AN INTERNATIONAL VISION FOR WHEAT IMPROVEMENT

WHEAT INITIATIVE

VISION PAPER CONTENTS

I. OPENING STATEMENT

The Wheat Initiative Secretariat would like to sincerely thank you for your interest in our work as a framework for international wheat research and our efforts to support the implementation and development of the Wheat Initiative Strategic Research Agenda. It is with great pleasure that we provide you with the second version of our Vision Paper, "An International Vision for Wheat Improvement". Please note that this version of the Vision Paper has been updated specifically for the First International Wheat Congress, which will take place in Saskatoon in July 2019. The Wheat Initiative (WI) aims to produce a third version of the Vision Paper, comprised of more thorough changes and updates, later in 2019.

The original Vision Paper was published in May 2013, when the Wheat Initiative (WI) was conducting activities from France under the direction of Hélène Lucas. Since then, the WI moved its offices to the Julius Kühn-Institute (JKI), the German Federal Research Centre for Cultivated Plants, in Berlin-Dahlem, Germany. Thus, the management structure was changed as Alisa-Naomi Sieber was appointed to the new role of overall Programme Manager. Peter Langridge was appointed as the interim Scientific Coordinator, in addition to his role as the Chair of the Scientific Board (SB). The relocation to Berlin was welcomed with strong support from the German Federal Ministry of Food and Agriculture (BMEL).

In the pages that follow, you will find information pertaining to WI's mission and vision, global challenges facing wheat, goals for the next decades, and more. If you are interested in getting involved with the Wheat Initiative or learning about how you can further promote the international vision for wheat improvement, please contact wheat.initiative@julius-kuehn.de. More information regarding the Wheat Initiative's activities can be found online at www.wheatinitiative.org

II. GETTING TO KNOW WHEAT

Population growth, climate change, and unsustainable use of natural resources have made a negative impact on food security around the world. In the absence of a global commitment to build food systems adapted to climate change and ensure food security, while minimizing greenhouse gas emissions and sustaining our natural resource base, this negative impact is likely to increase.

A. General Information Pertaining to Wheat

Such drastic occurrences will lead to international food shortages and rising food prices in the coming decades, which will result in malnourishment and an increase in poverty increase in lesser developed regions. Expanded investments in sustainable agriculture to increase agricultural productivity per land area and to avoid losses in productive capacity, as well as promotion of healthier food diets and food waste reduction, are required to avoid an increasing gap between food supply and demand. Given the time lapse between research and development and widespread applications, immediate action is required at national and international levels.

Along with rice and maize, wheat is absolutely essential for the security and development of the human civilization. Wheat is the most widely cultivated cereal in the world, as more than 215 MT are planted annually. The cereal is the most important plant protein source and provides approximately 20% of global calories for human consumption.

With around 180 MT [Ref. https://apps.fas.usda.gov/psdonline/circulars/grain-wheat.pdf], the annual global wheat trade is higher than that of maize and rice combined. More than 60% of wheat is produced in lesser developed countries. For example, China and India together produce nearly five times as much wheat as the U.S. and Russia combined. In North Africa and West and Central Asia, wheat is the dominant staple crop and provides almost 50% of all calories.

Stable and reliable wheat production, as well as the maintenance of prices at an affordable level, are paramount for global food security and socio-political stability. Among the major staples, wheat is the only crop adapted to low temperatures that can be grown during the cool season, which gives it a unique position in many important rotations involving rice, cotton, soybean or corn. Farmers cultivating millions of hectares in more developed and lesser developed countries have no alternative to wheat as a winter crop that can be economically efficient, while providing major dietary benefits.

B. Global Wheat Production Challenges

Though wheat is originally the most cold and drought tolerant crop among the major staple crops, it is unfortunately also the most sensitive to high night and day temperatures. Wheat yield models indicate that a 1°C temperature increase reduces yield potential of wheat by 10% in some parts of the world and that the wheat producers in South Asia and North Africa will be hit hardest by climate change. Experts from the Intergovernmental Panel on Climate Change (IPCC) report that an average temperature increase of 1.5-6°C by the end of this century is very likely.

Furthermore, the World Bank estimates that we are barrelling down a path to heat up the average global temperature by 4°C if issues pertaining to climate change are not addressed and prioritised immediately. By 2050, scientists project that the world's leading wheat belts in the U.S. andCanadian Midwest, Europe, Northern China, South Asia, Russia, and Australia could experience, up to every other year, a warmer summer than the warmest one now on record. The International Food Policy Research Institute (IFPRI) projected that wheat yield in 2050 could decline by 27% in some regions, unless drastic measures are taken to limit temperature rise and develop crop varieties that can tolerate a hotter world.

