The International Treaty
ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

# Full Project Proposal Guidelines

Third Call for Proposals under the Benefit-sharing Fund

*Deadline for submitting full project proposal: 5th of December 2014*
*at Treaty-Fund@fao.org and PGRFA-Treaty@fao.org*

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## PROJECT PROPOSAL COVER SHEET

Project No. _____ (*For Treaty use. Do not write anything here)*

Project Title: Genetic Base Broadening and Germplasm Enhancement for the Development of Drought TolerantCultivars of Wheat and Barley in the Democratic People's Republic of Korea

Project duration: 23 months

Target crops: Wheat and barley

Targeted developing country/ies : Democratic People's Republic of Korea

Other Contracting Party/ies involved _____

Project geographic extension (km²) 123,138㎢

Total requested funding 137,553 US$

Total co-funding 23,436 US$

**Please select the type of project you are applying for:**

☐ Single-country Immediate Action Project (Window 2)
☐ Multi-country Immediate Action Programme (Window 2)
☒ Single-country Co-development and Transfer of Technology project (Window 3)
☐ Multi-country Co-development and Transfer of Technology project (Window 3)

**Applicant**

Name of Organization: Academy of Agricultural Sciences (AAS)

Type of organization: Governmental organization

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## GENERAL REQUIREMENTS

These guidelines have been prepared to support applicants in the development of full project proposals. They describe the requirements that all applicants should adhere to when developing their full project proposal.

Please make sure you read these guidelines carefully before proceeding to fill in the Project Proposal Form. The full proposal should be prepared taking into account the thematic focus of the Third Call for Proposals, including in particular, the rationale, scope and expected outputs for each Window and sub-Window.

Project proposals must be clear and realistic on the problem to be addressed and objectives it tries to achieve. Project objectives have to fit in the thematic focus of the call and ultimately contribute to food security and poverty alleviation. Project objectives have to be logically interlinked with the planned activities, outputs and expected outcomes. The objectives and outputs have to be feasible in terms of duration and resources requested. The information to be provided in each section has to be focused and straightforward, qualitatively and quantitatively measurable in terms of what will be done, with what purpose, who, why and how will be involved in the activities to be implemented, who and how many will directly and indirectly benefit from the implementation of the project. A good full proposal will have a sound, clear and logically linked methodology of implementation and management.

The full project proposal should contain no more than fifteen (15) pages of text (Appendixes, table of contents and cover sheets excluded). The number of pages allocated to each section is a guide. The information required can be less but not more than the pages stipulated. All Appendixes should be duly filled in according to the provided guidelines as they form an integral part of the full project proposal. Project proposals lacking at least one Appendix, will be excluded from the selection process. The Appendixes will be provided to you in separate files together with the present document.

When submitting the full project proposal, additional attachments (endorsement letters, funding commitments, certification of the status of the organization) can be provided.

Please ensure that the project proposal and all attachments are legible in Times New Roman 12 and provided in two formats (pdf and word). Make sure the signature of the project coordinator is put on the signature page.

The project proposal, if approved for funding by the Bureau of the Sixth Session of the Governing Body, will form an integral part of the contractual agreement (Letter of Agreement) that will be signed with each applicant organization of the approved projects.

## SECTION A: EXECUTIVE SUMMARY

### 1. Executive summary

In the DPR Korea, the total agricultural land is estimated at 1,826,000 ha, out of which approx. 1,423,000 ha are for cereal cultivation, the per-capita arable land being as small as 0.074ha. The total area under wheat & barley was estimated at 70,000 ha. Wheat and barley are grown as the first crops in double cropping areas, where potato, wheat and barley are the most important crops to alleviate the food shortage during June - August period when rice and maize are the scantiest.

The yield of wheat and barley has gone down in the last 10 years, recording a national average yield of 1.477t/ha in 2013. It is commonly agreed among scientists and farmers that the recent fall in wheat and barely (a drop in per hectare yield by 20-30%, on average) is due to the period of drought from late April to June, which has become prolonged and more severe in recent years due to climate change across the country. In 2014, numerous crop fields planted to wheat and barley was ploughed around the end of May and sown again to soybean and maize at most farms across the country.

However, wheat & barley cultivars tolerant to drought are not available because drought tolerance (DT) has not been focused in breeding activities, and so wheat-barley breeding programmes for DT-cultivars are urgently needed to be started. But DT-germplasm and effective selection techniques are not available as DT has not been targeted in germplasm management and breeding programmes. Moreover, farmers are not convinced that drought tolerance of wheat and barley can increase crop yields in drought seasons.

**Overall objective** is to increase the national cereal production by facilitating the development of wheat and barley cultivars adapted to the current and future climate change in the DPRK. **Specific objectives** are: 1) to develop a competence of exploring and broadening genetic base and crop breeding for drought tolerance in wheat and barley. 2) To initiate a model research programme for promoting base-broadening, pre-breeding and breeding activities, particularly for DT of crops at genebank and agricultural research institutions.

**Main expected outputs** are//Local and exotic drought-tolerant germplasm accessions of winter wheat and spring barley made available for drought tolerance breeding,// Technologies and information for drought-tolerance breeding and germplasm management of wheat and barley transferred from abroad//Increased capacity of farmers and researchers to identify, on-farm conserve and use drought-tolerant wheat and barley germplasm accessions.

The project targets at winter **wheat and spring barley as PGRFA,** encompassing **the DPRK territory**.

