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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Item 4 of the Provisional Agenda

INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Ninth Session

Rome, 25-27 July 2018

PREPARING *THE THIRD REPORT ON THE STATE OF THE WORLD'S PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE*

TABLE OF CONTENTS

I. INTRODUCTION

1. The Multi-Year Programme of Work of the Commission on Genetic Resources for Food and Agriculture (Commission) foresees the presentation of *The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (Third Report) at the Commission's Nineteenth Regular Session. A review of the Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture (Second GPA) is foreseen for the subsequent session.[1]

2. The Commission, at its last session, endorsed the revised timeline for the preparation of the Third Report and the monitoring of the implementation of the Second GPA and took note of the revised provisional budget.[2] According to the revised timeline, the Commission should review the guidelines for the preparation of country reports for the Third Report at its forthcoming Seventeenth Regular Session. The Commission, at its last session, also requested FAO to adjust the list of thematic studies, as necessary and appropriate, and to consult the Intergovernmental Technical Working Group on Plant Genetic Resources for Food and Agriculture (Working Group) and the Commission on the thematic studies before work commences.[3]

3. This document provides background information on the preparation of the Third Report, proposes modalities for country reporting for the Third Report and provides a revised list of thematic studies.

II. BACKGROUND

4. FAO launched the first report on *The State of the World's Plant Genetic Resources for Food and Agriculture* (First Report) in 1996 during the Fourth International Technical Conference on Plant Genetic Resources[4]. *The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (Second Report) was endorsed by the Commission at its Twelfth Regular Session in 2009.[5] The Second Report, an update to the First Report, presented the changes and developments that had occurred since 1996. It provided an assessment of the status and trends of plant genetic resources for food and agriculture (PGRFA) and identified the most significant gaps and needs.

5. Both reports attracted significant attention and generated global policy responses. In response to the findings of the First Report, the rolling Global Plan of Action on the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture (GPA) and the Leipzig Declaration on Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (Leipzig Declaration)[6] were adopted by 150 countries at the Fourth International Technical Conference on Plant Genetic Resources in 1996. The Leipzig Declaration provided added impetus for the revision of the International Undertaking on Plant Genetic Resources[7]. This revision resulted in the International Treaty on Plant Genetic Resources for Food and Agriculture (Treaty). In response to the Second Report, the Commission revised the GPA and the FAO Council, on behalf of the FAO Conference, adopted the Second GPA, in 2011.[8]

6. It is envisaged that the Working Group, at its Eleventh Session in 2022, and the Commission, at its Nineteenth Session in 2023, will review the draft Third Report. As per the agreed timeline, the Third Report will be based, *inter alia*, on two cycles of country reports on the implementation of the Second GPA (January 2012 – June 2014 and July 2014 – December 2019).

[1] CGRFA-16/17/Report Rev.1, *Appendix C.*
[2] CGRFA-16/17/Report Rev.1, paragraph 66. For the revised time-line, see CGRFA-16/17 /17 *Appendix I* ; for the revised provisional budget, see CGRFA-16/17 /17 *Appendix II.*
[3] CGRFA-16/17/Report Rev.1, paragraph 67.
[4] ITCPGR/96/REP, paragraphs 13-14.
[5] http://www.fao.org/docrep/013/i1500e/i1500e00.htm
[6] http://www.fao.org/FOCUS/E/96/06/more/declar-e.htm
[7] http://www.fao.org/wiews-archive/docs/Resolution_8_83.pdf
[8] CL 143/REP, paragraph 43.

III. COUNTRY REPORTING

7. Countries' periodic monitoring data on the implementation of the Second GPA form an important part of country reporting for the preparation of the Third Report. The outline of the Third Report mirrors the structure of the Second GPA which facilitates the use of the monitoring reports for the Third Report.

8. Countries had agreed to report by the end of last year on their implementation of the Second GPA between January 2012 and June 2014. As agreed by the Commission, a second monitoring report covering the period of July 2014 to December 2019, is due by the end of 2020. It is proposed that, for the preparation of the Third Report, countries complement the data generated from the monitoring exercises with a summative narrative providing the analysis of the progress made during the reporting period. This narrative should aim to identify the remaining gaps and constraints in the conservation and sustainable use of PGRFA. Both the data from the periodic monitoring exercises and the complementary analytical narrative would be entered into WIEWS. There would, thus, no longer be the need for a standalone Country Report.