C. The Need for the Wheat Initiative

Considering that wheat production needs to be increased by approximately 60% by 2050 to meet the demands of a growing population with changing diets, the challenges for wheat breeders and growers are tremendous. Current global investments in wheat improvement have been too small to address the aforementioned challenges properly.

Thus, the main objective of the Wheat Initiative is to coordinate global wheat research efforts so that, through international efforts, the progress needed to increase wheat production, quality and sustainability can be achieved, thus contributing to the global efforts towards food security and development under changing climate conditions.

Wheat is produced all over the world

6
Continents

735
Mt produced in 2017/18

219
Mha planted in 2017/18

Wheat is the #1 food crop consumed in the world

65 kg

of wheat are consumed per person per year.

67 %

of the wheat produced worldwide is used for consumption.

Wheat is especially critical for the

2.5

billion people who live on less than US $2 per day.

Wheat is used as

and many more...

[Refs.Wheat Initiative: An international vision for wheat improvement. (2013); Organisation for Economic Co-operation and Development, OECD), Food and Agriculture Organization of the United Nations, FAO: OECD-FAO Agricultural Outlook 2018-2027. – OECD Publishing, Paris/FAO (2018); Food and Agriculture Organization of the United Nations, FAO: http://www.fao.org (2019); Consultative Group on International Agricultural Research, CGIAR: https://www.cgiar.org (2019)]

III. THE WHEAT INITIATIVE

Created in 2011 following endorsement from the G20 Agriculture Ministries, the Wheat Initiative provides a framework to establish strategic research and organisation priorities for wheat research at the international level in both developed and developing countries. The Wheat Initiative (WI) fosters communication between the research community, funders and global policy makers, and aims at securing efficient and long-term investments to meet wheat research and development goals.

It also initiates and supports activities in order to enhance communication and increase access to information, resources and technologies. The Wheat Initiative actions will lead to the creation of improved wheat varieties and to the dissemination of better agronomic practices worldwide. The combination of new varieties and agronomic practices will in turn allow farmers to improve and stabilise wheat yields in diverse production environments.

B. Mission and Vision of the WI

The Wheat Initiative aims to encourage and support the development of a vibrant global wheat public-private research community sharing resources, capabilities, data and ideas to improve wheat land productivity, quality and sustainable production around the world. This community comprises public and private researchers, educators, and growers from all wheat growing countries who will collaborate to promote sufficient resources and capabilities to develop strong and dynamic national wheat programmes in their country.

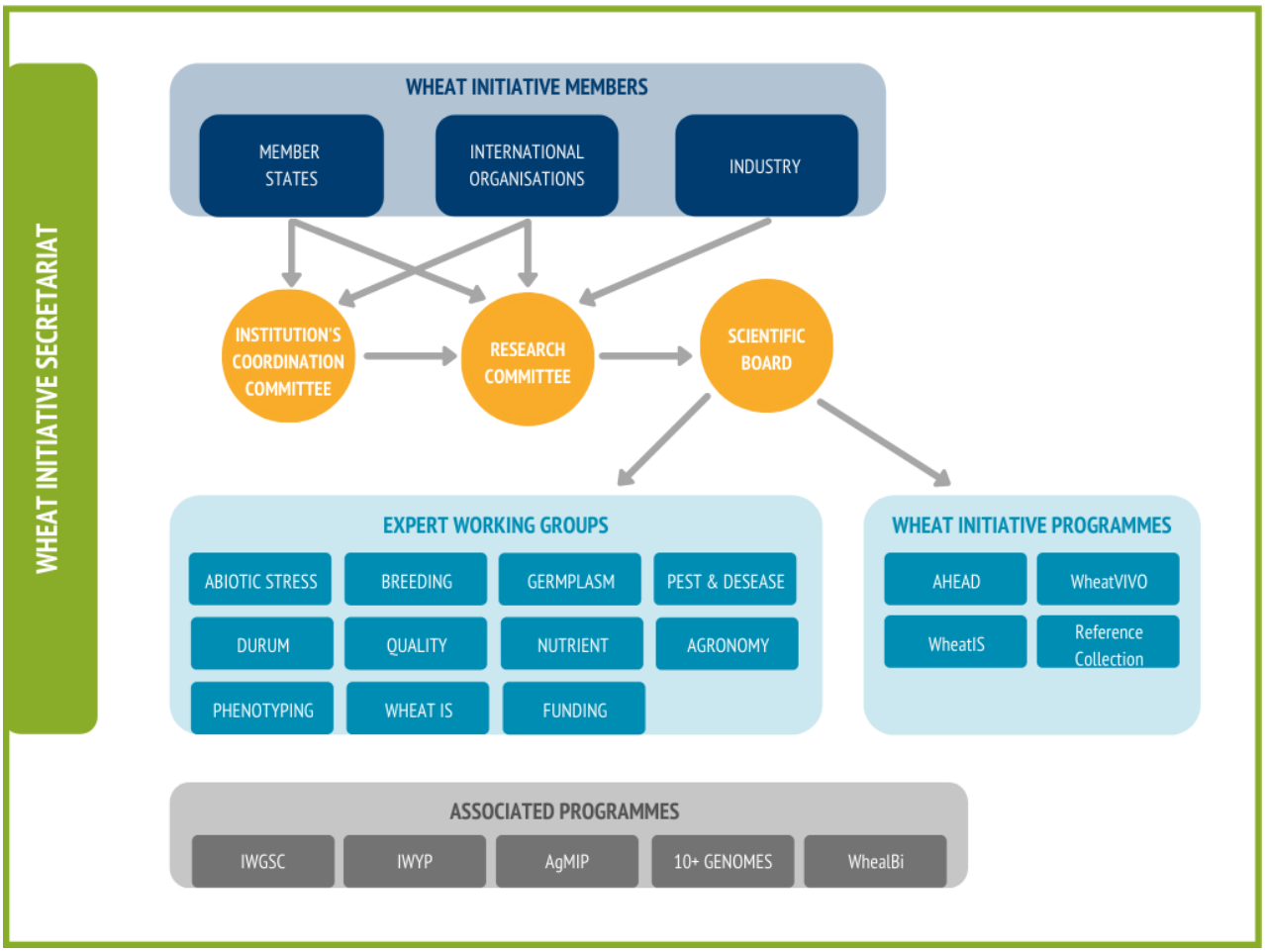
At the international level, this community will work together through specialised transnational programmes. Members of the community will also address wheat research globally on all wheat types (bread wheat, durum wheat, and wild relatives), while gathering pertinent information from research fields spanning genomics to agronomy.

