INTERNATIONAL WHEAT YIELD PARTNERSHIP

ANNUAL REPORT 2016/2017

IWYP International Wheat Yield Partnership

Research to Deliver Wheat for the Future

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PREFACE

We are delighted to present the Annual Report 2016/17 of the International Wheat Yield Partnership (IWYP). This report focuses on the science of IWYP and highlights what IWYP, through its team of dedicated scientists and associated staff, have achieved during this second full year. IWYP provides a new approach to funding and conducting an internationally competitive research and development program with the goal of increasing wheat genetic yield potential by 50% by 2035. IWYP is a public-private partnership that will deliver wheat yield breakthroughs evaluated in elite germplasm in relevant environments. Thus, this Annual Report should be assessed in this light by funders, researchers and all those concerned about crop productivity in future decades.

Our Science Program has been formulated to exploit the latest thinking, knowledge and genetic tools to both discover the necessary genetic systems and bring them into routine use in wheat breeding. The Program deliberately has a spectrum of projects to cover the intellectual, experimental and technical frontiers. Some are near the end of the breeding development pipeline while others are positioned at the beginning where promising ideas are first explored.

We are pleased to note in this second year of IWYP, that wheat lines initiated during the planning phase of IWYP and emerging from the end of the prebreeding and breeding pipeline of the IWYP Hub in CIMMYT, are out-yielding the local checks in the testing environments. This is a very important outcome because it endorses the IWYP scientific strategy of seeking plant genotypes with higher biomass and combining these with those that have better grain filling attributes, and selecting recombinant progeny that benefit from both kinds of attributes. These lines are already being sent around the world to be used in national public and private breeding programs. They illustrate that IWYP is starting to fulfil its mission.

This report also provides details on associated key accomplishments made during the year, including the launch of a 2nd Competitive Call for Research Proposals, conducting the second IWYP Program Conference, bringing new private partners into IWYP, integrating more “aligned research projects” and collaborating with the USDA National Institute of Food and Agriculture (NIFA) to integrate the new NIFA-IWYP Research Projects into the IWYP Science Program. These accomplishments are important for generating a stream of discoveries to fill the pipeline in later years.

Our thanks go to all who have enthusiastically worked hard to drive IWYP in the spirit of seeking new achievements that can significantly increase the genetic yield potential of wheat around the world.

IWYP MANAGEMENT STATEMENTS

As Chair of the IWYP Science and Impact Executive Board (SIEB), and speaking for all Board members, I am pleased to see the progress that has been made by IWYP over the last year, particularly with regards to the scientific knowledge and tangible outputs, including higher yielding germplasm, that are already emerging from our research projects. What is especially gratifying is to see many examples of "added value" being generated through scientific collaborations across the world, through the applications of new technologies to germplasm and through novel discoveries on the genetic determinants of important traits that underpin grain yield. Such "added value" is the living evidence on which IWYP needs to be evaluated year on year. We, the SIEB members, are also pleased to see the IWYP Science Program grow significantly this past year by the scientific partnership with USDA NIFA. We also look forward to further enlargement of the Science Program following additional awards coming from the 2nd Call for new international research proposals being processed this year. The goal of IWYP is huge but the organization has made a great start to addressing the challenges with its new approaches and commitment to generate impact in the wheat fields of the developed and developing world.

Richard Flavell – Chair, IWYP Science and Impact Executive Board

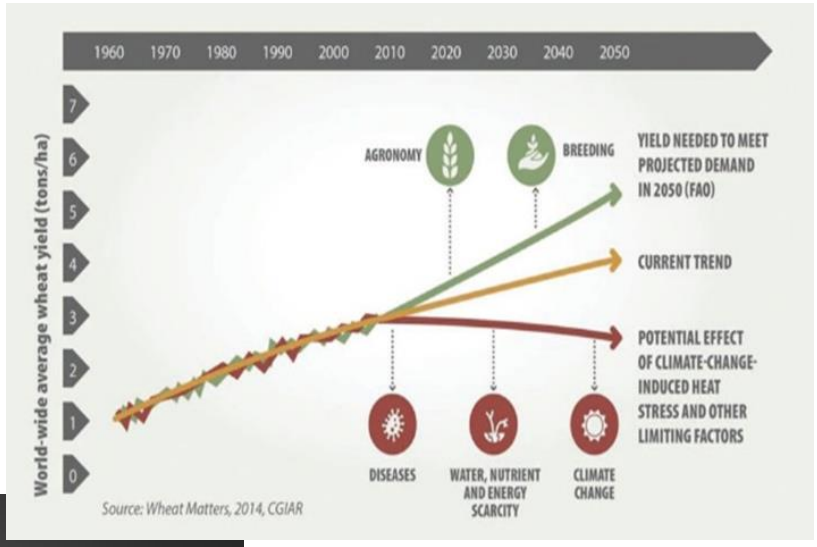
I am proud to present the 2nd IWYP Annual Report that provides a summary of the exciting