9. The Third Report will, thus, be based on:

(i) data provided by countries on the implementation of the Second GPA for the period, January 2012 to June 2014;

(ii) data to be provided by countries, in line with the agreed monitoring framework[9], for the period of July 2014 to December 2019;

(iii) a summative narrative of the progress made in the implementation of the Second GPA between January 2012 and December 2019 and the remaining gaps and constraints; and

(iv) thematic background studies.

10. The approach proposed for the preparation of the summative narratives is outlined in the document *Preparation of Country Reports for The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture*.[10]

IV. THEMATIC STUDIES

11. Studies on themes that are relevant to the conservation and sustainable use of PGRFA shall provide the context and background to the Third Report. In response to the Commission's request, FAO revised the list of proposed thematic studies considering recent developments, including feedback received from participants of an expert consultation held at the end of 2017 at FAO Headquarters.[11] While the five previously proposed studies remain relevant, an additional thematic study on seed policies is proposed.

12. The proposed revised list is given in *Appendix I* to this document, for review by the Working Group. The preparation of the thematic studies is expected to start once approved by the Commission, subject to the availability of necessary funds.

V. BUDGETARY REQUIREMENTS

13. As outlined in the revised budget presented to the Commission at its last session,[12] overall budgetary requirements for the preparation of the Third Report total USD 907 000 of regular programme budget resources and USD 1 702 000 of extra budgetary resources.

14. Financial support will be required to enable developing countries to prepare their Country Reports. Support will be required especially for organizing national stakeholder consultations, assessing the implementation of the Second GPA and conducting the analysis. To date, no extra-budgetary resources have been mobilized for this purpose.

[9] CGRFA-16/17/17, *Appendix I.*
[10] CGRFA/WG-PGR-9/18/Inf.9
[11] CGRFA-16/17/17, *Appendix III*
[12] CGRFA-16/17/17, *Appendix II.*

VI. GUIDANCE SOUGHT

15. The Working Group may wish to

(i) Recommend that the Commission invite countries to report through WIEWS starting in January 2020 and not later than 31 December 2020 on the implementation of the Second GPA for the period of July 2014 to December 2019, and provide, in line with the Guidance on Country Reporting, an assessment of progress made in the implementation of the Second GPA between January 2012 and December 2019 and an analysis of remaining gaps and constraints;

(ii) Review and revise, as appropriate, the approach proposed for the preparation of summative narratives as set out in the document *Preparation of Country Reports for The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture* and the list of thematic studies, for consideration by the Commission; and

(iii) Recommend that the Commission invite donors to provide the necessary extra-budgetary resources to support the preparation of the Third Report.

APPENDIX I

REVISED LIST OF PROPOSED THEMATIC STUDIES

In response to the Commission's request, a revised list of studies on cross-cutting themes that impact the conservation and sustainable use of PGRFA is proposed in this annexure. The thematic studies shall provide context for the Third Report. They shall catalogue emerging issues, advances and/or trends, especially in scientific and technological disciplines, legal and regulatory matters, policies, norms and societal developments. They shall therefore serve as reference materials that enhance access to validated information, technologies and decision-making tools, communities of practice and areas requiring strengthened capacities.

The proposed themes are:

- **Climate change**. Erratic extreme weather events will continue to impact on where and how PGRFA are conserved and used. It is for this reason that a majority of the Nationally Determined Contributions (NDCs)[13] to the implementation of the Paris Climate Accord[14] includes measures to adapt agricultural production to the vagaries of changing climatic conditions. Of particular import for the conservation and sustainable use of PGRFA, as climate change affects the natural habitats of CWR and wild plants harvested for food, their distribution and continuing evolution of adaptive traits will be impacted. The frequent occurrence of erratic extreme weather events also impels the development of hardy crop varieties that will continue to underpin food systems, especially in the vulnerable developing countries that subsist on low input production systems. Therefore, countries, in order to meet their obligations in the NDCs and to implement the related Sendai Framework for Disaster Risk Reduction[15] and the Koronivia Joint Work on Agriculture[16] (which also seeks to address the vulnerabilities of agriculture and hence food security and nutrition to climate change), will require support and tools for, *inter alia*, predicting the PGRFA that are most at risk and determining how to safeguard and use them sustainably.