To answer the challenges of wheat research internationally, the Wheat Initiative will:

1. Develop a global strategic agenda for wheat research through the identification of research, outreach priorities, and challenges beyond the capacity of single research groups and countries that can best be achieved by international coordination and collaboration between researchers, research institutions, and funding organisations.
2. Encourage efficient investment in wheat research based on the capabilities of, and synergies among, national and international programmes.
3. Initiate the development of new collaborative programmes and coordinated actions across more developed and less developed regions.
4. Develop and coordinate knowledge sharing amongst the international wheat community.
5. Improve global access to resources, services, and facilities.
6. Support the education of students and life-long learning of wheat researchers and farmers.
7. Stimulate public-private partnerships.

C. Principles and Organization

The Wheat Initiative governance is driven by principles of transparency and inclusivity. It values its members' engagement and it promotes the sharing of knowledge, information and resources to increase synergy through collaboration. The global governance of the Wheat Initiative is set out in its Charter. It is organised around 3 major committees, the Research Committee, the Institutions' Coordination Committee and the Scientific Board.



Thematic Expert Working Groups (EWGs) contribute to the identification of research priorities and to the emergence of coordinated research programmes. EWGs are established where there would be benefit from bringing together experts with a focus on a topic of relevance to the Wheat Initiative's aims and objectives, and they are open to non-Wheat Initiative members. Associated Programmes are already established international collaborations and partnerships that develop research activities in line with the priorities identified by the Wheat Initiative.

The Institutions Coordination Committee (ICC) comprises high-level representatives from public research and funding organisations who facilitate cross-border collaboration and funding concerning the priorities identified by the research community. The Scientific Board (SB), elected by the RC, is the executive committee of the Wheat Initiative that translates research priorities into decisions and actions, while liaising with the different committees.

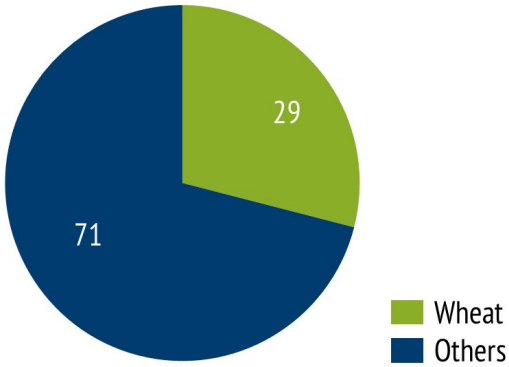
IV. THE GLOBAL CHALLENGE

With a predicted world population of 9.3 billion in 2050, the demand for wheat is expected to increase by 60% compared to 2010 [Ref. FAOSTAT (2019) www.fao.org/faostat/en/]. To meet this growing demand, mean annual yield increases must rise from the current level of 1.1% (2001-2010) to 1.6% (2011-2050). International research efforts are needed to increase wheat production and sustainability, while ensuring the production of high quality and safe products despite high food prices, climate change, and natural resource depletion.

