employees may not receive funds under this award. In addition, federal funds may not be used to sue the Federal Government or any other government entity.

In addition, this will be a cost reimbursable agreement issued under 7 U.S.C. 3319a; therefore, University indirect costs are limited to 10% of the direct costs.

These funds cannot be used for construction purposes, general purpose equipment (no particular scientific, technical, or programmatic purpose), scientific equipment exceeding $5,000 or more, entertainment, capital improvements, thank you gifts, or other expenses not directly related to the project

Management and Administration (M&A) Costs:
M&A costs are not allowable.

Indirect Facilities & Administrative (F&A) Costs
Indirect F&A costs means those costs incurred for a common or joint purpose benefiting more than one cost objective and not readily assignable to the cost objectives specifically benefited without effort disproportionate to the results achieved. 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)
The host research institution and mentor must have the 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 Participant's country or a similar location will be considered as appropriate. The recipient'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 stated objectives and background. The program plan should be thorough, and it should also help achieve the desired post-program deliverables and the Participant'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 Participants and length of the program. The budget should include appropriate cost savings where available and narrative should accompany each line item.

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.

FAS conducts a two-part application review process. The Agency conducts an initial review of applications to determine the responsiveness of the application. If an applicant is determined to be ineligible (see Section C. Eligibility Information) or an application is determined to be non-responsive, FAS will notify the applicant. All responsive and eligible applications will be reviewed as described below:

1. FAS will assemble reviewers which may include both federal and non-federal reviewers to review the eligible applications. Reviews of submitted applications will be conducted either on site or by remote review.

2. Technical reviewers will review each eligible application against the evaluation criteria. The reviewers will assign a score and provide summary comments based on the evaluation criteria identified above. Evaluation Criteria: the evaluation criteria must be directly related to key aspects of the project. The criteria must be measurable with an associated point range. It is a best practice, but not required, that the entire review criteria score range should be out of 100. From the scoring process, a recommendation list will be composed and sent to the selecting official, a minimum score of 60 is required to receive funding.

3. An application may be selected for a post-review quality control and possible rescoring if it received significantly diverging scores and comments from reviewers.

4. If necessary, a secondary application review process includes an internal review panel consisting of FAS staff, and the selecting official reviewing the recommendation list which will display the highest ranked applications. From this list this internal review panel will make final funding recommendations. The internal review panel may take applications out of rank order in consideration of strategic program priorities, which are identified below:

   a. Geographic distribution
   b. Incorporation of minority-serving institutions
   c. Institutional capability to host foreign Fellows
   d. Pre-existing relationships between the Fellow and an institution

5. FAS will perform an additional review of the applicant organization which may include reviewing any and/or its key personnel. This review will include reviewing audit

reports, publicly available materials and/or government databases and may have a bearing on award outcome. FAS may request additional materials from the applicant as part of this review, including:

a. The summary letter from the applicant's most recent audit report; and
b. Documentation of previous grant award completion that includes the name of the grantor, amount awarded, and whether the grant recipient sufficiently completed the requirements of the grant award (e.g., a final close-out report, certification of grant award completion, etc.)

6.After the technical review and before making final funding decisions, FAS may contact the highest-ranking applicants to seek clarification and to negotiate technical and programmatic aspects of the application. If an application includes a sub-awardee, FAS may request to speak with all parties included in the application to ensure sufficient planning and coordination has taken place prior to making an award.

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 Federal Assistance Awards, which are on the FAS website at:

https://www.fas.usda.gov/grants-and-cooperative-agreements-administrative-general-terms-and-conditions

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 unless explicitly stated otherwise in subsequent mutually-agreed amendments to the award.

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.

Federal Financial Reporting Requirements
The Federal Financial Reporting Form (FFR), as known as the SF-425, must be submitted semi-annually, within 30 days after the end of each reporting period, and a final report within 90 days of the end of the agreement. The required form is available online at: https://www.gsa.gov/portal/forms/download/149786

Program Performance Reporting Requirements
Performance Progress Reporting must be filed semi-annually, within 30 days after the end of each reporting period, and a final report must be filed within 90 days of the end of the agreement and should include details the activities undertaken and progress made.

Performance 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 Participant with a mentor. The host institution will select an appropriate mentor for one-on-one work with the Participant for the duration of the program.

- The mentor will establish a professional relationship providing guidance and training in the Participant's research and studies.
- The mentor will work with the Participant before arrival to discuss appropriate work plan, site visits, and other arrangements.
- The mentor will provide the agreed upon 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 Participant during the program.
- The mentor will continue communicating with the Participant beyond the end of the program in the U.S. through the mentor visit.
- Mentor will submit semi-annual progress reports that indicate all program activities are conducted.
- The mentor may assign other faculty members to assist with Participant's training and research activities.

- The mentor may not be assigned to multiple Participants during the same time frame.
- The mentor should include a leadership component to the training curricula; training course, workshop, or other suitable activity that provides leadership training to the Fellow.