activities that have occurred across the IWYP Program over the last year. What marks this year is that the IWYP Science Program is now fully up and running and that the IWYP research projects are now generating exciting and impactful results, some of which have been delivered from research laboratories to the IWYP Hub at CIMMYT for validation and prebreeding. We recently expanded our research capacity with a new set of NIFA-IWYP research projects, and continue to seek out the best and most relevant existing projects to join the IWYP family as "Aligned Projects". At the same time, the IWYP Hub continues to make strides in the steady improvement of the elite germplasm base with which validated research outputs are being combined. Several selected lines, improved for traits that are IWYP targets, have been made available to the global wheat community. Importantly, none of the progress reported this year would be possible without the dedication and passion of the research scientists of the IWYP science team. They share the vision of IWYP and without their ingenuity, and diligence, IWYP will not be able to make this vision a reality. In closing, the next year will be even more exciting as more of our research delivers outputs that meet our ambitious criteria.

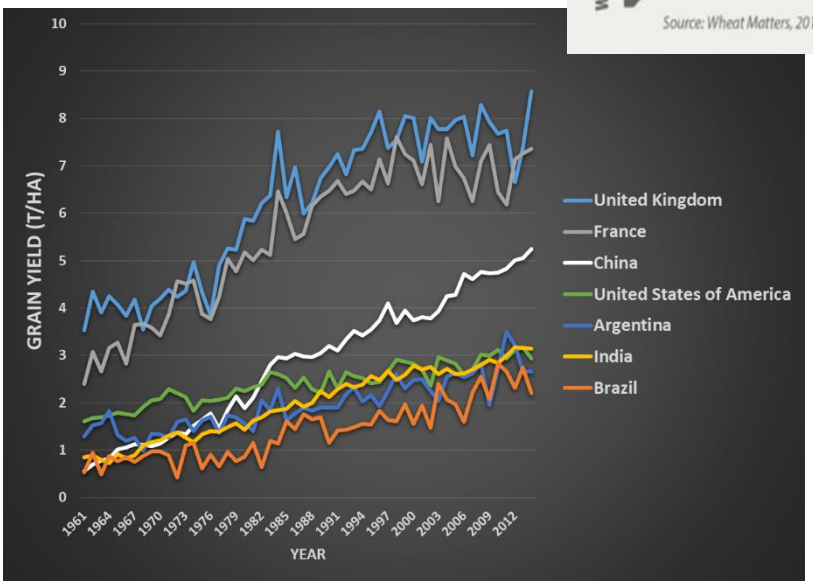
Jefferson Gwyn - IWYP Program Director

WHY IS IWYP NEEDED?

Today, wheat is the most important food staple crop and is grown on more land than any other commercial crop (>230 million hectares). It provides ~ 20% of both our daily calories and protein. The United Nation predicts that by the year 2050 there will be more than nearly 10 billion people on the Earth and demand for wheat is expected to increase by more than 60%. Demands to reduce the land used by agriculture will also increase, so it is vital to be able to produce greater yields on less land.



While global annual rates of wheat grain yield have been rising on average by ~ 1%, this will not be sufficient to meet the estimated demand for wheat in the coming years. In many countries, yields have stagnated (see below). Without at least a doubling of current rates of gains in wheat grain yield, global food and nutritional security is at significant risk. Increasing the current rates of genetic gain for grain yield cannot be achieved by simply continuing to make incremental improvements typical of conventional wheat breeding programs ("business as usual scenario"), but will require novel research breakthroughs using new approaches and state-of-the-art technologies to overcome the stagnating yield barrier and release more land for other purposes.