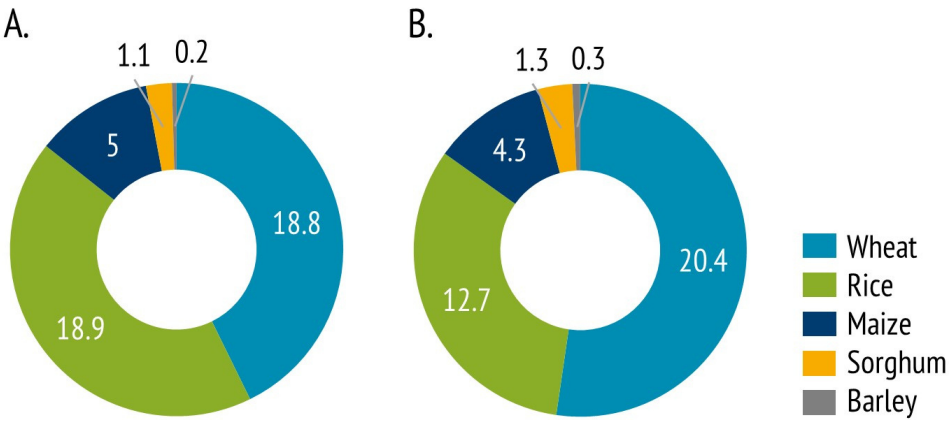
A. Wheat Through the Millennium

Since agriculture began approximately 10,000 years ago, cereals have provided the main source of calories for the human diet. Recognised for their high yields, nutritional value, and ease of transport and storage, a range of different cereals were domesticated by the world's original farmers. Wheat, rice, maize, barley, sorghum, millet, and root crops still constitute the basis of human nutrition worldwide. Of these, wheat has been particularly important, providing the principle grain stock that founded agriculture in the Middle East and led to its successful spread around the world.

Today, wheat is grown throughout temperate, Mediterranean-type, and sub-tropical areas across six continents. Wheat contributes approximately 30% of the total world cereal production, as shown by the figure to the right [Ref. FAOSTAT (2019) www.fao.org/faostat/en/]. To further clarify, the aforementioned image displays the amount of grain production in 2017-2018 of wheat, rice, corn, sorghum, and barley (in percentage).



Furthermore, Wheat is cultivated on more than 215 million hectares, which means that it is the most widely grown crop worldwide. Wheat is the most important protein source and, in relation to food calories, the crop is second most important after rice, as shown in Graph A in the figure below. Circle Graph B shows the impact of wheat on the human diet, energy supply (in %, A) and protein supply (in %, B) [Ref. FAOSTAT (2010). www.fao.org/faostat/en/].



Bread wheat represents more than 90% of total global wheat production, although durum wheat is prevalent in the Mediterranean region and countries such as Canada. Over the millennia, human selection of wheat plants with superior yield and quality traits has led to significant improvements in cultivated varieties compared to their wild relatives..

For example, early selection by the world's first farmers led to the development of varieties that produced grains of larger size, which were retained in the ear for longer periods of time. During the 20th century, the introduction of traits for accelerated crop development, semi-dwarf habit, photo period insensitivity, and enhanced disease resistance contributed to further enhanced yield improvements.