(3) Mentor Follow-up Visit

- The mentor visit is a required component of the Borlaug Fellowship Program.
- The mentor will work with the Participant to plan a follow-up visit to the Participant's home country. The trip should occur within 6 months to 1 year after the program ends and no sooner than 3 months before the end of the agreement.
- The mentor will follow up with the Participant for an additional year after their visit to assess the impact of the exchange program.
- The PI will provide USDA/FAS with an agenda for mentor's reciprocal visit, including goals and objectives, three weeks prior to the trip. 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) 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 Participant's home to Washington, D.C., and to the university.
- The host institution is responsible for arranging and purchasing all domestic travel related to the Participant's training program.
- The host institution will provide housing for the Participant 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 Participant 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.
- Necessities, such as sheets, towels, and cleaning supplies, will be provided for Participant's use. The Participant 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 Participant with a bus pass or proper allowance for transportation expenses.

- When planning lodging options, the host institution should check with the Participant and account for any special dietary restrictions or preferences.

(5) Meals and Incidentals (M&IE)

- The host institution will provide each Participant 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 Participant must receive per diem within the first week of the program. The PI must inform the Participant and USDA/FAS immediately if this cannot be accommodated.

(6) **Emergency Health Insurance**

- The host institution will purchase emergency health insurance for the Participant for the duration of stay, as required for all J-1 Visa holders (22 CFR 62.14). Dates of coverage must include date of departure from home country to the university until date of arrival in home country from the university.
- The Participant will not be required to purchase his or her health insurance and then be reimbursed.
- The host institution will educate the Participant as to what is covered under health insurance policy, especially highlighting that pre-existing medical conditions are not covered.
- The host institution will immediately alert USDA/FAS staff if any health/medical conditions arise during the program.

(7) Communication

- The host institution will initiate contact with the Participant 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 Participant'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 Participant'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 Participant can be reached in the event of an emergency.

(8) Program

- The host institution will provide educational materials and supplies to each Participant necessary for their full participation in the program.

- The host institution will pay for all fees related to the Participant'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 Participant's training program.
- The host institution will ensure the Participant submits an interim and final report (2-3 pages each) to USDA/FAS before the Participant leaves the United States. Reports should include the following:
    - Summary of activities, accomplishments, and any problems encountered or overcome
    - Photographs, when possible
- The mentor ensures that the Participant completes the Program Evaluation.

(9) Orientation

- The PI/Training Coordinator will communicate directly with the Participant 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 Participant'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

GOVERNMENT FURNISHED ITEMS: USDA FAS will provide Participants with a DS-2019 for the Participant to request and obtain a J-1 visa.

Monitoring

FAS through its authorized representatives, has the right, at all reasonable times, to make site visits to review project accomplishments and management control systems and to provide such technical assistance as may be required. During site visits, FAS will review recipients' files related to the funded program.

As part of any monitoring and program evaluation activities, recipients must permit FAS, upon reasonable notice, to review related records and to interview the organization's staff and clients regarding the program, and to respond in a timely and accurate manner to FAS requests for information relating to their program.

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.

Acceptance of final reports by the agency constitutes a closeout of the award with no further notice or obligation to either party. This acceptance will indicate the period of performance has expired, and any remaining funds will be deobligated. Records must be retained for a minimum of three years after the final reports are submitted, as described in 2 CFR 200.333

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

G. Awarding Agency Contact Information

Contact and Resource Information
For all general questions, contact:
Nicola Sakhleh; Director, Scientific Exchanges Branch
Hours of operation: 8:00 AM – 4:30 PM Eastern Standard Time
Telephone: (202) 690-2484
E-mail address: BolaugFellowships@usda.gov
1400 Independence Ave, SW, Room 3231-S; Stop 1031
Washington, DC 20250-1031

H. Additional Information

1. Extensions
Extensions to this program will be considered. 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.

2. Pre-Award Costs
The Recipient shall not, without prior approval from FAS, incur costs pertaining to the operation of the project, program, or activities prior to the approved project 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.

b. The Recipient shall obtain prior written approval 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.

4. Post-award program income

In the event program income becomes available to the recipient post-award, it is the recipient's responsibility to notify the FAS Program Manager to explain how that development occurred, as part of their request for guidance and/or approval. The Program Manager will review approval requests for program income on a case-by-case basis; approval is not automatic. Consistent with the policy and processes outlined in 2 C.F.R. Part 200, pertinent guidance and options, as determined by the type of recipient and circumstances involved, may be approved by the Grant Officer. If approval is granted, an award modification will be issued with an explanatory note in the remarks section of the face page concerning guidance and/or options pertaining to the recipient's approved request. All instances of program income shall be listed in the progress and financial reports.

Appendix

Borlaug Fellowship Program – Algeria – Leishmaniasis Risk Assessment – Fellow # 2

Scope of Work
Fellow #2: Algeria, Female, Veterinary Doctor, National Veterinary Medicine Institute, M.S., Biology Science

Goal
The fellow's goal is to identify the reality of the leishmaniasis epidemiological situation in Algeria.