- **Nutrition**. Hidden hunger, i.e. micronutrient deficiency, and obesity are critically important public health concerns. The international community, through, *inter alia*, the ICN2 Framework of Action[17] and its facilitating United Nations Decade of Action on Nutrition (2016-2025),[18] commit to address the scourges. Underscoring the importance of the sustainable use of PGRFA to the achievements of the set goals, the 2016 World Food Prize was awarded for work on the biofortification of staple crops and their enhanced availability to vulnerable populations.[19] The enhancements of the quality and nutritional attributes of improved crop varieties, as standard plant breeding objectives, and more diversified diets that include leafy vegetables and pulses must therefore be accorded high priorities. A review of the state of the art in the sustainable use of PGRFA to improve nutrition would therefore be an important contribution to the Third Report.

- **Genotyping and Phenotyping PGRFA**. New efficiency-enhancing tools and methods are increasing our capacities for generating large amounts of reliable data on germplasm at cost- and time-efficient rates previously unimaginable. For instance, Focused Identification of Germplasm Strategy (or FIGS) enables the predictive characterization of new genetic resources by permitting the assignment of potential phenotypic or genotypic properties based on environmental information of the collecting sites or data on already characterized samples. The average costs for generating molecular genetic data have decreased sharply in

[13] http://unfccc.int/focus/items/10240.php
[14] http://unfccc.int/files/home/application/pdf/paris_agreement.pdf
[15] https://www.unisdr.org/we/coordinate/sendai-framework
[16] https://unfccc.int/files/meetings/bonn_nov_2017/application/pdf/cp23_auv_agri.pdf
[17] http://www.fao.org/3/a-mm215e.pdf
[18] http://www.who.int/nutrition/decade-of-action/workprogramme-2016to2025/en/
[19] https://www.worldfoodprize.org/en/laureates/2016__andrade_mwanga_low_and_bouis/

the recent past. This, coupled with increasingly improved human and institutional capacities, is permitting the routine use of high throughput molecular genetic platforms to generate unprecedented amounts of data quickly and cheaply. Genotyping by Sequencing (or GBS), whereby whole genome sequences of several samples of individuals are used to catalogue variations, is one example. In like manner, high throughput phenotyping platforms, including those based on imaging, are being used to generate copious amounts of morphological, physiological and biochemical data that are of important predictive values. Phenomics is a relatively new biological discipline that is concerned with aligning phenotypic and genotypic data and therefore aiding the establishment of cause-effect relationships between observed traits and their underlying molecular bases.

- **Safety duplicates**. The safety duplication of unique accessions represents a fundamental practice to reduce the risk of loss of germplasm diversity in *ex situ* collections. On the other hand, duplication of accessions beyond some reasonable level is not necessary and drains financial resources which could otherwise be used for other urgent tasks. As highlighted by the Second Report, a significant increase in the number of genebank holdings is due to a large proportion of these holdings being duplicates. Ways and means to reduce the number of unintended duplications in *ex situ* collections should be further explored. A valuable contribution of such a study would be the definition of what constitutes a "safety duplication" and the articulation of its criteria. This has become necessary in order to delineate between "black box" collections that contain samples that are largely unmonitored from *de facto* "safety duplication" collections that must involve the active management of the stored accessions.

- **Novel Biotechnologies.** Biotechnologies are continually evolving and have a profound impact on the conservation and sustainable use of PGRFA. Among the novel ones are:

  Genome Editing. Recombinant DNA techniques have been used to incorporate desirable novel traits that were not readily accessible from germplasm collections into crop varieties. Over the past 20 years, some crop varieties have been developed using genetic transformation; these are generally known as genetically modified organisms (or GMOs). Though their commercialization has been characterized by polarising debates, the Cartagena Protocol on Biosafety to the Convention on Biological Diversity was agreed as the international framework that governs the safe release of GMOs into the environment. Capacities for the application of genome editing, a term for a relatively new set of technologies used to create precise changes to the genetic makeup of individuals and thereby generate organisms with predictable altered traits, has rapidly become widespread over the last few years. The Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR), first described in 2012, and currently applied in thousands of laboratories worldwide, is the most widespread of this new suite of techniques that induce predetermined mutations. Genome editing has been used to develop new crop varieties.[20,21] CRISPR, for instance, is cheap, is not technically tasking and there exists no reliable laboratory assays for identifying a genome edited organism. The rapid adoption, relative cheapness and ease of application of genome editing notwithstanding, associated policy regimes have not been developed. For instance, there is a lack of agreement as to whether genome edited organisms are GMOs and thus subject to the Cartagena Protocol.

