

Project Concept Template

Project Proposals for the RCA Programme 2024/2025

Part 1: Information Sheet

Project proposals for the RCA Programme 2024/2025 are to be prepared using the attached template and submitted **BEFORE 31ST OF DECEMBER 2021**. Completed templates will be reviewed by the RCA PAC in January 2022.

Resource documents required for developing Project Concepts can be found in the RCA web-site – ([RCA Regional Office \(rcaro.org\)](http://rcaro.org)), under Projects/Resource Documents. (see below for the list of resource documents).

The Project Concept should be prepared in consultation with the stakeholders of the other participating GPs. Information on RCA stakeholders can be found in the RCA web-site ([RCA Regional Office \(rcaro.org\)](http://rcaro.org)), under Projects/Project Information.

Please request access to the RCA Members Only web-site from RCARO (email: rcaro@rcaro.org) through your National RCA Representative if you do not already have access.

A proposal will be evaluated against the following criteria:

- Alignment of the objectives with priorities set out the RCA Regional Programme Framework (RPF) for 2024/25.
- Whether the project addresses a regional need.
- Whether nuclear technology is an essential component of the project.
- Whether outcomes and achievements of previous projects in this area of technology are considered.
- Does the proposal overlap or duplicate current or previous RCA projects?
- Is a convincing case made to justify further projects in this area?
- Is there a strong TCDC component?
- If the proposal is essentially an extension of previous projects in this area that have been implemented for more than 2 TC Cycles, does the proposal include arrangements for the transfer of project leadership to another GP?

List of Resource Documents on RCA web-site (www.rcaro.org)

1. Timeframe for preparation, review and approval of Project Concepts
2. Brochure on Logical Framework Matrix (Quick Reference Guide on Designing IAEA TC Projects)
3. RCA Regional Programme Framework for 2024-29
4. Details of RCA TC Projects implemented in 2007-2019
5. List of TC Projects being implemented in 2020/21 and projects approved for 2022/24
6. Recommendations on Technical Cooperation among Developing Countries (TCDC)

Please note that your National Representative will be reviewing the concept document to ensure that it has been prepared in compliance with the RCA and IAEA Criteria for TC Projects

Please contact the Chair of the RCA Programme Advisory Committee, Dr. Prinath Dias at prinathd@yahoo.com if you need assistance.

Part 2: Concept Template¹

Title:

The title should be as concise as possible and should summarize the objective of the project.

Mutational Biofortification for Improving the Nutritional Quality of Food Crops in Asia and the Pacific Region

Analysis of gaps / problems / needs as applied to the RCA region:

Outline the major gaps / problems / specific needs to be addressed by the project (~ max 300 words):

According to the report of “Asia and the Pacific Regional Overview of Food Security and Nutrition 2020: Maternal and Child Diets at the Heart of Improving Nutrition” by UN agencies in January of 2021, there are more than 350 million people in the Asia and the Pacific were undernourished in 2019, which was roughly half of the global total. The poor diets and inadequate nutritional intake are severe ongoing problems. It would be the most economic and effective approach to achieve food and nutrition security by supplying daily grains with improved higher content of vitamins and microelements, such as Ca, Mg, Zn, Fe, and so on.

Biofortification is the process of improving the nutritional quality of food crops. To develop more nutritional varieties of food crops is an effective and economic way to solve the problem of large malnourished population in Asia and the Pacific region. Developing food crop varieties can be traditionally achieved through conventional breeding or genetic engineering approaches. However, both methods need either a long period or specific skills to achieve the breeding goals. Additionally, there are strictly biosafety regulations for genetic engineering crops planting in most of the GPs.

Mutation techniques have played a very significant role in combating such problem by creating new mutant germplasm and mutant varieties. The impact of induced mutations on crop improvement is reflected in more than 2000 officially registered mutant varieties have been released or approved for cultivation in the Asian and Pacific region. It would be important and urgent to have this project implemented to speed up the development of biofortified new food crop varieties with high yielding potential and high nutritional level by mutation techniques, and contribute to both food security and nutrition security of people in Asian and Pacific region.

Review the resource documentation and list any past RCA projects that have addressed similar problems/needs in this area of technology. Consider outcomes and achievements of previous projects, and avoid any overlap or duplication.

There is no specific past RCA project for addressing the considered issue in the new proposal. The past related RCA projects were as below:

RAS/5/040, “Enhancement of Genetic Diversity in Food, Pulses, and Oil Crops and Establishment of Mutant Germplasm Network (2003-2006)”. The mutant germplasm network was established and exchange of mutant genetic materials including varieties were enhanced.

¹ If you have not been involved in drafting a concept before and if you are not fully acquainted with the RCA and its Programme you are encouraged to support advice and assistance from your RCA National Representative.

RAS/5/045, “Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology (2007-2011)”. The major outcomes and achievements of this project were mutant germplasm and mutant varieties with improved protein content and capacity drought and salt tolerance.