Fellow's Learning Objectives
- Learn the seroprevalence of leishmaniasis in farm animals across the entire Algerian steppe and identify its distribution across these different sub-regions
- List the risk factors for epidemics and current spread of leishmaniasis from rural to suburban disease with increased risks of human transmission
- Find out if there are new animal reservoirs (other than wild dogs and rodents) in domestic livestock allowing the sustainability and extension of this anthropozoonosis, which could spread further
- Identify if there are other arthropods than the sandfly which could also be a vector of leishmaniasis

Research Background
Leishmaniasis is one of the neglected tropical diseases; it is a parasitic disease of the reticulohistiocytic system belonging to the family of Trypanosomidae, genus Leishmania, transmissible by the bite of a female sandfly insect; it can be anthroponoic or zoonotic depending on whether man or animal constitutes the natural reservoir of the parasite endemic in all regions of WHO, it has been estimated that worldwide, 14 million people are infected and each year between 700,000 and 2 million approximately new cases and between 20,000 and 30,000 deaths are registered (WHO 2019). Leishmaniasis in Algeria, with its potential impact on human health and its medical seriousness, is prevalent throughout the eastern Mediterranean region. This area is part of around three-quarters (148,450 cases) of all cases of cutaneous leishmaniasis (study 2016; WHO 2018).

Expected Accomplishments
Leishmaniasis remains a serious threat to public health, aggravated by its wide distribution over the territory and the diversity of parasite species. The epidemics are barely controlled, new outbreaks emerging in the country in endemic areas and others despite the various information, awareness and prevention companions, which greatly worries the health officials who considers a real public health problem their all the more worrying as they cause heavy economic and social losses On the other hand, there was a need to update the national data concerning the distribution of leishmania species in the steppe region and assessment of the climatic impact and environmental changes on the disease transmission system thus allowing strengthening and multiplying prophylactic measures and establishing multidisciplinary collaboration to make the

leishmaniasis control program a success, working with a mentor in the United States will help the fellow by orienting themselves on the most recent techniques in the field of identification of leishmania species as well as possible subspecies or zymodeme emerging in the region on the other hand, cotutelle will help the fellow to deepen their entomological studies since in Algeria there are no specialties in the matter.

The identification of new foci of leishmaniasis in farm animals makes it possible to strengthen the programs for combating vector-borne diseases transmissible to humans and thereby improve the productivity of farms and human profitability in the agricultural sector, on the other hand it allows to save the expenses intended for the treatments of the patients and the epidemiological struggles and to use it to reinforce the agricultural development of these regions in Algeria since they constitute a first agricultural source for the country (meat and cereals).

Contributions to Algerian Agriculture Sector

The identification of new foci of leishmaniasis in farm animals makes it possible to strengthen the programs for combating vector-borne diseases transmissible to humans and thereby improve the productivity of farms and human profitability in the agricultural sector, on the other hand it allows to save the expenses intended for the treatments of the patients and the epidemiological struggles and to use it to reinforce the agricultural development of these regions in Algeria since they constitute a first agricultural source for the country (meat and cereals). This research will attract the government's attention to give more importance to the agricultural sector by mobilizing more funds to carry out more detailed studies.

Suggested Schedule

The applicant should propose a 12 week fellowship schedule that reflects the researcher’s goals and objectives as specified under this Scope of Work with a final schedule to be negotiated post award.

Borlaug Fellowship Program - Tunisia – Conservation of Tunisian Olives– Fellow #1

Scope of Work
Fellow #1: Tunisia, Male, Researcher, Ministry of Agriculture/IRESA/Olive Institute, PhD, Agronomy

Goal
The goal of the fellow's research is to study the conservation of Tunisian olives genetic resources and enhance the quality of olive oil by the use of molecular markers.

Fellow's Learning Objectives
- Use molecular markers methods (microsatellites, SNPs, etc.) on the Tunisian olive breeding programs

Research Background
Tunisia is the most important olive-growing country of the southern Mediterranean region. Tunisia's olive resources are estimated at over 90 million olive trees, grown on 1,900,000 hectares of land. Olive cultivation plays a vital role in the social and economic life of Tunisia and accounts for nearly 15% of the total value of final agricultural production. In semi-arid regions, periods with water restrictions as a result of both the increase in domestic use and also climatic changes are frequent and problems of drought (due to non-irrigation) can appear. For these reasons, the use of biotechnology and especially molecular markers are interesting to find new genotypes resistant to drought stress and showing good quality of olive oil.

Expected Accomplishments
The fellow hopes to enhance their knowledge of cultivated olives during their American fellowship experience. In the USA, there are experienced institutions like the National Clonal Germplasm Repository, Davis, and National Arid Land Plant Genetic Resources Unit, Parlier, which are repute in studying tree fruit and nut crops. Among fruit trees, olive is founded in the germplasm repository and research is conducted to study the genetic diversity and the adaptation of olives in United States of America.