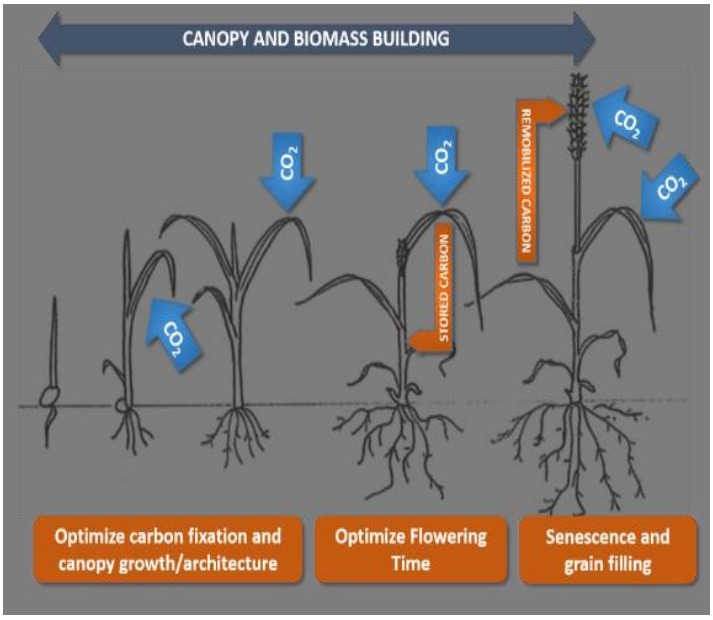


Wheat is an international crop and research to create breakthroughs is ongoing in all continents. There was a need therefore to combine the resources, thinking and expertise, and to coordinate the research both to achieve added value and to maximize the impact in wheat breeding. IWYP, acting under the auspices of the Wheat Initiative (http://www.wheatinitiative.org) as an Associated Programme, is the body performing this function.

WHAT IS IWYP?

IWYP represents a long-term collaborative effort with the ***goal to increase the genetic yield potential of wheat by up to 50% in 20 years***. IWYP will do this via a unique partnership of public sector agencies with private industry by supporting research that is innovative and high risk, but when successful will substantially boost global wheat productivity and contribute to meeting rising global demand. IWYP specifically chooses to deploy state-of-the-art approaches to maximize the chance of making breakthroughs and targets innovative research that focusses on:

- The discovery / creation of genetic variation in wheat that boosts the fixation of carbon into biomass for subsequent transfer to grains
- Optimizing wheat development and growth to improve grain yields and harvest index
- Building on discoveries coming from other species
- Developing improved wheat lines for deployment to wheat breeding programs globally
- Promoting the use of new breakthrough technologies to transform how wheat breeding is done
- A pipeline of research projects that encompass these objectives



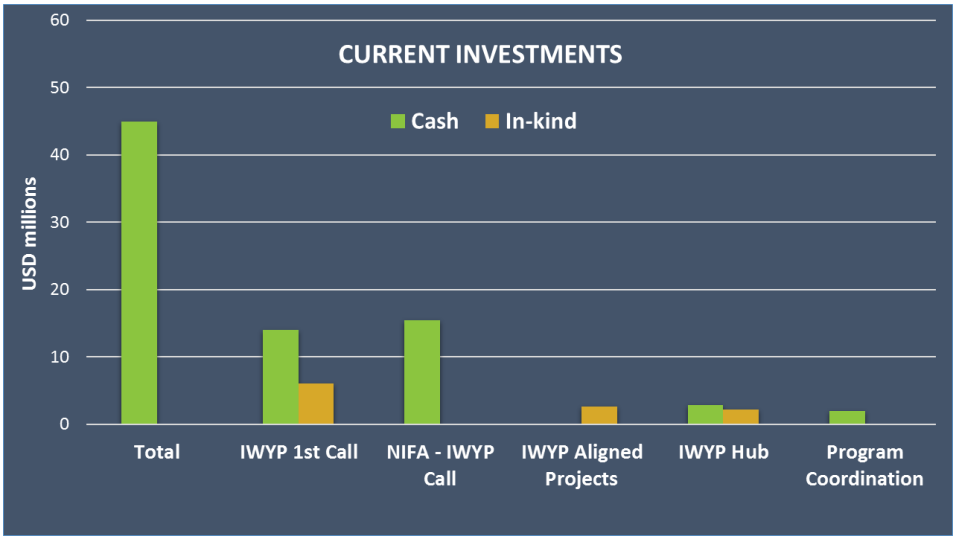
An important feature of IWYP that distinguishes it from other initiatives seeking to improve wheat yields is its **commitment to delivery**. Working with CIMMYT, a global leader in public sector wheat breeding, discoveries from the IWYP sponsored research projects are moved to a commissioned, central development platform at CIMMYT (the IWYP Hub) and combined into elite germplasm for delivery to wheat breeding programs around the world. The success of the IWYP research and delivery pipeline also depends on forging strong partnerships with private sector breeding companies, among others, who have a demonstrated ability to deliver outputs from research to the marketplace.