RAS/5/056, “Supporting Mutation Breeding Approaches to Develop New Crop Varieties Adaptable to Climate Change (2012-2015)”. The new developed mutant crop varieties were tested for productivity, resource use efficiencies, and tolerance to abiotic stress under large field demonstration and/or commercialization across the region.

RAS/5/077, “Promoting the Application of Mutation Techniques and Related Biotechnologies for the Development of Green Crop Varieties (2017-2020)”. The major outcomes and achievements were green crops with high photosynthetic efficiency, ideal plant type, resistance to abiotic and biotic stresses and less agricultural inputs.

RAS/5/088, “Enhancing crop productivity and quality through mutation by speed breeding in the Asia Pacific Region (2021-2024)”. This project aims to integrate mutation induction with speed breeding method to upgrade the mutation breed efficiency for new variety development.

What are the major additional capabilities/skills in this area of technology that will be provided through this project (~ max 200 words).

New mutation induction protocol based on upgraded irradiation platform will be provided and shared within counterpart institutions through training courses.

Methodology for biofortified mutant screening and identification by using molecular markers and high-throughput phenotyping will be provided and shared through this project.

Methods and skills on QTL (quantitative trait loci) identification for important nutritional traits will be provided through this project.

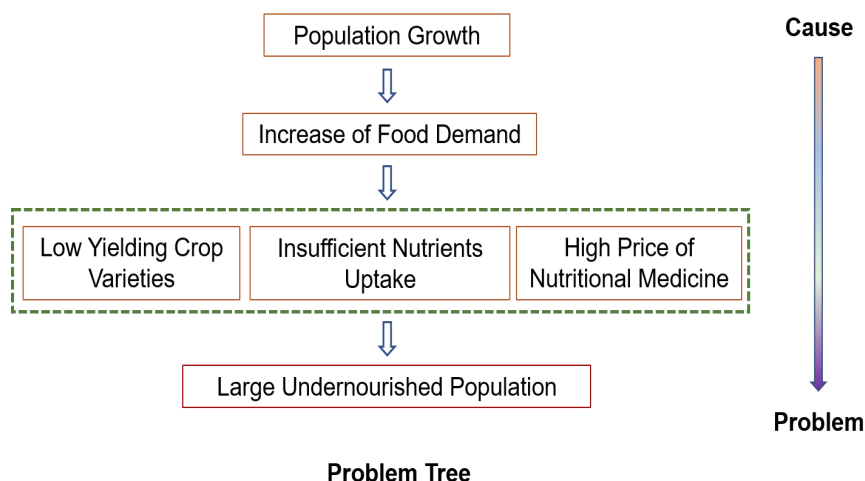
Overall Objective: (Required for the preparation of the IAEA Regional Programme Note)

State the overall long-term objective to which the project will contribute. This should reflect an impact related to the RCA Regional Programme Framework for 2024/29.

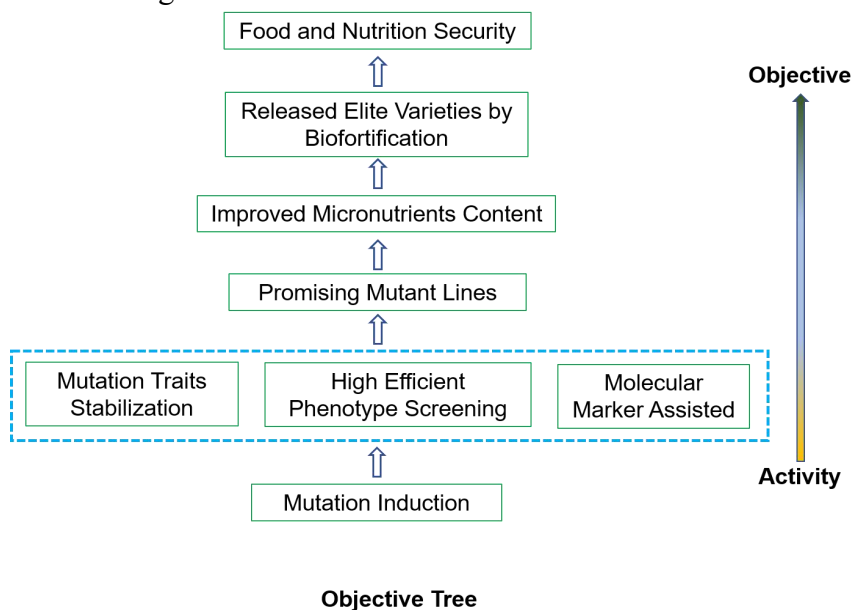
Through this project, the protocol to develop biofortification food crop germplasm and varieties will be established and shared within all participating GPs. Such methodology and crop varieties could significantly benefit to the large undernourished population in Asia and Pacific region in a long-term range. This is consistent with the recommended project areas of “Food Safety” and “Plant breeding” mentioned in the RCA Regional Programme Framework for 2024/29.