The fellow will be able to exchange innovative practices concerning promising strategies of food security and agriculture development. The training will offer the possibility to enhance their knowledge and skills on the use of new technologies in the field of agricultural policy and research. The training goal is to establish a long-term collaboration between and among trainees and between institutions, which are doing front activities in different fields of agriculture biotechnology use, agriculture safe products and food security. The course will help the Tunisian candidate from the Olive Institute to have access to a new approaches related to the use of safe biotechnology in agriculture.

Contributions to Tunisian Agriculture Sector
The fellow will put new skills and knowledge to work for their employing organization. To reach this goal, the output of this training will be directly used in their institute. Furthermore, this course will offer the possibility to the fellow to provide new strategies and methodologies which will be directly used for growers and for future research at the Olive Institute.

Suggested Schedule
The applicant should propose a 12 week fellowship schedule that reflects the researcher's goals and objectives as specified under this Scope of Work with a final schedule to be negotiated post award.

Borlaug Fellowship Program – Bangladesh–Highly Pathogenic Avian Influenza Bioinformatics - Fellow # 1

Scope of Work
Fellow #1: Bangladesh, Male, Scientific Officer, National Reference Laboratory for Avian Influenza. M.S. in Microbiology

Goal
To improve provide food security and public health through controlling highly pathogenic avian influenza virus infections in poultry in Bangladesh.

Fellow's Learning Objective
- To sequence the whole genomes of Bangladesh highly pathogenic avian influenza viruses by next generation sequencing
- To be able to apply bioinformatics to compare the sequences to determine molecular evolution and reassortment of Bangladesh highly pathogenic avian influenza viruses by time-scaled Bayesian phylogenetic model
- Perform antigenic cartography on Bangladesh highly pathogenic avian influenza viruses to determine antigenic evolution and select a vaccine candidate from circulating stains.
- Develop new reagents and tests for specifically detecting highly pathogenic avian influenza virus infections in Bangladesh poultry

Research Background
A total of 556 outbreaks of Highly Pathogenic Avian Influenza Viruses (HPAIV) in poultry and wild birds have been reported in Bangladesh since 2007. In addition, eight human cases and one human fatality caused by infection with H5N1 have been reported in Bangladesh since 2008. Control measures applied to HPAIV outbreaks in Bangladesh poultry include quarantine, movement restrictions and culling of infected birds without compensation. These measures result in significant reductions in both income and food supply for poultry owners. Since 2012, H5 vaccines have been imported and used in commercial poultry to control infections, however no testing of the two imported commercial vaccines has been done to verify their efficacy against the circulating field viruses. Preparing a vaccine from a local H5 virus would reduce Bangladesh's dependence on imported vaccines and reduce the costs to Bangladeshi poultry farmers.

Expected Accomplishments
Establish next generation sequencing technology in our national reference laboratory and in applying updated bioinformatics tools for genetic characterization and monitoring evolution of avian influenza in Bangladesh. Develop the ability to select potential vaccine candidate virus from local virus isolates and monitoring the antigenicity of circulating virus for evaluation of vaccines. The ability to monitor the genetic and antigenic evolution of Avian Influenza Vaccines, improved diagnostic tests, and locally produced vaccines will contribute to institutional capability to diagnose and control outbreaks of HPAI, which will result in reduced vaccine costs to poultry farmers and less birds being culled.

Contributions to Bangladeshi Agriculture Sector

Increase capacity for monitoring genetic evolution and to produce vaccines for HPAIVs from circulating strains will be established, which will help in reducing the prevalence of AIV in Bangladesh. It also is helpful to develop an appropriate farm biosecurity model for future prevention of AIV. National food security will be strengthened by protecting the productivity of safe animal protein and economic development. Moreover, the knowledge acquired from the fellowship can be applied to other diseases, with the hope of protecting other livestock sectors. The fellowship would also contribute to the capacity building for molecular characterization of current circulating strains of HPAIVs and will be helpful for predicting the threat of new emerging AIVs from mutation and reassortment of circulating viruses. The current Bangladesh government policy is to control HPAI outbreaks by culling infected birds without compensating the owner and to import vaccines from international vaccine manufacturers. Improved diagnostic tests will allow farms to be tested more quickly and then be cleared of infection. The availability of vaccine produced from a local virus strain will significantly improve protection of vaccinated birds and reduce the costs to poultry producers.

Proposed Schedule

The applicant should propose a 12-week fellowship schedule that reflects the researcher's goals and objectives as specified under this Scope of Work with a final schedule to be negotiated post-award.

Borlaug Fellowship Program – Bangladesh – Newcastle Disease Vaccine - Fellow # 2

Scope of Work
Fellow #2: Bangladesh, Male, Assistant Professor, Bangladesh Agricultural University. PhD in Immunology

Goal
To develop an improved vaccine against Newcastle disease virus (NDV) circulating in Bangladesh using a reverse genetics approach.