**Direct target groups** and beneficiaries include a total of 65 persons(63 researchers and 2 officials) of the AAS. 3 officials of MoA, 9 officials of provincial rural management boards, 4 officials of 4 county management boards, 9 farm managerial staff persons of 9 cooperative farms: 15 farmers of 3 Targeted farms. About 600 farmers of the targeted farms. **Indirect beneficiaries** include about 500 crop-related researchers and breeders, about 300 households( on average, 4 persons per household) of the 3 targeted farms, ultimately, about 4,387,000 producers at about 3080 co-operative farms, crop breeders, breeding institutes and seed producers.

The proposed project was designed and will be implemented under the support from the National Crop Genetic Resources Management (NCNCGRM), contributing to the successful implementation of the "National Strategic Action Plan for the Food Crop Genetic Resources Management to Adapt to Climate Change in the DPR Korea" (NSAP) as well as to the achievement of Millennium Development Goals 1 and 7.

## SECTION B: PROJECT DESCRIPTION AND CONTENTS

### 2.1. Problem definition

In the DPRK, Mountains accounts for almost 80% of its territory, and the topography of the DPRK is characterized by a large number of hills, rivers and streams and steep ravines. The total territorial land area is estimated at 123,138㎢. The population of the DPRK was approximately 24,625,000 in 2012.

The climate change in the DPRK is characterized by 1) the average annual temperature risen by 1.9℃ in the last 100 years (1918 to 2000) with a sharp rise in temperature during the last 30 to 40 years, 2) a big variation in the seasonal and regional distribution of annual precipitation in recent years, and 3) more frequent disastrous abnormal phenomena like prolonged drought, flooding, typhoon and rainstorm.

Agriculture(inclusive of forestry and fisheries) accounts for the largest portion of the Gross National Production(GNP). The total arable land area is estimated at 1,826,000 ha, the *per-capita* arable land being as small as 0.074ha. Out of the arable land area, 574,000 ha is occupied by paddy fields and about 1,000,000 ha by non-paddy fields. Rice, maize, wheat, barley, potato have been the main traditional food crops in the DPRK. In addition, sweet potato, sorghum, upland rice have been grown in specific areas.

Wheat and barley, mostly winter wheat and spring barley, are grown in different cropping systems in diverse ecological conditions on the whole arable land of the country - as a mono crop in northern highlands, and as an early crop in double cropping system in the regions with relatively high climatic temperatures, preferably as the first crop before maize and soybean in flatlands. The total area under wheat and barley was estimated at 70,000 ha in 2013. In the double cropping areas of the country, potato, wheat and barley are the most important crops which alleviate the food shortage during the period from May to August when rice and maize are the scantiest.

Severe drought periods were recorded between 1998 and 2001. Drought lasted for 30 days at longest in the years before 2000, but lasted for 60 days in 2001. The drought period occurred in 2001 was proved to be the one that comes every 1,000 years with a rainfall 4% as much as the average rainfall in the same period. These severe droughts were also recorded in the last few years. The rainfalls during the period from March to May, a main growing period of wheat and barely, in 2014 were recorded less than 100mm, much less than the annual average over pre-2000 years(about 400mm). Moreover, as the rainfall in April to June was too little in 2014, numerous crop fields planted to wheat and barley were ploughed around the end of May and sown again to soybean and maize at most farms across the country.

As for the production recorded during the last 10 years, the yield of wheat and barley has gone down, recording a national average yield of 1.477t/ha in 2013. It is commonly agreed among scientists and farmers that the recent fall in wheat and barely (a drop in per hectare yield by 20-30%, on average) is due to the period of drought from late April to June, which has become prolonged and more severe in recent years due to climate change across the country.

In this context, with a view to sustainable agricultural production and food security, the Government has launched a national movement against drought, which focuses on the development of drought tolerant crops and cultivars, the exploration of water resources, and development and application of different techniques for the efficient conservation and use of water resources. Particularly, the development and planting of drought tolerant crop cultivars has been put forth as one of the important tasks in implementing the Government's strategy for alleviating drought damage in agriculture.

Some *constraints* should be lifted up to facilitate the development and planting of drought tolerant cultivars. ***Firstly,*** the breeders and agricultural researchers have no experience of developing drought-tolerant crop cultivars. ***Secondly,*** Germplasm

accessions, which have been proved tolerant to drought, and technical packages(technical references and facilities, etc.) are not available for the immediate and future use in crop breeding for the development of drought-tolerant wheat and barley cultivars. Particularly, drought tolerant germplasm and effective selection techniques are not available as drought tolerance has not been targeted in germplasm management and breeding programmes. ***Thirdly,*** farmers are not convinced that drought tolerance of wheat and barley can increase crop yields in drought seasons.

These constraints are attributable to the fact that drought has not so problematic in the past years. Hence, farmers and researchers have not been concerned about drought, and drought tolerance has not been focused in the fore-gone breeding or research programmes for wheat and barley as well as other crops. Thus, wheat-barley breeding programmes for DT-cultivars are urgently needed to be started.

The germplasm and the technical packages for broadening genetic base and enhancing germplasm for DT in wheat and barley are relevant to the successful implementation of the Action V-"Identify the genetic resources of target crops adapted to eco-regions & stresses and improve genetic bases under climate change", Action VIII-"Accelerate the breeding of the target crops through a combination of conventional & modern breeding techniques and actively introduce new varieties into crop production", and Action X- “Promote Germplasm and Information Exchange among In-country Institutions and with International Organizations and Foreign Institutions.” within the framework of the "National Strategic Action Plan for the Food Crop Genetic Resources Management to Adapt to Climate Change in the DPR Korea" (NSAP) which was developed through the BSF-funded project in 2013.