  Gene drive. The probability for an offspring inheriting a variant of a gene from a parent can be accurately predicted. The bias away from an expected frequency towards the prevalence of the inheritance of a particular gene or set of genes is known as gene drive. With the recent demonstration that genome editing could be accompanied by gene drive, genome edited mutant mosquito populations with gene drive for a preponderance of males, heritable

[20] https://www.scientificamerican.com/article/gene-edited-crispr-mushroom-escapes-u-s-regulation/
[21] http://cen.acs.org/articles/95/i24/CRISPR-new-toolbox-better-crops.html

infertility in females or reduced ability to transmit malaria, dengue or zika diseases have been produced.[22,23,24] There are concerns that genome edited gene drive plants could therefore skew permanently the genetics of an entire population of the organism and by extension the overall ecosystem dynamics. Environmentalists have therefore been vocal in criticizing gene drive and even called for a moratorium on its research and development.[25] Just as is the case with genome editing, there are scant dedicated policies and certainly no global mechanism for regulating this powerful technology with demonstrable environmental and ethical issues.

Synthetic biology. In the absence yet of an internationally agreed definition for synthetic biology, common distinguishing features of applications that are categorized under this term include "the *de novo* synthesis of genetic material and an engineering-based approach to develop components, organisms and products".[26] In effect, by harnessing, in a concerted way, the advances in biology, chemistry, computer science and engineering, scientists are now able to create DNA sequences from the scratch. Basically, "computers and laboratory chemicals" are being used "to design organisms that do new things -- like produce biofuels or excrete the precursors of medical drugs".[27] A number of products, including artemisinic acid – an anti-malarial drug, are either being commercially produced or in the pipeline. This novel field of biotechnology opens up immense opportunities but there remain several safety and ethical concerns that are seemingly not receiving significant levels of attention.

- **Vegetatively propagated crops and species with recalcitrant seeds**. Although a large proportion of conserved crop species produce orthodox seeds, a number of species produce recalcitrant seeds or are propagated vegetatively. These genetic resources are often maintained in field genebanks, requiring large amounts of land, inputs and resources, and are at risk due to environmental and biological threats. Alternative methods of conservation, including *in vitro* culture and cryopreservation, require highly trained technical staff, expensive equipment and supplies and species-specific methodologies need to be developed. As a result, many of these species are underrepresented in genebanks and their conservation is disadvantaged. The Third Report will review the status of conservation of these genetic resources and review the technologies necessary to enhance their maintenance in genebanks.

- **National seed policies and laws and on-farm diversity of PGRFA.** National regulatory frameworks, especially seed policies and laws, are often assumed to be amongst the drivers for the ever increasing on-farm genetic erosion. In order to query this assumption FAO has conducted a preliminary characterization of national seed laws and policies to ascertain whether there are legal or policy provisions that could have the unintended effect of diminished diversity of crop varieties, in particular of farmers' varieties/landraces. This preliminary review considered seed laws, policies and regulations from 94 countries, the Andean Community and the European Union. Many countries' laws included provisions that could potentially restrict the sale or use of farmers' varieties/landraces. Perhaps most importantly, 28 percent of countries both explicitly prohibited the sale of non-certified seeds and required that all varieties of all crops must be registered. Also, 45 percent of the countries studied regulated all commercial seed transactions. Some other countries, however, exempt seed transactions among farmers from regulation. Many important provisions that may affect PGRFA were left as 'management decisions' to be taken by national seed authorities. The impacts of national regulatory frameworks on the on-farm diversity of PGRFA will depend on how they are interpreted and implemented. This thematic study would build upon this

[22] https://www.nature.com/news/gene-drive-mosquitoes-engineered-to-fight-malaria-1.18858
[23] https://www.nature.com/news/mosquitoes-engineered-to-pass-down-genes-that-would-wipe-out-their-species-1.18974
[24] http://www.nature.com/news/gene-drives-thwarted-by-emergence-of-resistant-organisms-1.21397
[25] http://www.the-scientist.com/?articles.view/articleNo/47854/title/UN-Rejects-Calls-for-Moratorium-on-Gene-Drive-Research/
[26] https://www.cbd.int/doc/publications/cbd-ts-82-en.pdf
[27] http://www.synbioproject.org/topics/synbio101/definition/

review, using it to select case studies representing different scenarios for more in-depth analysis of the trends and their impacts.