Fellow's Learning Objective
- Generate a genotype-matched, live attenuated vaccine from circulating virulent NDV strains in Bangladesh
- Generate of a recombinant NDV vaccine candidate by a reverse genetics' technique using genotype XIII backbone and an avirulent F protein cleavage site (FPCS)
- Study the genetic stability of the recombinant vaccine virus on serial back passage in chickens, the in vitro replication and pathogenicity of the recombinant vaccine virus, and the immunogenicity and protective efficacy of the recombinant vaccine virus against challenge with homologous virulent NDV strains

Research Background
Newcastle disease (ND) is a highly contagious and often fatal disease affecting wide varieties of domestic and wild birds worldwide. It is caused by Newcastle disease virus (NDV) which is a non-segmented single stranded negative sense RNA virus. The F protein cleavage site (FPCS) is the critical sequence responsible for major changes in the virulence. In Bangladesh, ND prevention is focused on biosecurity and vaccination of poultry with live and inactivated ND vaccines. Today, the strains of NDV used in locally produced or imported ND vaccines in Bangladesh, such as BCRDV, RDV, LaSota and B1, belonged to genotype II and are phylogenetically divergent from virulent virus circulating in the field. For effective control of ND in Bangladesh, a genotype-matched vaccine is required using field NDV strains. Several recent studies showed the promise of reverse genetics technique to generate live attenuated NDV vaccine by replacing the F protein cleavage site of virulent viruses with F protein cleavage site of avirulent strains.

Expected Accomplishments
Upon successful completion of the project, a genotype-matched, live attenuated NDV vaccine will be generated from local virulent strains. Most of the vaccines that are being used in Bangladesh were developed using conventional techniques. An innovative approach, such as reverse genetics, to develop genotype matched vaccine within short time would provide better protection for poultry flocks. The skill of reverse genetics technique can be applied to generate other vaccines against infectious diseases such as avian influenza and Gumboro disease in Bangladesh.

Contributions to Bangladeshi Agriculture Sector
Infectious diseases are major threat towards successful poultry industry in Bangladesh. Besides avian influenza, ND is number one killer of commercial and backyard poultry in Bangladesh.

Most of the vaccines that are being used in Bangladesh are imported and genotypically different from field viruses. This project will be used to develop an improved, genotype matched reverse genetics vaccine which will help the poultry industry to fight against deadly NDV infection. In return, the poultry farming which is a major provider of meat will be sustainable leading to enhanced food security in Bangladesh.

Proposed Schedule

The applicant should propose a 12-week fellowship schedule that reflects the researcher's goals and objectives as specified under this Scope of Work with a final schedule to be negotiated post-award.

Borlaug Fellowship Program – Mongolia– Pathogens in Pork and Poultry - Fellow #1

Scope of Work
Fellow #1: Mongolia, Male, Infectious Diseases Department Head, Mongolian University of Life Sciences. PhD Veterinary Medicine

Goal
Develop a better understanding of genomics and molecular epidemiology research methods, including next-generation sequencing, for detection and identification of pathogens in pork and poultry products for the improvement of food safety/security and veterinary service in Mongolia

Fellow's Learning Objective

- Detect and analyze genome sequences and evolutionary dynamics of pathogens in pork and poultry products including bacterial hazards
- Detection and identification of bacterial pathogens including but not limited to campylobacter and salmonella by microbiological culture and traditional molecular biology methods such as PCR for viral pathogens in poultry products
- Detect and identify viral pathogens including but not limited to avian influenza virus by egg inoculation, cell culture, and traditional molecular biology methods such as PCR in poultry products for genomics and molecular epidemiology
- Determine protocols for different types of NGS platforms for samples of bacterial and viral cultures, in pork and poultry products

Research Background
Agriculture especially livestock is a traditional and special sector of the national economy and an important source of employment in Mongolia. Although traditional livestock production is central to Mongolia's economy, the intensive livestock production (exotic stock such as pig and poultry) is increasing due to economic development, food culture changes, tourism, migrations and it is challenging for the diagnostic capacity and research experiences on poultry and pig products safety and diseases. Also, food poisoning incidents sporadically occurred in poultry or pork products and it is the lead government to periodically ban the import of pork, chicken, egg, and feed and/or suspend the food market and restaurants due to lack of research-based evidence and/or risk assessment for the policymakers. African Swine Fever (ASF) is a deadly viral disease of swine that has significant economic consequences in food security. ASF has become endemic among the domestic swine population in Asian countries, including Mongolia, where outbreaks associated with transmission are linked movement of pigs and pig products. Research investigating of pathogens in Mongolia has primarily focused on large food animals, and poultry and pig pathogens have largely been neglected. Current diagnostic methods such as isolation, culture, and genotyping although useful for pathogen identification, have limitations since it includes cost, the necessary skill set, and is time consuming. Mongolia needs to develop more accurate methods such as NGS that allow single test to screen of its identification of biological hazards in pig and poultry products.

Expected Accomplishments
Gain a better understanding of genomics and molecular epidemiology research methods including next-generation sequencing for detection and identification of emerging and high consequence pathogens in pig and poultry products for improvement to the food safety and veterinary service in Mongolia.