### 2.2. Project objectives: Overall and specific objectives

The proposed project was designed to improve the adaptation to climate change and enhance the food security of resource-poor farmers in the DPRK by strengthening the sustainable management of plant genetic resources for food and agriculture (PGRFA), thus ultimately contributing to the achievement of Millennium Development Goals 1(to eradicate extreme poverty and hunger) and 7(to ensure environmental sustainability)

**Overall objective** is to increase the national cereal production by facilitating the development of wheat and barley cultivars adapted to the current and future climate change in the DPRK.

**Specific objectives** are: 1) to develop a competence of exploring and broadening genetic base and crop breeding for drought tolerance in wheat and barley. 2) To initiate a model research programme for promoting base-broadening, pre-breeding and breeding activities, particularly for drought tolerance of crops at genebank and agricultural research institutions.

The successful implementation of the proposed project will bring about the following **benefits(positive changes)** to the local population:

- Local and exotic germplasm accessions which have been proved to be useful in drought tolerance breeding will have been identified, conserved for use in drought tolerance breeding. The useful local and exotic accessions and their relevant information will have been made accessible both at home and abroad through multilateral system.
- Technologies will have been made available for drought-tolerance breeding and germplasm management, particularly with regard to wheat and barley. And a reliable channel for the transfer of advanced technologies from abroad will have been created.
- The capacities of the national genebank and local research institutes will have been increased to develop and implement research and breeding programmes for drought tolerance, particularly in wheat and barley.

- Local breeding programmes based on participatory approach for the adaptation and resilience to drought under climate change will have been initiated.
- Agricultural decision-makers, researchers and farmers will have become aware of the importance of genetic resources in adapting to drought.

These benefits will lead to the development of drought-tolerant wheat and barley cultivars that will contribute to the sustainable grain production under climate change.

## 2.2. Targeted outputs, activities and related methodology of implementation

**OUTPUT 1.** Local and exotic germplasm accessions of winter wheat and spring barley characterized, conserved and used for drought tolerance breeding.

**Activity 1-1:** To collect 20 promising exotic accessions from CIMMYT and IPK, Germany including wild relatives or species

- Pyongyang Crop Genetic Resources Institute(PCGRI) will contact and request CIMMYT and IPK, Germany to provide necessary germplasm accessions before the official start of the proposed project in September, 2015. The accessions can be chosen in consultation with CIMMYT and IPK, Germany.

**Activity 1-2**: To characterize, regenerate, conserve 80 local accessions and 20 exotic accessions(including 3 accessions of promising wild relatives or species) of each of winter wheat and spring barley germplasm for important traits, particularly, drought tolerance, and conserved at the national genebank.

- 4 researchers of the PCGRI and the Field Crop Research Insitute(FCRI), and 3 farmers of each of 3 farms will be directly responsible for the trials conducted concurrently at 3 farms for 2 crop seasons(yr. 2015 to 2017).
- In the first year, the accessions are grown on fields for multiplication as well as characterization. Characterization is done with reference to the germplasm descriptor lists(including drought tolerance) at the national genebank, and for important traits including drought tolerance at the FCRI and 3 targeted farms. In the second year, the multiplied seeds are distributed among targeted farms for characterization, selective crossing, and further multiplication for multilocational trials.
- The field trials are conducted by participatory approach with active involvement of researchers and farmers.

**Activity 1-3**: To make 5 $F_1$ progenies and 5 $F_2$ populations from crossings, each between elite local varieties and drought tolerant exotic germplasm accessions of each of wheat and barley.

- Researchers from PCGRI and FCRI make crossings and advance generations during 2 periods: one from July to August, 2016 in Julius Kühn-Institut (JKI), Federal Research Centre for Cultivated Plants(FRCCP), and the other in May, 2017 in the FCRI and PCGRI.
- For each crop, in 2016, at least seeds of 5 local varieties are sent to the JKI, Germany for growing together with well-proved drought tolerant germpalsm accessions in a greenhouse. 3 researchers who will have a hands-on training in Germany will make crosses under the supervision of German experts. The seeds will be sown in the following crop season for harvesting seeds of at least 5 $F_2$ genetic populations.
- For each crop, in 2017, the local and exotic germplasm accessions, which have been identified to be promising for the development of at least 5 F1 drought tolerant progenies in yr. 2016 trials, will be planted and crossed among them according to pre-designed schemes in PCGRI.

**Activity 1-4:** To multiply the seeds of at least 3 accessions of each of winter wheat and spring barley for multilocational trials.

- Researchers from PCGRI and FCRI and farmers of 3 targeted farms jointly identify promising germplasm accessions in the trial fields in the crop season of 2017.
- On the basis of the evaluation done by participatory approach in the 2 crop seasons in 2016 and 2017, the researchers and farmers of targeted farms will identify and separately harvest seeds of promising accessions for the multilocation trial in the following season.

**OUTPUT 2:** Technologies for drought-tolerance breeding and germplasm management, particularly with regard to wheat and barley, transferred from abroad.

**Activity 2-1**: To conduct a hands-on practical training abroad of 3 researchers .

- 3 researchers(2 breeders and 1 biotechnologist) will participate in a hands-on training abroad from mid-July to the end of August, 2016(45days) in Julius Kühn-Institut (JKI), Federal Research Centre for Cultivated Plants(FRCCP), Germany.
- Through the practical training, the participants will learn the following knowledge and techniques:

Marker-assisted selection technique for drought tolerance in wheat and barley.//Procure selected primers for local use//Collection of the genomic data of wheat and barley and the methodology of interpreting and using them.//Collection of reference books and articles related to the pre-breeding, drought-tolerance, wheat and barley breeding, on-farm conservation, etc.//On-field trial method for drought tolerance in wheat and barley.//Methodology of using wild relatives or species for pre-breeding and base-broadening//Collection of more than 20 promising germplasm accessions of each of wheat and barley.