EVOLUTION OF WHEAT YIELD OVER 10 YEAR PERIODS SINCE 1960 AND PROJECTED NEEDS FOR 2050

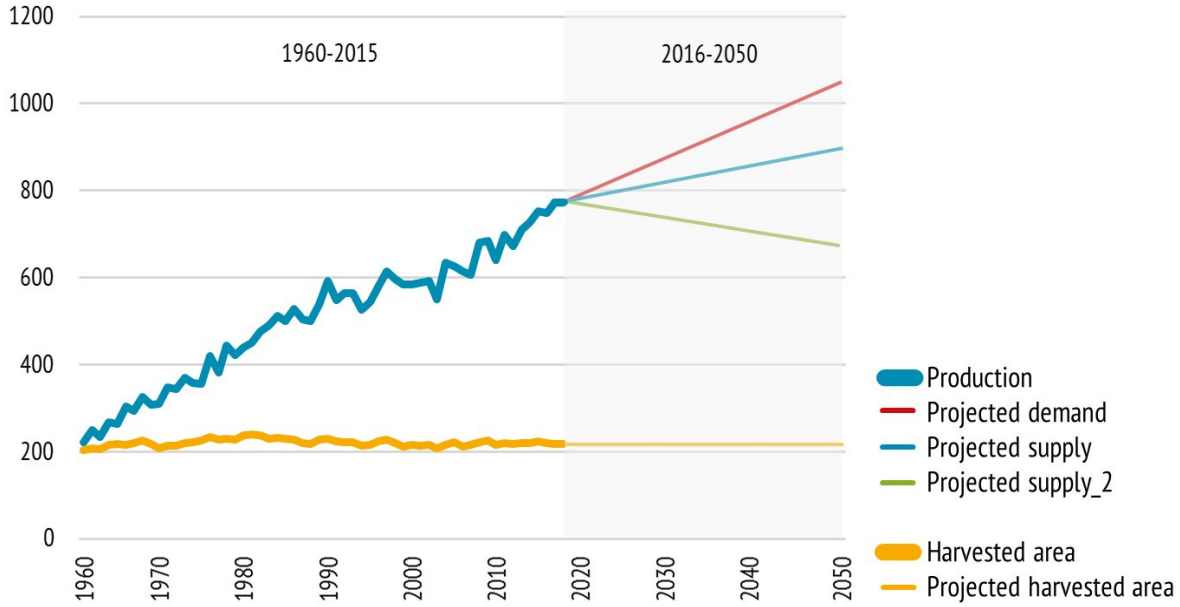
Period	Mean Area Harvest/Yr (Mha)	Mean Production/Yr (Mt)	Mean Production Increase/Yr	Mean Yield/Yr	Mean Yield/Yr
1961-1970	213	278		1.3	
1971-1980	225	388	3.9%	1.7	3.2%
1981-1990	229	509	3.1%	2.2	2.9%
1991-2000	220	571	1.2%	2.6	1.7%
2001-2010	216	622	0.9%	2.9	1.1%
2050 (Target)	220	1,045	1.7%	4.75	1.6%

B. Pushing the Agenda: Increasing Sustainable Wheat Production

Though there was a strong increase in the rate of wheat production from the Green Revolution in 1960 until the early 1990's, there are now varying stages of productivity around the world. Rising prices for pesticides and fertilisers, a growing global population and changing diets, increasing competition between food and non-food uses, as well as the negative effects of drought and high temperature resulting from climate change, have led to the decline in the overall production rate of the crop.

The U.S. Department of Agriculture (USDA) reported that the world wheat production has not met global demands in ten of the last fifteen years. Havoc is ensuing within lesser developing regions due to the increasing price of wheat. Threats to food supplies and their increasing costs are a major source of volatility and civil unrest. Experts are concerned that long term sustainability of the global ecosystem would be threatened if more land is brought into production.

To increase global wheat production, perhaps the most favourable solution is to increase wheat productivity. On an international scale, wheat productivity increased only 1.1% p.a. over the last decade. The production of wheat seems to be stagnating internationally, despite the need for production increase of 60% by 2050. To meet the increase in demand for wheat in a sustainable and resilient way, more collaborative research between private and public partners is urgently needed through significant investments.



Global wheat production (in Mt) and harvested area (in Mha) since 1960 and projected demand (in Mt) based on,11 projected supply (in Mt) baseline 2001-2015, projected supply_2 (in Mt) climate change scenario P2039=97,5% P2010, and projected harvest area (in Mha) between 2015-2050. [Refs: Wheat Initiative (2013). An international vision for wheat improvement.; OECD, FAO (2018). OECD-FAO Agricultural Outlook 2018-2027. OECD Publishing, Paris/FAO.; OECD, FAO (2019). OECD-FAO Agricultural Outlook (Edition 2018). OECD Agriculture Statistics (database), accessed on 28 March 2019.]

C. Growing Wheat Relationships: Building International Coordination and Investment

Although specific wheat varieties and species adapted to different production constraints, end products around are needed around the world. Such end products include spring vs. winter wheat, rain-fed vs. irrigated, bread vs. durum wheat, and so forth. All nations urgently need to increase the rate of wheat genetic progress for yield, nutrient and water use efficiency, and adaptation to biotic and abiotic stress, while ensuring the production of high quality and safe products.

To take full advantage of wheat's genetic potential, improved agronomic practices and the development of innovative cropping systems are absolutely essential. The international scientific wheat community must address these immediate needs an efficient manner by ensuring inclusive coordination and communication, establishing common goals, sharing resources and information, improving coordination among public and private research funding organisations, as well as enhancing technology delivery to breeders, agronomists and farmers globally.

Adopting more efficient uses of genetic resources is one of the most important approaches to enhance wheat yield. During the past decade, developments in genomics, molecular genetics, and biotechnology have provided new tools for wheat breeding. Together with a better understanding of wheat physiology and development, these technologies can be used to accelerate traditional breeding programmes and artificially insert genes into wheat; from related plants or from a completely different species. However, significant and increased investments, both in conventional and molecular-based breeding, are necessary to reduce the time from trait discovery to the widespread cultivation of new wheat varieties.