Contributions to Mongolian Agriculture Sector
Well-defined pathogens and phylogeny based on whole-genome sequencing could be a valuable forensic tool to isolate geo-origin or source attribution of accidental or deliberate incursions into Mongolia and to provide data support to local policymakers for the evidence-based decision. Develop a genomics and molecular epidemiology laboratory focused on a wide range of diseases include pig and poultry pathogens.

Proposed Schedule
The applicant should propose a 12-week fellowship schedule that reflects the researcher's goals and objectives as specified under this Scope of Work with a final schedule to be negotiated post award.

Borlaug Fellowship Program – Vietnam–Tilapia Aquaculture - Fellow # 1

Scope of Work
Fellow #1: Vietnam, Male, Vice Dean, Vietnam National University of Agriculture.
PhD Aquaculture

Goal
To establish effective management for sustainable development of Tilapia farming industry in Vietnam.

Fellow's Learning Objective
- Detect new emerging bacterial diseases in Tilapia that have appeared and caused massive mortality in Vietnam in recent years
- Establish methods for the diagnosis of infections caused by new emerging bacterial diseases in Tilapia for laboratories in Vietnam
- Establish effective prevention and treatment through trials for practical application in tilapia farming

Research Background
Tilapia is a crucial cultured species of Vietnam's seafood industry and has been designated as the main farming species, facilitating the expansion of scale and increasing production to serve processing needs and exportation by the Vietnamese Government and the Ministry of Agriculture and Rural Development. However, in recent years, new diseases of Tilapia have been occurring, causing massive mortality for Tilapia, causing economic losses and affecting the productivity and sustainable development of the tilapia industry. Due to the lack of investment for research, the causative pathogens have not been detected and diagnosed correctly, the methods of disease prevention and treatment are based on judgment. Hence, the effectiveness is not good enough. It is urgently requested to determine the new emerging diseases on Tilapia, establish diagnostic procedure, the effective prevention and treatment to minimize economic losses due to the disease outbreaks, improve production efficiency, and enable sustainable development for the tilapia industry.

Expected Accomplishments
Detect new emerging bacterial diseases in Tilapia that have appeared and caused massive mortality in Vietnam in recent years.
Establish methods for the diagnosis of infections caused by new emerging bacterial diseases in Tilapia for laboratories in Vietnam.
Establish effective prevention and treatment through trials for practical application in tilapia farming.

Contributions to Vietnamese Agriculture Sector
In recent years, the government and the Ministry of Agriculture and Rural Development targeted that Tilapia will be the main culture species for domestic use and exportation. Thus, Tilapia has been widely cultured and expanded in Vietnam with many models such as culturing in earth ponds, and cage culture in rivers and hydroelectric lakes. However, the biosecurity to protect fish and sustainable tilapia farming is poorly practiced by farmer and community. Consequently, the

outbreaks of diseases have been appearing frequently and cause severe economic loses. Reduction of the overuse of antibiotics and chemicals in aquaculture that assists in increasing quality of products for exportation, increases the value of products. The project will help to reduce the side effect of antibiotic use in aquaculture, especially occurring resistance antibiotic bacteria strains and antibiotic residual in meat. All subsequently could be enhanced aquaculture productivity, economic development for farmers, improve food biosecurity and enable for sustainable aquaculture and tilapia farming in Vietnam. Tilapia farming was changed from traditional culture species only for domestic use to the main culture species for exportation is one of the policy changes in 2019 in Vietnam Aquaculture, but the disease outbreaks become the most challenging. Therefore, research on management for the disease outbreaks is a key factor playing a vital role in the success of this policy changes.

Proposed Schedule from Applicant Proposal

The applicant should propose a 12-week fellowship schedule that reflects the researcher's goals and objectives as specified under this Scope of Work with a final schedule to be negotiated post-award.

Borlaug Fellowship Program – Vietnam–Soybean Biotechnology- Fellow # 2

Scope of Work
Fellow #2: Vietnam, Female, Lecturer, Vietnam National University of Agriculture.
PhD in Crop Science and Plant Biotechnology

Goal
Determine the efficiency of the CRISPR/Cas9 system in editing soybean drought tolerance genes.

Fellow's Learning Objective
- Design single-guided RNAs for drought tolerance genes of soybean
- Construct CRISPR/Cas9 expression vector
- Evaluate mutation efficiency of the CRISPR/Cas9 system for drought tolerance genes of soybean

Research Background
Soybean is an important legume crop with great economic and environmental values. Soybean provides protein and oil for food production and animal forage. However, soybean production is currently affected by abiotic stresses. Drought, an important abiotic factor of frequent occurrence limits plant growth and yield in many areas on the earth that is increasingly topical because of climate change and water shortages. Traditional breeding is constrained due to narrow genetic bases of soybean. In addition, breeders must repeatedly introgress the mutations into elite soybean cultivars by conducting genetic crosses and selection over generations and years. This is a long and labor-intensive process, which delays delivery of soybean varieties to cope with a continuously changing agriculture environment. Genome editing technologies provide new opportunities for crop improvement by employing precision genome engineering for targeted crop traits. Among three genome editing techniques, zinc-finger nucleases (ZFNs), transcription activator-like nucleases (TALENs) and clustered regularly interspaced short palindromic repeat (CRISPR)/CRISPR-associated protein (Cas) system, CRISPR-Cas system is simpler, faster and more efficient. Application of CRISPR/Cas9 for crop improvement is through modification a target crop plant's genome in very precise ways, provided availability of the plant's genomic sequence and the genes that code for, or allow production of, specific proteins with known functions. However, primary application of this tool has been the generation of gene knock-outs so far. CRISPR/Cas9 system has not been employed for studying abiotic stress responses as of now. Soybean is among crops that its genomic resources has been well studied. However, there has been little focus on use of CRISPR/Cas9 for adaptation studies including drought tolerance in soybean.