- The participants will be involved in the on-going research programmes for MAS and pre-breeding for drought tolerance in wheat and barley, and work together with German researchers. They will make at least 5 hybrids of each crop between local varieties(sent to Germany for planting) and promising exotic accessions(to be chosen through discussion with German experts before training abroad). The seeds of hybrids will be harvested and sent to DPRK by German experts after the return home of the participants.

**Activity 2-2**: To make up a joint research programme between PCGRI and JKI for the pre-breeding and breeding of elite drought tolerant cultivars of winter wheat and/or spring barley.

- During the hands-on training abroad in 2016, the participants will design for a joint research programme, together with German experts. Through this, they will learn how to develop breeding and pre-breeding programmes.
- The joint research programme will be further improved through discussion during the project period on the basis of experiences.

**OUTPUT 3.** Information on promising germplasm accessions, breeding techniques and pre-breeding for drought tolerance in wheat and barley created, documented and disseminated both at home and abroad.

**Activity 3-1**: To make up 2 technical protocols for the characterization and pre-breeding of winter wheat and spring barley germplasm, and distribute them among relevant researchers and farmers.

- 3 researchers and 3 breeders of the PCGRI and FCRI will prepare the protocols in January to March, 2017, referring to the collected information and reference books as well as the past experiences and local reference books.
- The technical protocols will be examined by the AAS scientific screening committee before publication and distribution.

**Activity 3-2**: To integrate the genomic data of wheat and barely into the databases of "National Genetic Resources Information System" for ready access by users.

- The genomic data which the participants in practical training abroad will have collected will be integrated into the current "National Genetic Resources Information System" by two PCGRI 's IT specialists by the end of 2016.

**Activity 3-3**: To add the data(passport, characterization and conservation) of 100 accessions of each of winter wheat and barely added to the germplasm database.

- The PCGRI will add into its current Genebank databases the data resulting from collection, characterization and conservation every after each of 2 crop seasons( in June,2016 and June, 2017),
- The data will be sent to Centro Internacional de Mejoramiento de Maíz y Trigo, Internacional( CIMMYT) and IPK for their integration into MLS in June, 2017.

**Activity 3-4**: To publish 2 scientific articles in public agricultural journals

- The researchers of PCGRI, FCRI and technicians of targeted farms will jointly prepare 2 scientific articles, one on characterization of germplasm accessions for drought tolerance by November, 2016, and the other on the brief introduction to pre-breeding for drought tolerance by March, 2017.
- In these articles, some practical experiences and the activities of the on-going project will be contained.

**OUTPUT 4**: Increased capacity of farmers to identify, on-farm conserve and use wheat and barley germplasm accessions with promising traits like high yield and drought tolerance.

**Activity 4-1**: To provide the 3 targeted farms with equipment, instruments and materials essentially needed for on-farm germplasm management

- The equipment, instruments and materials necessary for on-farm germpalsm conservation, seed production, and field trials, particularly for drought tolerance will be provided to the 3 targeted farms from September, 2015 to march, 2016 .
- Researchers of the PCGRI and FCRI will survey the existing conditions to identify necessary items for on-field trials for drought tolerance and other characterization, and germplasm conservation.

**Activity 4-2**: To conduct 2 workshops for the farmers of 3 targeted farms

- Participants: 4 officials of 2 county rural management boards and 9 technicians and 15 farmers of the targeted farms
- Periods and sites: the 1st one – 3 days in February, 2016 in Pyongyang, and the 2nd one- for 3 days in February, 2017 in Unsan county
- Topics: on-farm management of wheat and barley germplasm// participatory approach to wheat and barley breeding// on-farm seed production of wheat and barley// characterization of drought tolerance of wheat and barley// methods of field trials
- Methodology: the researchers of the PCGRI and FCRI will prepare training materials: one participant of each targeted farm will prepare a presentation on the wheat and barley production and seed management. At the end of the workshop, questions and answering will be done to evaluate and consolidate the learnings

**Activity 4-3**: To conduct one national workshop on on-farm germpalsm management and participatory approach in wheat and barley germplasm management and breeding.

- Participants: a total of 42 persons(3 officials of MoA, 9 officials of Provincial Rural Management Boards, 9 technicians of the 9 experimental farms of Provincial Subsidiary Academies, 9 technicians of 9 cooperative farms including the targeted farms, 12 officials and researchers from the research institutes and headquarters of the AAS)
- Periods and sites: 2 days in early June in 2017 in Pyongyang and Unsan county

- Topics: Worldwide trends in plant genetic resources management//on-farm management of wheat and barley germplasm// participatory approach to wheat and barley breeding// on-farm seed production of wheat and barley// characterization of drought tolerance of wheat and barley// methods of field trials
- Methodology: the researchers of the PCGRI and FCRI will prepare presentations and training materials on the basis of the findings from the past workshops: one participant of each targeted farm will prepare a presentation on their experiences. Participants will visit the national Genebank, the FCRI and one of the 3 targeted farms.

**OUTPUT 5**: Increased capacity of the national genebank, 2 research institutes(PCGRI, FCRI) and Provincial Subsidiary Academies of Agricultural Sciences to successfully characterize, conserve and use drought tolerant germplasm accessions of winter wheat and spring barley.

**Activity 5-1:** To conduct 1 workshop on molecular maker-assisted selection of drought tolerance.

- Participants: 12 researchers from PCGRI, FCRI, Agrobiology Research Institute
- Period: 4 days in April, 2017
- Topics: Worldwide trends in MAS in germplam characterization and crop breeding// Application of MAS for drought tolerance in wheat and barley// Interpretation and use of Genomic data// Current status of MAS in our country// hands-on practice of MAS for drought tolerance
- Methodology: the information and techniques obtained from the practical training abroad in Germany will be used for the workshops. The first and second day is for theoretical and discussion, and the other 2 days for hands-on training using samples taken from wheat and barley fields and also a guided visit to the National Genebank and one of the targeted farms.