Problem and objective analysis using objective and problem trees is recommended. (See pages 9 and 10 of the Quick Reference Guide on Designing IAEA TC Projects in resource documents)

The problem tree is as following:



The objective tree is as following:



Project Outcome: (Required for the preparation of the IAEA Regional Programme Note)

The outcome is the planned result of a project, achieved through the collective effort of stakeholders and partners. It represents the change or improvement that occurs as a result of the project. Should be worded in past tense. (eg. The capability fordeveloped)

The capability for development and characterization of biofortification crops through mutagenesis techniques will be developed. The major planned outcome of this project includes optimized mutation induction and screening methodologies, promising mutant germplasm with enhanced nutrition contents, and elite biofortification crop varieties. Through this project, the young scholars from participating GPs will get well training on key skills of mutation breeding.

RCA Projects are to be designed to have a Socioeconomic Benefit:

What is the potential socioeconomic benefit that would be realised from the project concept over a 5 to 7-year horizon?

Micronutrient malnutrition, also known as hidden hunger, affects a large proportion of human population and is associated with long-range effects on health, learning ability, and huge economic losses, especially in

Asia and Pacific region. Biofortification is a food-based strategy of increasing the bioavailability or nutrients level in crops to improve human health in an economic way. By exploring mutational method, we can develop elite food crop mutant varieties with enriched micronutrients content to solve the problem of hidden hunger effectively. Millions of people will benefit from the outcome of this project over 5 – 7 years period.

Proposed Participating Government Parties:

List the Government Parties expected to participate in the project. Indicate target and resource GPs:

Host government party: China

Target GPs:

Bangladesh; Cambodia; Indonesia; Lao P.D.R.; Mongolia; Myanmar; Nepal; Pakistan; Philippines; Sri Lanka; Thailand; Viet Nam

Resource GPs:

Australia; China; India; Malaysia; Japan; Korea, Republic of

Technical Cooperation among Developing Countries (TCDC) Project Component:

Please refer to the resource documents (RPF and Recommendations on TCDC)

Will the project design feature partnering arrangements between those advanced and those less advanced in the technology to be transferred through this project?

If so, list those expected partnerships.

The project will provide technical cooperation to enhance national and regional capacities through regional training courses, expert missions and technical meetings, all the support and information will be provided on the use of methodologies and technologies for the induced mutation, accelerated breeding, and highly efficient phenotype screening to improve the micronutrients (including vitamins and microelements) contents of crop. The expected partnerships including:

- Regional training courses: young researchers from all the participated parties;
- Expert missions: specific advices and technical supports from those advanced to those less advanced;
- Technical meetings: scientists from all the participated parties.

Requirements for participation:

Indicate the minimum requirements that the counterpart institutions in Government Parties would need to meet in order to participate in this project.

The counterpart institutions in GPs should have their proper foundation to support their mutation breeding related research works, dedicated team (3-5 permanent persons at least) engaged in field and/or lab works, and basic resource like experiment station, green house, or molecular equipment needed by related field works and/or lab works.

Stakeholder analysis and partnerships:

Briefly describe who are expected to be the end-users and principal beneficiaries of this project. Indicate whether the end-users contributed to development of the Concept.

Crop breeders, related biotechnology researchers, agricultural universities, institutions and academies would be the beneficiaries of the proposed project. The farmers and the people suffering from hidden hunger would be the end-users. The end-users did not contribute to the development of this concept.

Have any extrabudgetary funding possibilities been identified?

No.

Role of nuclear technology:

Indicate the essential nuclear technique that would be used and outline why it is suitable for addressing the problems/needs in question.

The nuclear techniques including gamma rays, heavy ion beams, and protons would be used for mutation induction in this project. All the nuclear techniques listed above have been proved to be highly efficient to induce genomic mutation in plants genome to generate desired traits.

Is this the only available technique that could be applied to address the problem/ need?

No, it is not the only available technique. Conventional breeding method and some biotechnologies including transgenic approach and genomic editing technique could also be potentially applied to address the problem.

Does it have a comparative advantage over non-nuclear techniques?

Compare to the non-nuclear techniques, mutation breeding takes less time to obtain the target traits and elite lines. It will generally take 7-9 generations to get the desired plant traits by conventional breeding method, while it needs just 3-5 generations by mutation breeding. Additionally, the transgenic plants are strictly regulated in some GPs in Asia and Pacific region.

Duration of the project:

Indicate the number of years required to complete the project.

Four years, from 2024 to 2027.

Part 3: National Representative Endorsement for Project Concept

As the RCA NR of(RCA GP)....., I have reviewed the Project Concept thoroughly and confirm that it meets the following requirements:

1. The objective of the Project Concept is aligned with priorities set out the RCA Regional Programme Framework (RPF) for 2024/25.
2. The project addresses a regional need.
3. Nuclear technology is an essential component of the project.
4. Outcomes and achievements of previous projects in this area of technology have been taken into consideration
5. There is no overlap or duplication with current or previous RCA projects
6. Further projects in this area can be justified (if relevant)
7. The Project Concept has a strong TCDC component



Signature:

**Deputy Director General
Department of International Cooperation
China Atomic Energy Authority**

Name: Mr. HUANG Ping

Date: 31/12/2021