IWYP FINANCIAL INVESTMENTS

IWYP is halfway towards its overall goal to invest US$100 million to realize its aims and objectives

The IWYP financial plan is built upon investments from the many IWYP Partners, each of which funds or underwrites specific components of the total IWYP operational and research activities. Government agency partners that support scientific discoveries (currently in the UK, USA, Australia, Canada, France, India, and Mexico) are responsible for the activities where investments are usually research project based and made in multi-year assignments (grant awards). USAID, BBSRC and SFSA currently invest in the development pipeline downstream of discovery (IWYP Hub) through a commission to CIMMYT in Mexico.

Through its partners, approximately US$45 million has been committed to the IWYP strategy to date. New investments into the discovery science enter IWYP linked to specific selected scientific projects that cover their costs. However, additional sustained funding is critical to support central operations and research coordination, and especially to support the essential IWYP Hub technical development platform. It is vital that the IWYP Hub continues its development activities to generate added value and new products for years after the research projects are completed. Thus, funding for these have to be within the IWYP financial objectives.

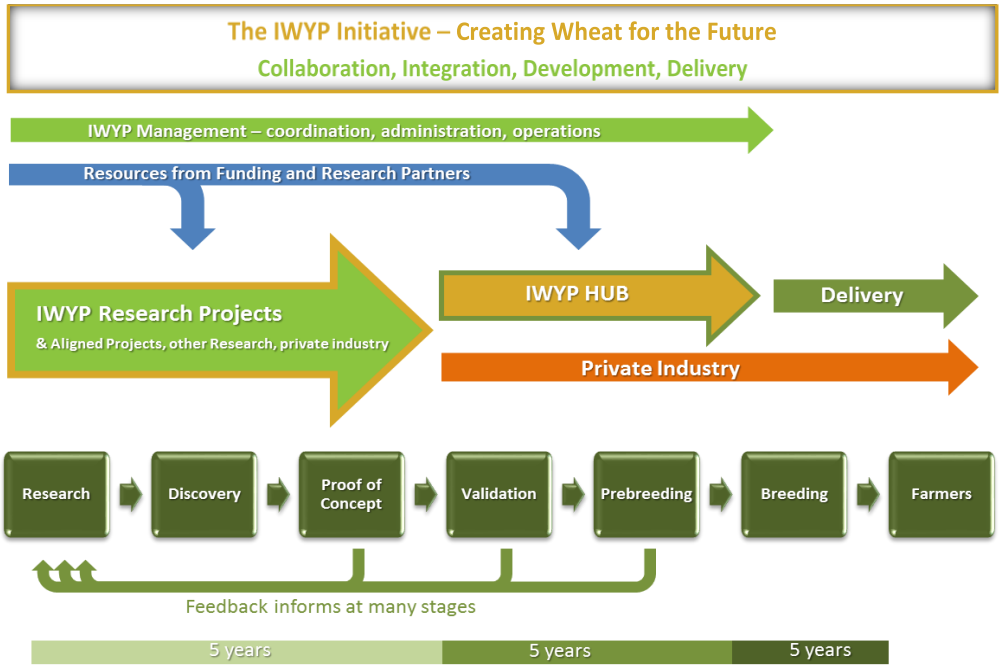


IWYP PUBLIC PARTNERS

THE IWYP SCIENCE PROGRAM

The IWYP Science Program has an overall strategy to coordinate and link our research efforts, integrate our outputs, generate added value and actively drive delivery. IWYP initiated its Science Program with several specific key end targets chosen by leading wheat scientists. It exploits the recently available full genome sequences of wheat varieties, and state-of-the-art ways to map DNA markers and genes to chromosome segments and thereby map complex traits to chromosome segments. It exploits novel germplasm with chromosome segments introduced from closely related species to find plants with more efficient photosynthesis. It uses novel high throughput ways to measure photosynthesis and test hypotheses not tested previously. It seeks to optimize grain production and phenology. Overall, IWYP seeks to exploit the frontiers of thinking and experimentation because it is seeking the best ways to make breakthroughs for commercial yield potential.