**Activity 5-2:** To conduct 2 workshops on the pre-breeding and breeding for drought tolerance.

- Participants: In total, 2 officials of AAS, 50 breeders and researchers from PCGRI, FCRI, 9 provincial AASs( 26 persons in each of 2 workshops)
- Period: the 1st one -3 days in September, 2016, and the 2nd one-3 days in March, 2017
- Topics: Worldwide trends in pre-breeding and breeding for drought tolerance and other abiotic stress tolerance// Wild relatives and species available for wheat and barley breeding// Methodology and techniques of pre-breeding for drought tolerance// Application of MAS for drought tolerance in wheat and barley// Interpretation and use of Genomic data// Current status of Wheat and barley breeding in our country// Participatory approach in crop breeding//Discussion on the design of pre-breeding and breeding programmes for drought tolerance// Introduction to Genebank databases.
- Methodology: the information and techniques obtained from the practical training abroad in Germany will be used for the workshops. The first workshop is for the target research institutes while the second one is for the other research institutes and 9 provincial AASs. The findings from the 1st workshop will be integrated into the 2nd workshop. Questioning and answering will be encouraged. The 3rd day is for the discussion on research programmes and a guided visit to the National Genebank and one of the targeted farms.

. **Activity 5-3**: To develop 2 pre-breeding research programmes and breeding programmes for drought tolerance in wheat and barley involving different relevant agricultural research institutes and cooperative farms.

- the Scientific Guidance Department of the AAS will organize a team of 4 experts for the formulation of the programmes in October, 2016, who will be assigned to finish the formulation by the end of May, 2017.
- The team members will lead the discussions in all the workshops to collect necessary information, and based on it, formulate the programmes, which will be screened by the Scientific Screening Committee by the end of June, 2017 for official approval.

**2.4. Targeted PGRFA**

- Winter wheat and spring barley are the targeted PGRFA

- In the project, local germplasm accessions including local cultivars of winter wheat and spring barley which are conserved in the national genebank, and exotic germplam accessions of wheat and barley including wild relatives and species which have been proved to be highly tolerant to drought and are conserved in IPK, Germany and CIMMYT(through MLS). The exotic accessions are preferred to be able to mature by the end of June in our country, and in case of winter wheat, need to have strong winter hardiness, high yield potentials and good nutritional traits.

- Within one year of the completion of the project, the information on a total of 160 local germplasm accessions of winter wheat and spring barley and their seeds will be made available at national and international levels according to the terms and conditions of MLS. The information, particularly the characterization data of the exotic germplasm accessions collected from abroad during the project which will result from the field trials in the DPRK will be also made available

**2.5. Target groups and beneficiaries**

- Direct beneficiaries:

- A total of 65 persons(63 researchers and 2 officials) of the AAS. Out of which 3 researchers will participate in a practical training abroad, and the 62 researchers will participate in 3 in-country workshops. They will support or directly engage themselves in field trials, preparation of training materials, technical protocols, formulation of research programmes, scientific articles. The benefits to them include knowledge and techniques for MAS and breeding, broad-based and enhanced germplasm, equipment and materials, and support from farmers and decision-makers.
- 3 officials of MoA, 9 officials of provincial rural management boards, 4 officials of 4 county management boards, 9 farm managerial staff persons of 9 cooperative farms: 15 farmers of 3 Targeted farms. They will participate in workshops, and support for the involvement of target farms and farmers in the project. They will give suggestions for the project implementation. The benefits to them include fermented links with the AAS in adapting to climate change, knowledge and techniques learned for on-farm breeding activities, and drought tolerant germplasm available for direct use at farms.
- About 600 farmers of the targeted farms will be benefited from the equipment and materials needed for on-farm germpalsm characterization and conservation of wheat and barley germplasm as well as promising drought tolerant accessions or cultivars selected through field trials.

  A stakeholders' meeting with the participation of 1 MoA official, 2 AAS officials, 3 researchers and breeders from the PCGRI and FCRI, 3 farm technicians of the targeted farms was held at PCGRI to work out the concept note of this proposed project. In order to formulate the full proposal, a stakeholders' meeting was held again to discuss about the specific activities and methodology, PMT, specific needs, workplan.

- Indirect beneficiaries:
  - about 500 crop-related researchers and breeders will update their knowledge and techniques by use of the information collected or created by the project

- about 300 households( on average, 4 persons per household) of the 3 targeted farms. They will be benefited from increased wheat and barley yields resulting from the use of drought tolerant cultivars appropriate to their local conditions.
- Ultimately, about 4,387,000 producers at about 3080 co-operative farms, Crop breeders, breeding institutes and seed producers. The DPRK population(about 24,625,000 people) through the improved food security.

**2.6. Impact and impact pathways**

Overall, through the project, technical packages for drought tolerance in wheat & barley will be put in use, replicated in other crops, which will facilitate the development of cultivars of other crops as well as wheat and barley adapted to climate change, thus contributing to the national adaptation activities in crop production under climate change. The development and introduction of genetic base broadening and pre-breeding is one of the important strategic issues considered and integrated in the NSAP, particularly Action V, and VIII and X. Hence, the project will contribute to the achievements of the expected outputs of the NSAP, which will in turn contribute to the national food security. The information and germplasm accessions generated/identified will be put in MLS at national and international levels for the use of local and foreign users.