Meeting the growing demand for affordable wheat also requires a new strategic research emphasis on crop, soil, and water conserving practises that will significantly increase the sustainability of production and accelerate yield gains. Improvements in water and nutrient-use efficiency are imperative to confront the major trends of declining resources for agriculture, the increasing prices of fossil fuels, and the deleterious environmental effects caused by poor fertilizer use practices, which includes greenhouse gas emissions and ozone damage.

At the same time, production methods must lead to reductions in soil erosion and degradation, as well as the decreased use of pesticides and fossil fuels. Achieving the needed improvements in efficiency will require precise and site-specific management techniques that are suited to the needs and capabilities of farmers in diverse environments. The aforementioned approaches must embrace the challenges posed by both seasonal and spatial variability.

In the last twenty years, considering its importance for global food security, wheat has become an orphan crop in terms of research investments As of 2010, global investments in maize research, deriving mostly from the U.S. and Europe, were more than four times greater than in wheat research. To change this situation, the public and private sectors must address the great challenges facing wheat through substantially increased and coordinated investment in research. As part of the global response to the major food security challenges over the next forty years, international coordination of wheat research is needed to avoid duplication of efforts, increase economic efficiency, and add value to the existing national or international public and private initiatives.

Promoting grand-scale collaborative efforts is critical to ensure that all countries and groups, particularly in less developed regions, have suitable access to technological advances, which will ultimately increase the speed and sophistication of wheat improvement. Such efforts will ensure that wheat research and improvement programmes are conducted synergistically to increase food security and safety in a changing environment, while taking into account societal demands for sustainable and resilient agricultural production systems.

V. OUR VISION FOR WHEAT IMPROVEMENT

"Increasing production and productivity in a sustainable basis in economic, social and environmental terms, while considering the diversity of agricultural conditions, is one of the most important challenges that the world faces today." [Ref. G20 Agriculture vice-ministers and deputies meeting report, 2012; www.g20.org]. For wheat, a second Green Revolution is needed to increase global wheat production by 60% by 2050. This will be achieved by breeding high-yielding varieties adapted to diverse environments that are accessible to all, delivering high-quality end products.

Furthermore, investing in both fundamental and applied science will facilitate a more rapid route to significant improvements and will ensure that research is targeted at delivering public goods and improving the economics of farming. Although the following is not of direct relevance to the Wheat Initiative's aims, it will also be necessary to improve infrastructure, develop appropriate regulatory frameworks, improve distribution and access to seeds, and develop the whole value chain. Through targeted, coordinated, and well-funded actions, we believe that it will be possible to carry out the following:

A. Increase the Yield Potential of Wheat Cultivars

Increasing wheat production without agricultural expansion implies that we must increase wheat production on existing agricultural lands. This could be partly achieved partly by improving wheat yield genetic potential through a better understanding of the physiological traits involved, their interactions with the environment, and via their complementary introduction into new varieties by breeding and/or genetic manipulation.

B. Close the Yield Gaps on Under-Performing Land and Increase the Sustainability of Cropping Systems

Due to intensive tillage coupled with indiscriminate use of irrigation water and fertilisers, particularly nitrogen, soil and water resources have been degraded over time. Location-specific resource conservation technologies need to be employed for the sustainability of crop production.

While continued improvements in wheat genetics will increase wheat yield potential, better deployment of varieties and improved management will help close the yield gaps and improve end-use quality in many wheat growing areas. Cropping systems for sustainable wheat production, including diversified rotations, will be used in more developed and less developed regions, which will contribute to the control of pathogens, weeds, and the reduction of inputs. Knowledge-based decision-making tools and a new generation of precision-agriculture approaches will help farmers determine the best agronomic practises.

C. Monitor Wheat Diseases and Develop Wheat Varieties with Durable Resistance

An international system will be established to contain the threat of wheat diseases and pests using several approaches such as the identification of new resistance genes in genetic resources, the wide use of durable resistance genes in breeding programmes, the international monitoring of pests and diseases, and the appropriate deployment of resistance genes. These approaches will be based on extensive comprehension regarding plant-pathogen interactions.

D. Increase Resource Use Efficiency and Tolerance to Abiotic Stress

Abiotic stresses such as extreme temperatures, low water availability, high light intensity, high salt, mineral deficiencies and toxicities can severely reduce yield for wheat and other crops. In many cases, several types of abiotic stress challenge plants simultaneously. High temperatures, high irradiance, scarcity of water, and nutrient deficiencies are commonly encountered in environments where wheat is grown.

However, these stresses are not amenable to management through traditional farm practices. Integration of genetic and phenotypic data, along with the availability of unique populations adapted to specific environments and end uses, will greatly improve the understanding of traits that determine yield in water and nutrient limited environments. Such beneficial integration practices will enable the creation of wheat varieties with improved nutrient and water efficiencies, as well as altered roots, to maximise crop nutrient intake and interactions with beneficial soil microorganisms. Advances in the knowledge of symbiotic signalling will allow progress toward nitrogen-fixing wheat. Conservation agriculture practises will help address temperature fluctuations and moisture scarcity.