Expected Accomplishments
Design single-guided RNAs for drought tolerance genes of soybean, construct CRISPR/Cas9 expression vector, and evaluate mutation efficiency of the CRISPR/Cas9 system for drought tolerance genes of soybean.

Contributions to Vietnamese Agriculture Sector

Vietnam is ranked among five countries affected severely by climate changes which currently cause serious drought and salinity conditions. Consequently, many areas are not cultivatable, and farmers are becoming poorer. Therefore, the Ministry of Agricultural and Rural Development's (MARD) efforts have been channelized towards development of varieties adaptable to stresses. Thus, scientists need to focus on applying advanced biotechnology tools, such as genome editing and genetic engineering for development of new crop varieties, including soybean. The research will provide evidence on the effectiveness of genome editing techniques for soybean improvement of targeted traits, such as drought tolerance. This will increase the awareness about efficient application of biotechnology in crop breeding in Vietnam.

Proposed Schedule

The applicant should propose a 12-week fellowship schedule that reflects the researcher's goals and objectives as specified under this Scope of Work with a final schedule to be negotiated post-award.

Borlaug Fellowship Program – Turkey– Apomixis in Gene Level - Fellow #3

Scope of Work
Fellow #3: Turkey, Male, Professor, Canakkale Onsekiz Mart University. PhD, Biotechnology, Field Crops

Goal
The goal of this project is to obtain extensive information about Apomixis (an asexual reproduction system through seed) in gene level using a natural apomict Boechera species and engineer apomixis in sexual crop plants using the model system Arabidopsis thaliana.

Fellow's Learning Objective
- Using Boechera species with autonomous embryo development and produce seeds without meiosis and fertilization (apomixis)
- Analyze apomixis associated genes in natural apomicts using gene deletion and gene introduction methods
- Characterize the structure of the apomixis associated genes (controlling meiosis, parthenogenesis, and endosperm development) in diploid apomict and sexual Boechera spp. using genome and transcriptome data
- Clone the best candidates (gene cloning) obtain mutant Arabidopsis lines (gene deletion) complementation analysis in Arabidopsis mutants (gene introduction)

Research Background
In the sexual production of the angiosperms, one of the well-known process double fertilization where the specialized cell division called meiosis produces haploid gametes combine to form diploid (2n) embryo. In contrast to this, an asexual reproduction system known as apomixis represents an exception since the embryo formation occurs without fertilization of the egg (Koltunow 1993). Previous studies suggest that three elements are commonly observed in apomicts; the generation of a cell capable of forming an embryo without prior meiosis (apomeiosis); the spontaneous, fertilization-independent development of the embryo (parthenogenesis); and the capacity to either produce endosperm autonomously or to use a pseudogamous endosperm derived from fertilization (Bicknell and Koltunow 2004; Koltunow 1993; VielleCalzada et al. 1996). It has been already proposed that apomixis has the potential to change hybrid seed technology by providing a new tool to maintain hybrid vigour in plant breeding since the progeny of apomictic plants are genetically identical to the mother plant (Grimanelli et al. 2001; Koltunow et al. 2001). Until now, the molecular mechanisms underlying apomixis are not known in natural apomicts, there are studies suggest that apomixis may emerge from the sexual system deregulated by epigenetic modifications (Carman 1997; Curtis and Grossniklaus 2008; Grimanelli 2012; Grimanelli et al. 2003; Koltunow and Grossniklaus 2003). Apomixis also is a desirable trait for breeders to maintain hybrid vigor for subsequent generations through seeds that contain genetically identical embryo to the mother plant (Grimanelli et al. 2001; Koltunow et al. 2001). However, several candidate genes triggering specific components of apomixis are known, the function of their proteins is not clear (Albertini et al. 2004), the most important genes, which demonstrate a phenotype inherent in gametophytic apomicts are recently reviewed (Brukhin and Baskar, 2019).

Expected Accomplishments
This research will allow for new collaborations with the experts in the field of innovative plant breeding specialized on gene mapping, gene expression, gene deletion, gene introduction, marker-assisted plant breeding, and DNA mapping. This fund would provide a more international platform with which to release ideas. Taskin lab researches both the molecular biology of apomixis and plant metabolic pathways. They are working with natural apomicts plant species Boechera and optimized an efficient regeneration system and investigated the Agrobacterium-mediated transformation method. The innovative breeding techniques will create new tools to induce apomixis in agriculturally important plants such as rice and maize. Working with a mentor in the U.S. is very important since there are much better facilities and more specialized scientists in the USA.