**2.6.1. Food security and poverty alleviation**

Winter wheat and spring barley are important crops which are popular among farmers as the crops that alleviate food scarcity normally occurring in May to July. However, prolonged drought periods in recent years sharply downslide the yields of wheat and barley crops at farms. Farmers have no other option for adapting to drought than to grow maize and soybean instead of wheat and barley as the first crop. This will decrease the total grain yield and, moreover, the period of food scarcity will be further aggravated.

The project will develop a national capacity of developing drought-tolerant wheat and barley cultivars while empowering farmers of the targeted farms to be able to adapt to drought through the active support from the agricultural research sector. The project results brought about in the targeted farms will be a model to be extended across the country after the project.

**2.6.2. Adaptation to climate change and environmental sustainability**

As drought has not been a great problem in the DPRK in the past, adaptation measures related to drought has not come forward at both farming and research sectors. In the context that farms try to explore water resources either by digging wells and ponds, or forming water channels(this will result in much damage to land resources), drought tolerant wheat and barley cultivars will lead to a saving of water resources, with less disturbance of land resources.

**2.6.3. Scientific impact**

Through the project, advanced technologies like molecular maker-assisted selection and characterization of germplasm, pre-breeding for base-broadening and germplasm enhancement, genomic data interpretation and application in wheat and barley breeding will be transferred. These technologies have not been applied in germplasm management and breeding of wheat and barley in the DPRK.

The germplasm characterization data of wheat and barley will be supplemented with a new trait-drought tolerance, and the national germplasm stock enriched with drought-tolerant exotic accessions(base-broadening), so that users can choose drought tolerant accessions for breeding.

The pre-breeding programmes, the first-ever one in the national genetic resources management, will be developed and initiated for facilitating the use of genetic resources.

Technical packages resulting from the project will be directly used or replicated in other crops as well as wheat and barley. The germplasm accessions and their data will be kept in the national genebank for ready access by local users and through MLS.

**2.6.4. Capacity development and empowerment**

Base-broadening and germplasm enhancement has not been pursued in the crop genetic resources management. Germplasm characterization programmes have been conducted under natural conditions, which lowering the reliability and reproducibility of characterization data.

The project will provide technologies related to drought tolerance like MAS, elite germplasm, field trials under artificial conditions, genomic data, so that the national genebank, PCGRI and FCRI will be able to actively and scientifically pursue investigations into wheat and barley. The technical packages including pre-breeding methodology will be extended to other crops. The outputs of the proposed project will be utilized through pre-breeding and breeding research programmes which will be designed within the project implementation and periodically updated after the project.

The targeted farms will be able to manage their own wheat and barley germplasm on their farms, and identify or develop promising germplasm useful to the production of wheat and barley and other crops. This will create a model for a nation-wide extension after the project.

## 2.7. Relevance to national or regional priorities in its plans and programmes for PGRFA

The outputs of the proposed project will be conducive to the successful implementation of the "National Strategic Action Plan for the Food Crop Genetic Resources Management to Adapt to Climate Change in the DPR Korea" (NSAP) which was developed through the BSF-funded project in 2013.

The project is highly relevant, among others, to the following actions and their specific activities:

Action V-*"Identify the genetic resources of target crops adapted to eco-regions & stresses and improve genetic bases under Climate change".*

Action VIII-*"Accelerate the breeding of the target crops through a combination of conventional & modern breeding techniques and actively introduce new varieties into crop production"*

Action X- "*Promote Germplasm and Information Exchange among In-country Institutions and with International Organizations and Foreign Institutions."*

By contributing to the successful implementation of the NSAP, the proposed project will improve the adaptation to climate change and enhance the food security of resource-poor farmers in the DPRK by strengthening the sustainable management of plant genetic resources for food and agriculture (PGRFA), thus ultimately contributing to the achievement of Millennium Development Goals 1(to eradicate extreme poverty and hunger) and 7(to ensure environmental sustainability).

## SECTION C: OPERATIONS

### 3.1. Methodology of project implementation

The key elements of the project implementation are to transfer promising germplasm, information and technologies to local conditions, to strengthen the capacities of research and farming sectors, and to apply the transferred knowledge and technologies to develop genetic populations for use in the pre-breeding and breeding programmes for drought tolerance and to develop pre-breeding and breeding programmes for drought tolerance based on a participatory approach.

In consideration of the cropping season of winter wheat from October to the following June, and that of spring barley from March to June every year, the proposed project will be officially started in September. 1, 2015 and finished in July, 31, 2017(for 23 months)

The proposed project will be implemented under the guidance of and support from the National Crop Genetic Resources Management (NCNCGRM) consisted of the decision-makers of stakeholders and scientists, in such a way as to successfully implement the "National Strategic Action Plan for the Food Crop Genetic Resources Management to Adapt to Climate Change in the DPR Korea" (NSAP) which is now implemented under the coordination of the NCNCGRM with the involvement of different governmental organizations like ministries, academies, farm communities. The National coordinator will regularly report to the NCNCGRM and should get support from it whenever and whatever needed.

As no programmes have been pursued for DT in wheat & barley at genebank and breeding institutes in the DPRK, collection of promising germplasm and technology transfer are of primary importance for the successful implementation of the project. Before the official start of the project(September, 2015), A no-cost pre-project activities will be implemented for 4 months to contact with CIMMYT, IPK and JKI to check and identify promising germplasm and necessary information needed fro the successful implementation of the project. Linkages with the Julius Kühn-Institut (JKI), Federal Research Centre for Cultivated Plants(FRCCP), Germany and CIMMYT will be made for training, and the technical information and access to germplasm accessions through Multi Lateral System (MLS).

In order to collect necessary germplasm accessions and information, which will be referred to in the inception phase for finetuning the project workplan, official contacts with international institutions will be made 4 months before the official start of the proposed project(September 1, 2015)

The project will include one-month inception phase, in which a conference of relevant partners(AAS, MoA, targeted farms) to discuss the detailed workplan and specific responsibilities of the partners. The project management team and their terms of reference will be introduced.