The overall strategy of the IWYP Science Program is to operate an "assembly line" where research activities focused on IWYP target traits deliver outputs for validation, and once passing this validation step are assembled in the most suitable combinations to meet our overall objectives. These different stages in the process, occurring in many laboratories around the world, are coordinated and integrated to generate "added value" over and above the separate projects. There are international initiatives in wheat breeding that also need to be monitored and assessed to avoid duplication.



Science Program

- Coordination of research and development activities to generate added value and drive delivery
- Scientific outputs from IWYP Funded Research Projects
- Scientific outputs from IWYP Aligned Projects
- Private Industry expertise for strategy and delivery
- Other national and international initiatives
- CIMMYT's longstanding research into wheat improvement
- IWYP validation and prebreeding Hub at CIMMYT
- CIMMYT International Wheat Information Network (IWIN) for delivery of improved IWYP germplasm

IWYP RESEARCH PORTFOLIO

The IWYP Science Program is currently comprised of a research portfolio of 23 individual research projects targeting different and overlapping aspects of genetic yield potential. The projects are developed by a globally distributed network of researchers who are internationally recognized leaders in their field. These stakeholders conduct research in an open and collaborative manner to tackle the ambitious IWYP objectives that have been set. Relevant research outputs from all projects are delivered as soon as possible to the centralized IWYP Hub at CIMMYT where they are validated to ensure that the yield benefits discovered are maintained in relevant wheat growing environments. Promising attributes are then combined to create new and improved elite wheat lines for evaluation or direct use by plant breeders and / or farmers worldwide.

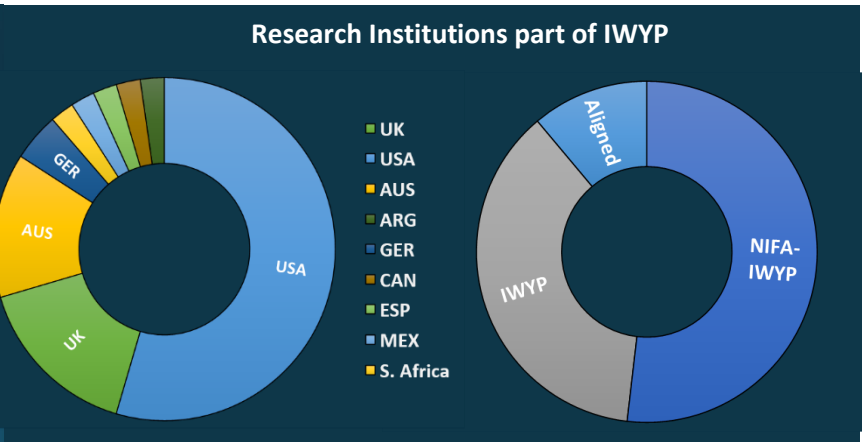
IWYP RESEARCH PROJECTS

The total value of the first 8 IWYP funded research projects selected in 2015 is ~ US$20 million. The projects involve institutions and research teams in the United Kingdom, Australia, United States, Mexico, India, Argentina and Spain. The science areas of these research projects include:

