Concept Paper: Sustainable Agriculture Development in Drylands

I. Rationale

Drylands—zones with an aridity index of less than 0.65[1]—are vital for providing a significant quantity of the world's grains, fruits, vegetables, and livestock. Furthermore, they play a crucial role in food security of the growing world population in addition to poverty reduction in the coming decades. However, the main problems in these areas are the low yields of agricultural commodities mainly because of water shortage, poor soil fertility, inappropriate agricultural practices and inadequate information about new practices / techniques for farmers to make informed decisions. The biggest challenges for agriculture particularly in drylands are the declining natural resources, soil fertility and food production. Sustainable natural resources management is critical to sustain the livelihoods of millions of rural populations directly dependent on or connected to these regions. A range of opportunities in terms of revamping agriculture in drylands through innovative cultivation methods and developing novel technologies for drylands exist for most of the G20 member countries to achieve sustainability. These opportunities lie in the newly developed modern smart irrigation technologies, soil fertility management, improved dryland crop varieties, and promoting plant and animal health for sustainable production in drylands in order to achieve SDGs.

[1] United Nations Environment Programme (UNEP), 1992: World Atlas of Desertification. First edition

II. Background

Global challenges to food security arise because of the growing human population pressure on the limited natural resource base. Providing adequate and nutritious food for such a large population necessitate future research directors towards global issues challenging animal and crop production. Dryland agriculture covers a significant part of regions characterized by hyper-arid, arid, semi-arid and dry sub-humid climatic environments[2]. They also encompass significant proportion of grasslands, agricultural lands, forests and urban areas contributing to global food security. The issue has been very intense especially in drylands, which globally occupies about 41.2 percent of land area. Overall, it has been estimated that 2.1 billion of the global population is inhabit and depend on drylands. These drylands support 44 percent of the cultivated systems of the world. The 30 percent of plants under cultivation are endemic to drylands. Overall, arid zones that are largely characterized as drylands contribute to 50 percent of the livestock production[3]. The harsh climatic conditions prevailing in drylands and its inherent vulnerability to climate change adversely impact the sustainability of dryland agriculture given the very limited resources for successful animal and plant production. The success in drylands in terms of agricultural production mainly depends on numerous factors including soil fertility management, efficient water use technologies, judicious use of appropriate production and protection measures.

1. Soil Fertility Management in Drylands

Soils are an essential non-renewable largest terrestrial natural resource hosting 95 percent of global food production[4]. They are providing essential ecosystem services, which are important for water regulation and supply, climate regulation,

[2] United Nations Environment Programme (UNEP), 1997: World Atlas of Desertification. Second edition

[3] 2010–2020: UN Decade for Deserts and the Fight against Desertification. https://www.un.org/en/events/desertification_decade/whynow.shtml

[4] Healthy soils are the basis for healthy food production, FAO, 2015.

biodiversity conservation, carbon sequestration and cultural services. However, soils are under pressure from increases in population, higher demands for food and competing land uses[5]. While fertile soils supply essential nutrients to plants to enhance their productivity, declines in soil fertility[6] have long been a major concern of agriculturalists due to direct impacts on crops in terms of reduced productivity. Soil fertilization by adding optimal synthetic and organic fertilizers is an important soil fertility enhancement technique for sustainable production of agricultural commodities in drylands. Historically, the application of fertilizers in addition to improved management practices are known as the major driver for global green revolution. The Ministerial Declaration of the G20 meeting of Argentina (2018) emphasized the importance of developing and enhancing actions to promote soil health in addition to the utilization of soils in a sustainable manner. The landscapes prevailing in drylands especially in the arid and semi-arid areas of the world are facing low productivity due to reduced soil fertility. The upcoming 2020 G20 under the presidency of Kingdom of Saudi Arabia would be a valuable opportunity to reach collaborative strategies for sustainable soil fertility management in order to enhance crop productivity.