During the project, contacts and linkages with decision makers of AAS and MoA, researchers and breeders at the crop- related research institutes & PSAASs as well as farmers of the targeted farms will be made to exchange the information, recommendations, experiences and also to use locally available technical resources through meetings, conferences and workshops. This will ensure the sustainability of the project results as well as successful implementation of the proposed project.

As the proposed project aimed at increasing the capacities of both research and farming sectors, participatory approach will be a principle of any conferences or discussions in designing and implementing the project activities.

For the successful implementation of the project, monitoring and evaluation will be regularly organized. the FAO Country Office will avail one officer who will regularly monitor all implementation activities. Monitoring will be undertaken at 4 important

stages of the project cycle; the 1st one in February, 2016, the 2nd one around the end of July,2016, the 3rd one in February 2017, the 4th one around the end of June, 2017. .

**3.2. Partnerships and collaboration arrangements**

The Academy of Agricultural Sciences (AAS) will have overall responsibility for the execution of the project.

The roles of the major stakeholders in the project are highlighted as follows:

**1) Academy of Agricultural Sciences, DPRK (AAS)**

It will be responsible for undertaking scientific activities related to germplasm collection, characterization, evaluation, workshops, and the facilitation of information exchange, the collection, database build-up and provision of agricultural information.

① Pyongyang Crop Genetic Resources Institute (PCGRI): As a national Genebank, it undertakes the germplasm collection, conservation, characterization and information management. It provides expertise for field trials and workshops. It provides experts for the participatory activities for on-farm germplasm management at targeted farms.

② Field Crop Research Institute(FCRI): It provides expertise related to the breeding of wheat and barley for field trials and workshops. It provides experts for the participatory activities for participatory breeding at targeted farms.

③ Agrobiology Research Institute: It provides expertise for molecular marker-related activities, and allow its labs to be used for training workshops when needed.

④Agriculture Information Technology Research Centre (AITRC): It provides expertise for the information management at the national genebank, and is responsible for the publication of technical protocols and scientific articles.

⑤ Specialized research institutes of provincial subsidiary academies of agricultural sciences (PSAAS-RIs): They provide participants in workshops, give suggestions and provide experiences, and conduct extension activities..

**2) Ministry of Agriculture (MoA)**

As a government agency responsible for agricultural production, it governs all the cooperative farms(basic farmers' organizations), seed farms, and other agricultural sectors. It is the key government agency that will provide administrative support and policy guidance to facilitate implementation of project activities through its subordinated organizations at different tiers of administrative jurisdiction.

It provides administrative support for the involvement of targeted farms in the project implementation, and the participation of farmers in workshops. It is responsible for the extension activities within and after the project.

**3) 3 targeted cooperative farms: (Namsan Cooperative Farm, Unsan cooperative farm, and Huasong Cooperative Farm)**

As the basic farmers' organizations to which all the farmers of the whole country are affiliated, they provide whatever information requested for the project implementation like the information on their local climate and agro-ecological conditions, farmers' awareness of genetic resources management of target crops, fields for trials. They organize a team which is responsible for the project implementation, and allow the visits of workshop participants as well as necessary missions for project activities.

**4) Food and Agriculture Organization of the United Nations (FAO):**

It will provide technical and operational support to project implementation activities through its offices in Pyongyang, Beijing, Bangkok and Rome.

FAO office in Pyongyang will provide the operational support to the PMT. FAO experts will provide the required technical backstopping support to the NPC for the implementation of the project activities through its Headquarters in Rome and the Regional Office for the Asia-Pacific (RAP) in Bangkok. The PMT will be located in Pyongyang at the Pyongyang Crop Genetic Resources Institute of the AAS. The NPC

will work closely with FAO Country Office and national experts to ensure that project outputs are effectively delivered.

**5) Julius Kühn-Institut (JKI), Federal Research Centre for Cultivated Plants(FRCCP), Germany.**

It will be a foreign partner institute. It will provide expertises and advanced techniques like drought tolerance field trials, MAS, genomic data, information and germplasm, and practical training to the AAS researchers and breeders. When the DPRK delegation visited the JKI in 2012, the project concept was discussed, and after return home, further elaborated via email for the submission of the concept note of the project.

**6) Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) Gatersleben, Germany**

It will provide germplasm, expertises and advanced techniques like drought tolerance field trials, MAS, genomic data, information. When the DPRK delegation visited the IPK in 2012, the project concept was discussed, and after return home, further elaborated via email for the submission of the concept note of the project.

**7) Centro Internacional de Mejoramiento de Maíz y Trigo, Internacional(CIMMYT)**

It will provide expertises for drought tolerance field trials, MAS, genomic data, information and germplasm.

**3.3. Project management team**

A full-time National Project Coordinator (NPC) will be appointed by the AAS for the implementation of the project. The project will be implemented in close cooperation and coordination with relevant agencies in the United Nations (UN) system.

A Project Management Team (PMT) led by a National Project Coordinator (NPC) appointed by the AAS will be responsible for the overall project implementation. The project team will be consisted of 3 AAS official & experts, 1 MoA official and 1 farm managerial staff person.