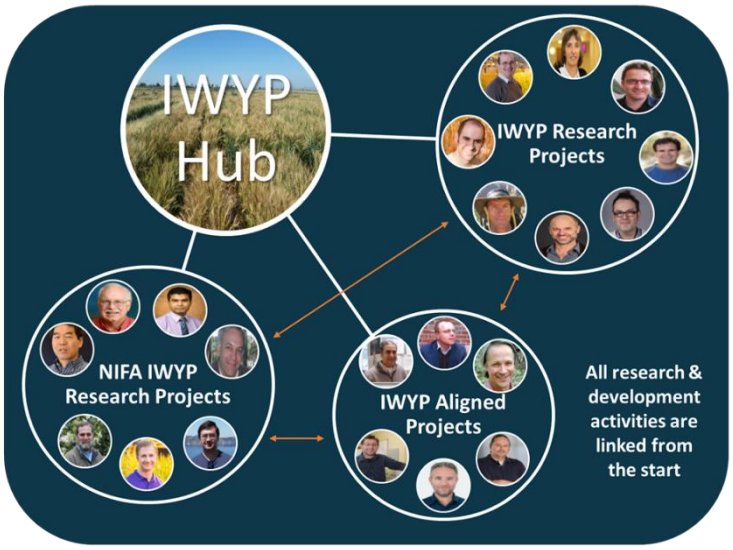
- Finding and employing traits and genes to increase photosynthesis
- Testing genes to boost spike development
- Reducing respiration and thereby enhancing photosynthetic efficiency
- Optimizing canopy architecture to increase carbon capture and conserve nitrogen
- Using selected genes from other species to increase biomass and yield
- Optimizing plant phenology leading to increased harvest index

NIFA – IWYP RESEARCH PROJECTS

The selection of projects from the NIFA-IWYP RFA (Competitive Call) was finalized in late 2016. 6 Standard projects were each awarded at ~US$1 million over 3 years. A single CAP (Coordinated Agricultural Project) grant was awarded at ~US$9.4 million over 5 years.



For the standard grants, research topics include:



Portfolio of Research Projects at IWYP

- The deployment of genome editing technologies to create novel variation in various yield components that lead to significant increases in the genetic yield potential of wheat (2 different projects)
- Optimizing harvest index through genomic enabled physiological breeding
- Photosynthesis – specification of high impact changes in the deposition of carbon compounds during plant development
- Development of methods to measure yield and other important phenotypic traits in field plots using new technologies
- Development of practical systems to facilitate implementation of hybrid wheat breeding programs for commercial production of hybrids

For the large USDA NIFA CAP project, research topics include:

- Validation, characterization and deployment of genetic loci (QTL) specifying grain yield components including grain weight, grain size, spike architecture, sink dynamics, floret number and fertility, phenologies, sucrose transport, carbon assimilation, carbohydrate mobilization and partitioning, spike photosynthesis, and enhanced carbon capture.

IWYP ALIGNED PROJECTS

The 8 IWYP Aligned Projects, similar in scope to the IWYP and NIFA Research Projects, are formally collaborating but financed primarily outside of IWYP. These projects serve to reinforce our research portfolio by targeting the following research areas:

- Selecting lines with increased biomass, harvest index and photosynthetic efficiency
- Developing improved protocols to select for biomass, harvest index and source sink balance
- Modifying canopy architecture for enhanced radiation use efficiency
- Validating the effect of known genes for yield components and photosynthetic traits
- Manipulating spike architecture traits
- Modifying the regulation of plant growth mechanisms, particularly those of resource allocation to the developing grain

For more information on all of the IWYP research projects, please visit www.iwyp.org