2. Modern Smart Irrigation Technologies in Drylands

Dryland agriculture is practiced globally and is characterized by highly variable rainfall, water shortages, and frequent droughts. Therefore, it is very important to invest in the innovative modern irrigation technologies to promote efficient use of water to achieve sustainable agricultural operations in drylands. These technologies can further enhance the effectiveness of the disaster risk reduction related interventions ongoing in most vulnerable countries. The Kingdom of Saudi Arabia is prioritizing modern smart irrigation technologies in drylands in MACS for

[5] FAO 2017. Voluntary Guidelines for Sustainable Soil Management Food and Agriculture Organization of the United Nations Rome, Italy

[6] Soil fertility is the ability of soil to sustain plant growth by providing essential plant nutrients and favorable chemical, physical, and biological characteristics as a habitat for plant growth.

discussion in order to boost international research collaboration to enhance agricultural productivity in drylands by promoting optimal use of water.

3. Improved Dryland Crop Varieties

High yielding efficient crop varieties have played a pivotal role in revolutionizing crop production in irrigated and intensive management conditions. However, extreme variability in the agro-climatic conditions prevailing in drylands are posing a much stiffer challenge for plant breeders in evolving efficient varieties for dryland conditions. The prospects for improving crop production under dryland conditions mainly lies in the development of improved crop varieties with characteristics such as efficient utilization of abiotic factors to maximize stable economic yield and total production. Moreover, high early seedling vigour, wide crop adaptability, deep rooted branched root system, photo- and thermo-insensitive, and diseases and pests resistant are important characteristics for breeding varieties.

4. Promoting Animal and Plant Health

Drylands are the home to 33 percent of the global human population and 50 percent of the livestock production. Plant and animal health is crucial for the production of food for human consumption. Sustainable food supply is mandatory to meet the emerging food demands for growing masses of the population in order to eliminate hunger and malnutrition[7]. The fight against food insecurity continues to signal as significant challenge especially in developing countries of Asia and Africa that are battling food insecurity challenges. Global food security is also threatened by reduced productivity in drylands resulting from pests and diseases. Plant pests and diseases are important threats to farmer's livelihoods especially in developing countries where agriculture is the main source of income. Their prevalence impart huge economic losses, which risk the global food security[8] at all levels including house

[7] Bennett BC. Plants as food. Economic Botany. Encyclopedia of Life Support Systems (EOLSS). 2010. https://www.eolss.net/Sample-Chapters/C09/E6-118-07.pdf

[8] Food security exists when all people at all times have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life

hold, national and global. FAO estimates that about one sixth of global agriculture production is lost annually due to destructive pests and diseases[9]. Newly introduced Food Loss Index (FLI) developed by FAO revealed 14 percent of global food losses (post-harvest to the retail level, but not including retail level) in terms of economic value[10]. A recent study conducted on the global burden of pathogens and pests against five major crops disclosed the highest crop losses especially in food-deficit regions with fast-growing populations. Their findings document 21.5, 30.0, 22.5, 17.2, and 21.4 percent worldwide losses for wheat, rice, maize, potato and soybean, respectively[11]. By keeping in mind the contribution of the reduction in food losses towards global food security, there is a pressing need to develop durable, appropriate, affordable, and environmental friendly management technologies especially for drylands.

To set this issue on G20, it would be locally, regionally and internationally very important due to the significant contribution of drylands in global food security. The previous Leaders' Declaration clearly stated the need for information sharing to ensure animal and plant health. The outcomes will ultimately benefit all the stakeholders by contributing toward health and safe food for all.

[9] Flood J. The importance of plant health to food security. Food Security. 2010;2:215–231

[10] FAO. 2019. The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction. Rome. Licence: CC BY-NC-SA 3.0 IGO.

[11] Savary S, Willocquet L, Pethybridge SJ, Esker P, McRoberts N, Nelson A. 2019. The global burden of pathogens and pests on major food crops. Nature Ecology and Evolution. 3(3): 430.

III. Proposed Future Collaborative Mechanism for G20 MACS 2020

1. Improve knowledge and information sharing for enhancing agricultural production in drylands with interested G20 members. Kingdom of Saudi Arabia will organize an Experts meeting in collaboration with interested G20 members, and relevant International Organizations later in the year to discuss developing appropriate measures to enhance productivity and sustainability in drylands.
2. Share knowledge and information on sustainable agriculture in drylands research and development to increase knowledge of institutions and farmers.