E. Improve the Nutritional and Processing Quality and Safety of Wheat Varieties

Wheat is particularly valued for the functionality of its grain to produce a multitude of end-use products. The suitability of wheat for baked, flat and steamed bread, noodles, pasta, biscuits, and cookies is determined by breeding and processing technologies. Evolving processing technologies, coupled with changes in consumer preferences, demand continual modification of the quality attributes of wheat. Future wheat varieties will exhibit defined functionalities and enhanced nutritional quality through elevated levels of key nutrients, such as iron and zinc. The level of harmful mycotoxins produced by fungal diseases in wheat grains will be strongly reduced or non-existent.

F. Tailor Wheat Varieties and Types to Diverse Agro-Systems and Production Systems

Merging crop-modelling methods with genomic prediction will drastically increase efficiency levels when identifying genotypes suited to particular climatic conditions, regions, and agro-systems.

Tailoring phenology and architecture, as well as abiotic and biotic tolerance to diverse agro-ecosystems, will give farmers the opportunity to use varieties that are well adapted to their growing environment. In "An International Vision for Wheat Improvement" addition to the existing selfed varieties of winter, spring, irrigated, rain-fed durum and bread wheat, new wheat types (e.g. GM, hybrid, and apomictic) and production systems will be available to the growers.

G. Request All Breeders Implement Modern Breeding Methods

Well characterised genetic resources from wheat and related species will be accessible to the research and breeding community. Wheat breeders will be aware of the function of many genes such as the way they are regulated and the availability of genetic variants. Conventional breeding will still be used, but such practises will be complimented on a large scale by sound approaches that already available; for instance, double haploids (DH), Marker-Assisted Selection (MAS), and transgenics.

New breeding methods, including those currently under development and those that are in the process of emerging, such as targeted mutagenesis and Genome-Wide Selection (GWS) will be available to improve the selection of traits under complex genetic control. The use of hybrids and/or apomixis to accumulate valuable alleles will also be available for international implementation by the breeders. Genetic variability from related species will be widely used to introduce new traits and alleles into wheat by interspecific hybridisation.

H. Provide Access to Shared Platforms and International Standards

High throughput sequencing and phenotyping, as well as statistical genomics and computational efficiencies, will revolutionize wheat improvement. A wheat reference genome sequence anchored to genetic and phenotypic maps will be widely available. The sequence of many accessions will provide a virtually unlimited amount of molecular markers for genetic dissection of important traits and will accelerate isolation of the underlying genes. Genomic platforms using standardised protocols to allow genotyping, transcript, and metabolomic profiling for metadata analysis will be available to the wheat community.

Well instrumented phenotyping platforms using common standards and methods will be used to bridge the gap between the identification of gene function and the development of wheat varieties with improved characteristics by identifying mechanisms and beneficial traits of roots and shoots, by accelerating the breeding process with novel technologies and concepts in controlled, semi-controlled and field conditions, and by integrating all of these aspects into physiological models.

I. Benefit from a Wheat Information System Providing Easy Access to Data

An integrated Wheat Information System (Wheat IS) will provide the international wheat research community easy access to existing and future genetic, genomic, phenotypic and agronomic data as well as bioinformatics tools and services to visualize, analyse and connect the different types of data.

VI. WHEAT INITIATIVE'S VISION EXTENDED

A. Implementation of a Strategic Agenda

An overarching strategy for wheat research and development, with an appropriate balance of short, medium and long-term targets, and with an emphasis on goals necessitating collaboration/coordination at the international level to meet global needs, will be developed and implemented. The priorities will be revised periodically to address new scientific and technological developments.

B. Investing in Research and Promoting International Cooperation

Wheat research funders will have the opportunity to work together and address grand challenges, from science to policy, to farm to end-users. It is expected that public and private funders will use Wheat Initiative's Strategic Agenda to direct funding in national and transnational research programmes dedicated to wheat priorities.

The Strategic Research Agenda aims to enable the development of partnerships, joint programmes, and public-private cooperation. Improved knowledge among the funders, along with the exciting opportunity to work together, will enhance efficient and long term funding of wheat research to increase wheat production and food security.

C. Developing Communication and Training

The Wheat Initiative will facilitate communication and training among the wheat community by:

- Establishing a biennial International Wheat Congress (the first of which will take place in July 2019 in Saskatoon, Canada);
- Featuring leading information and communication efforts regarding international wheat research and development activities, results, and initiatives on the official Wheat Initiative website;
- Organising workshops about special topics that are relevant to the strategic priorities identified by the Whet Initiative in the SRA;
- Facilitating student and staff exchanges by providing information on training activities.