The PMT would seek advisory and administrative support from the Non-standing Committee for the National Crop Genetic Resources Management (NCNCGRM), which was organized in 2012 and is now in operation.

| № | Name | Position/occupation | Responsibility | Field of Experience |
|---|---|---|---|---|
| 1 | KIM Hung Gyun | Senior officer, Department of International Science and Technology Exchange, AAS | <u>National Project Coordinator</u><br>·Coordination of the overall project implementation.<br>·Collection of International information, germplasm accessions.<br>·Organization of international activities for the project.<br>· Finalizing the specifications of the project equipment/supplies,<br>· Bookkeeping.<br>· Organization of workshops and meetings.<br>· Issues related to International law and regulations. | ·Currently, coordinator for international cooperation projects related to ITPGR, FAO, UNEP, EU and BIOVERSITY.<br>· Formerly, coordinator for the CFC cooperation project for rehabilitation of potato production. |
| 2 | KIM Sang Il | Team leader PCGRI, AAS | <u>Technical Coordinator</u><br>·Advising/Coordination of scientific and technical activities.<br>·Activities related to the germplasm management , particularly characterization, conservation, | · Responsible for consultancy for the national crop genetic resources management<br>· Head of germpalsm |

| | | | | |
|---|---|---|---|---|
| | | | information management, molecular maker selection., workshops<br>· On-farm field trials<br>· Activities related to capacity building of the PCGRI. | conservation and analysis.<br>· Formerly, Technical coordinator for the formulation of NSAP |
| 3 | RI Jong Su | Team leader, FCRI,AAS | · Activities related to field trials, crossing and workshops.<br>· on-farm field trials<br>· Activities related to capacity building of the FCRI | · Currently, involved in programmes for wheat/barley breeding.<br>· Head of wheat and barley breeding team. |
| 4 | RIM Bong Hyok | Senior Officer, Seed Department, MoA | · Support for mission trips to farms, on-farm activities and training workshops.<br>· on-farm field trials.<br>· Activities related to capacity building of targeted farms. | · Responsible for national variety release and seed production and distribution of food crops. |
| 5 | KIM Song Kil | Farm Manager, Unsan cooperative farm | ·Activities related to workshops, field trials, germpalsm selection, and capacity building of targeted farms. | ·Managing a farm<br>· Formerly a researcher in germplasm management sector. |

### 3.4. Sustainability

**Sustainability of the project**

The proposed project activities will be implemented with a main objective of ensuring the long-term sustainability of the expected results.

The proposed project was designed and will be implemented under the guidance of and support from the National Crop Genetic Resources Management (NCNCGRM) consisted of the decision-makers of stakeholders and scientists. The NCNCGRM is mandated to successfully implement the proposed project and consolidate and extend the outcomes of the project.

- The trained researchers and farmers will be the main actors for the technology transfer to the individuals of the partner institutions, target groups and stakeholders, constituting an integral part of the tangible impact on the target group of the project. Germplasm and information resulting from the project will be integrated into the national genebank germplasm as well as into the MLS for ready access by users.

- The installations, equipment and technical information, research and training which will be provided by the project will constitute an important condition for the continued research and extension activities within and after the project. thus being another part of the tangible impact on the target groups.

- The partnership with IPK, Germany and CIMMYT which will be cemented through the project will facilitate the technical support from not only from them but also from other international and other regional institutions through their mediation.

**Financial Sustainability**

As the project implementation is within the framework of the NSAP, financial support will be given from the government as well as the NSAP during and after the project.

In the context of the substantial negative impact of climate change like drought , the DPRK Government is actively committed to solve the food problem by its own efforts and gives importance to the adaptation to climate change in agriculture. In its endeavour, the Government has given strategic assignments to the AAS to develop and extend adapted cultivars and cultural techniques.

**Institutional Sustainability**

In the DPRK, the research institutes of the AAS- PCGRI(national genebak) and FCRI are the two institutes directly responsible for the wheat and barley genetic resources management and wheat and barley breeding. They coordinates and organize such programmes across the country.

PCGRI, FCRI, and breeding and research teams of provincial subsidiary academies of agricultural sciences which are engaged in wheat and barley breeding across the country will participate in the project activities like workshops and formulation of pre-breeding and breeding programmes under the coordination of the Department of Scientific and technological Guidance of the AAS. In these programmes, experimental farms and cooperative farms will be involved. The programmes will be multi-partner programmes involving research and farming sectors. And the physical capacities provided by the project will be used by relevant researchers and breeders when needed.

Relevant officials(decision-makers)of the Ministry of Agriculture and provincial and county rural officials will participate in the training workshops, conferences and discussions in the project.

The technology provided by the project will be extended across the country through the Nationwide Agricultural Technology Extension System which is regularly organized at national, provincial and county levels. The targeted farms will serve as model farms, and the physical capacity.

**Policy level sustainability**

Green revolution is a Government's strategic policy for the national agricultural development. Drought-tolerance breeding is conducive to the implementation of this national policy. With a view to sustainable agricultural production and food security in the context of harder drought phenomena in recent years, the Government has launched a national movement against drought, which focuses on the development of drought tolerant crops and cultivars, the exploration of water resources, and development and application of different techniques for the efficient conservation and use of water resources. Particularly, the development and planting of drought tolerant crop cultivars is regarded as one of the important tasks in implementing the Government's strategy for alleviating drought damage in agriculture.

The AAS is mandated to provide scientific and technical consultancy and support to the MoA, and the officials of the AAS and MoA will be involved in the project activities. Hence, decision-makers at the AAS and MoA will become aware of the needs and possibilities of adapting to drought through accelerating the enhancement and utilization of crop germpalsm.

## SECTION D: APPENDIXES

By signing this submission form for full proposal, the applicant confirms that all the above statements, including the attached Appendixes, are true to the best of his/her knowledge. Any deliberately untruthful response will lead to the automatic exclusion from the further screening and appraisal process, and may lead to the denial of awarded grants from the Benefit-sharing Fund.

**Signature of contact person:**

Dec. 1, 2014. Pyongyang.

**Date and location**