Plant Biotechnology is perhaps one of the most important areas in Turkey's growth because it is largely an agricultural country. The use of apomixis thus holds great promise for sustainable agricultural production in other developing countries, as well as Turkey. The important applications of this project include:

- Creating newly apomictic crop species all of which can be hybrids, thereby broadening the scope of hybrid technology
- Retaining the maintenance of extreme heterozygosity
- Enabling propagation through seed of crop species currently vegetatively propagated
- Avoiding crop losses due to failures in pollination/fertilization
- Allowing propagation of hybrid seed directly by the farmers

Contributions to Turkish Agriculture Sector
The introduction of apomixis in crops will change the hybrid seed technology through the reduction in cost and time of breeding. Also, apomixis will provide the rapid generation and multiplication of superior forms through seed from novel germplasms and the avoidance of pollinators and cross-compatibility. Although growing genetically modified plants in fields do not allow in Turkey, the government should be aware of the beneficial effects of such technologies. The fellow will organize a workshop about the techniques learned during their visit to conventional plant breeders and researchers from the Ministry of Agriculture.

This fellowship would also further strengthen existing relationships between the two Universities and expand our co-operation in the future. Canakkale Onsekiz Mart University was founded in 1992. The university has expanded rapidly over the last few years and wishes to increase its participation in international research and other projects. With this fellowship, the fellow also stands to benefit considerably from such specialized knowledge, help students and finally assist colleagues in the university.

Suggested Schedule
The applicant should propose a 12 week fellowship schedule that reflects the researcher's goals and objectives as specified under this Scope of Work with a final schedule to be negotiated post award.

Borlaug Fellowship Program – Guatemala Medfly Gene Editing - Fellow #1

Scope of Work
Fellow #1: Guatemala, Female, Technology Transfer Advisor, Universidad del Valle de Guatemala. M.A. in Project Management

Goal
To identify pro-longevity gene orthologues in Medfly and test the effects of overexpression on the Medfly longevity and sterilization process.

Fellow's Learning Objective
- Design target-specific sgRNA and Cas9 nuclease expression plasmids and synthesize single guide RNAs
- Evaluate the fertility and longevity of the new strains

Research Background
The Sterile Insect Technique (SIT) is widely accepted to reduce insect pest populations. It employs X rays or gamma radiation to sterilize males that later are released into the wild population to mate with wild type females and reduce the pest population. Today, SIT is used to control the dissemination of pests such as: Ceratitis capitata, Anastrepha sp. and Bactrocera sp. A technical limitation of the SIT process is the development of specific strains with classic induced mutagenesis. This technique, although unpredictable and time consuming, allows the SIT programs to develop fly strains with favorable characteristics. The release of transgenic organisms is highly regulated or prohibited in many countries, but some studies are proposing the use of the tool CRISPR-Cas9 toolbox, which is classified in some regions as a non-Genetically Modified (GM) tool, to create non-GM fly strains with favorable characteristics for the SIT process. This project proposes to use CRISPR/Cas to overexpress potential pro-longevity genes in testis and evaluate the effect on fertility and longevity of medfly. This will allow identification of pro-longevity genes that would not affect the Medfly sterilization process. These results will be the first step to engineer non-GM, longer-lived fly strains as a novel technology in the region.

Expected Accomplishments
The sterile medfly life span is directly proportional to its impact in wild-fertile population decrease, therefore fruit productivity will be enhanced by the degree of control achieved by a new long-lived strain. This project will develop methods to increase the production efficiency of the SIT process by silencing sexual differentiation genes in Anastrepha ludens, to create male-only progeny to create the first CRISPR-Cas medfly strain for SIT use in Guatemala.

Contributions to Guatemalan Agriculture Sector
The Borlaug Fellowship will allow Guatemalan scientists to locally design and develop a novel strain with gene editing technology. Moreover, this fellowship will be a step forward in setting up the first CRISPR laboratory in Central America, which will give the region the opportunity to apply this technique to tackle different problems ranging from pest and vector control to human diseases. The implementation of a new medfly strain in the SIT program Moscamed, will be Guatemala's first example of the new technical manual that classifies CRISPR organisms as non-

genetically modified. The project will initiate a gene editing laboratory at UVG's Center of Innovation and Technology (CIT), hub of maker spaces dedicated to designing prototypes in collaboration with industry, regional entrepreneurs, students, faculty, and researchers. The laboratory will be part of the B-HIVE, a cluster of bio-based maker spaces for the development of new biotechnological solutions. The goal is to be able to turn this cluster into a biotechnology benchmark in the region that will introduce and popularize CRISPR-Cas tool and its potential throughout Guatemala.

Proposed Schedule

The applicant should propose a 12 week fellowship schedule that reflects the researcher's goals and objectives as specified under this Scope of Work with a final schedule to be negotiated post award.