D. Active Participation on Twitter

In March 2012, the Wheat Initiative's Twitter account was created. The Wheat Initiative's Communications Team, comprised of Whitney Buchanan and Xuan Hinzmann, aims to schedule relevant Tweets daily, while feeding the account with trending re-Tweets. The WI Twitter account is promoted on the official WI website and in the quarterly newsletter.

With the creation and implementation of a new Twitter strategy, the amount of WI's Twitter followers increased from 1,270 followers in August 2018 to 1,808 followers in June 2019. The Communications Team generally Tweets about the following information:

- Daily wheat (research) related news articles
- Wheat (research) related re-tweets from the wheat community
- Information regarding EWG members if they appear in articles, publish papers, or interviews
- Wheat, research, plant breeding, research opportunities, and job offers from universities

More information regarding Wheat Initiative's Twitter account can be found be via the Twitter handle: @WheatInitiative. Please note that in late 2019, the Wheat Initiative will also re-adopt the use of LinkedIn, as much of the global wheat community refers to LinkedIn for information.

E. Publishing Informative Quarterly Newsletters

In order to ensure high quality content, the Wheat Initiative Secretariat decided to send out its quarterly Newsletter in January, April, July, and October. The launch of the improved Newsletter occurred in October 2018.

The seven fixed topics within the Newsletter are as follows:

- Wheat Initiative Update (Information regarding the Secretariat, Associated Programmes, etc.)
- Wheat Must Read (Four reading suggestions from the Scientific Board)
- Wheat Story (An editorial article about a current wheat topic)
- Wheat Dates (Special events, workshops, meetings, etc.)
- Wheat Quote
- Acknowledgements and Archive
- Call to share the newsletter, share the subscription link, and follow the WI on Twitter at @WheatInitiative

F. Updating the Wheat Initiative Website

In May 2019, with the SB's approval and enthusiasm, the Wheat Initiative Secretariat decided to move to a new website host with the aim to make the website more user-friendly and visually appealing. The new website has a more minimalistic feel, as it is much less "bulky" and does not require excessive clicking and searching to find details regarding WI's activities and aims, for example.

As of July 2019, the new website is still undergoing construction, but the WI Secretariat aims to have the website fully updated in the autumn of 2019. The website can be accessed at the following address: www.wheatinitiative.org.

F. Wheat in the Media

The Wheat in the Media letter (media digest) was originally created in 2016. Raelene Regier (Canada) has been responsible for selecting news articles from various international sources to curate the media digest newsletter. Regier uses a helpful news monitoring tool from Meltwater to provide a detailed overview of articles concerning wheat, food security, and sustainable development. The WI Secretariat redesigned and launched the Wheat in the Media newsletter at the beginning of 2019.

VII. CLOSING STATEMENTS

A. Access to Resources, Data, Facilities, and Services

The Wheat Initiative works diligently to promote the importance of the accessibility to genetic and genomic resources of wheat and their relatives, as well as the creation of a central site for directing seed orders and requests to the appropriate providers.

Common standards and protocols,and reference germplasm sets, have been established within the core of the Wheat Initiative's activities to ensure that datasets are comparable over time, which will lead to the enhancement of synergies between programmes.

The Wheat Initiative encourages and facilitates the development of open genomics platforms, as well as the establishment of an international phenotyping network in controlled and field conditions, with services available to the global community. WI also promotes the development and sharing of precision-agriculture tools and practises.

The Wheat Initiative actively supports the establishment of an integrated information system, aiming to provide access to information on genetic resources, genetic and molecular basis of traits, marker-trait associations, genomic sequences, allelic variation at key loci, and phenotypic data in different environments through a framework constructed for linking genomic, genetic, phenotypic, and agronomic analysis to practical breeding and crop management.

B. Planning for Long-Term Engagement

The success of the Wheat Initiative is dependent on the continual engagement of the global wheat community. It is of great importance that all countries and companies interested in wheat improvement participates and contributes to the development of this unique international coordination and collaboration platform.

Through collaboration, Wheat Initiative will improve food security and resolve the urgent challenge of food security and sustainable development providing enough safe, nutritious, and affordable food for a growing population.

Abbreviations

BMEL German Federal Ministry of Food and Agriculture
DH Double Haploids
EWG Expert Working Group
GWS Genome-Wide Selection
IFPRI International Food Policy Research Institute
IPCC Intergovernmental Panel on Climate Change
MAS Marker-Assisted Selection
RC Research Committee
SB Scientific Board
SRA Strategic Research Agenda
WheatIS Wheat Information System

Organization of Wheat Initiative

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