2016 - 2017 RESEARCH HIGHLIGHTS

HIGHLIGHTS FROM THE FRONT OF THE PIPELINE - THE IWYP HUB

Building Higher Yielding Wheat Lines

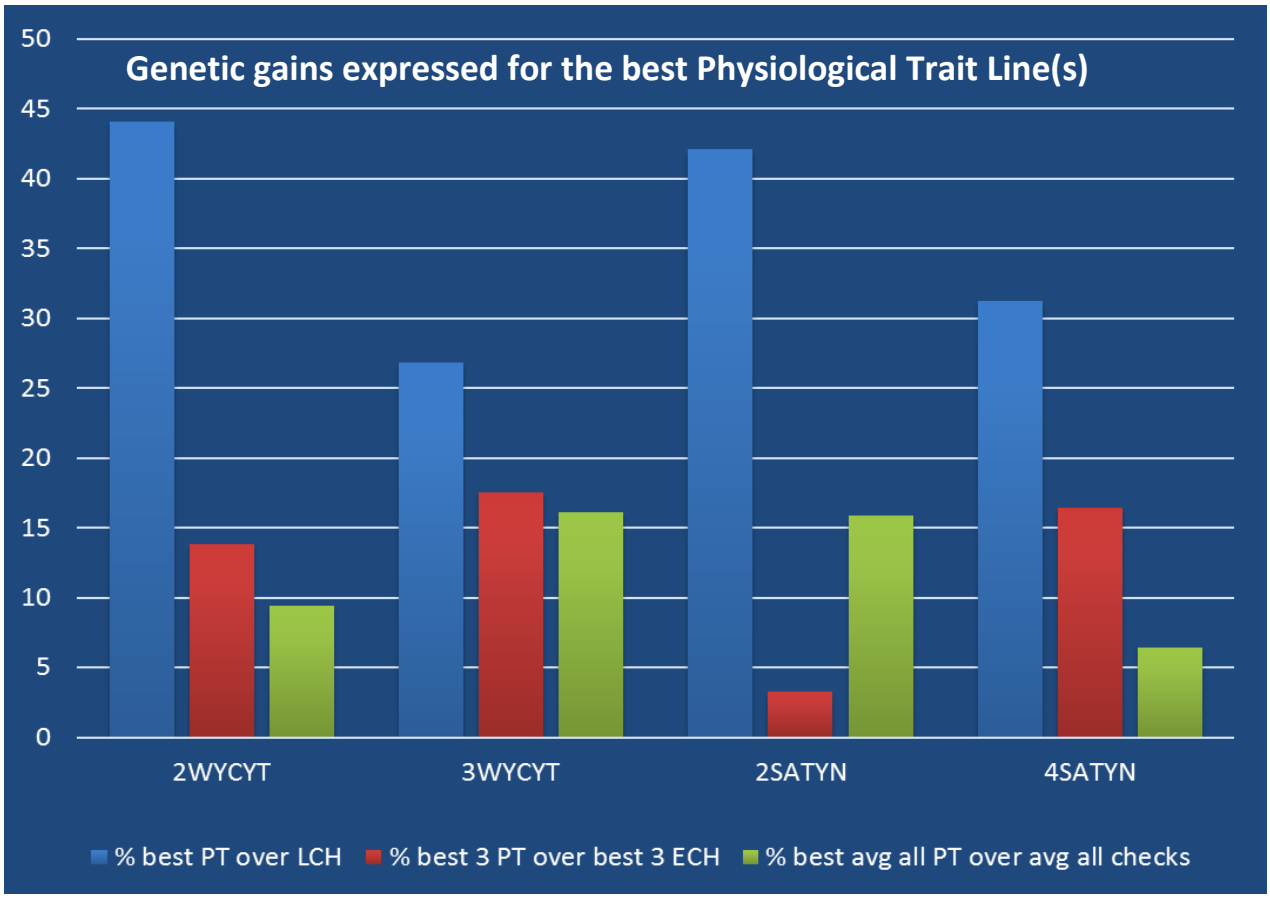
A distinctive feature of the IWYP initiative is our centralized validation and development platform called the "IWYP Hub" that enables translational research. In partnership with CIMMYT in Mexico, the IWYP Hub ensures that research outputs are further developed and delivered to breeding programs worldwide to create impact. It is exciting to report that the first discoveries in terms of traits, germplasm lines and tools have been transferred to the IWYP Hub and are proceeding through the pipeline towards delivery. Further, the first IWYP lines contributed by CIMMYT are being trialed via the International Wheat Improvement Network (IWIN) system.

At the IWYP Hub, a key breeding strategy is to select "physiological-based" traits that make improvements in genetic yield potential. For example, the current strategy is to optimize, and then combine, high "source" and "sink" traits as exemplified by selecting one parent for the ability to produce an abundance of biomass (source) and crossing it to another parent that has excellent sink related traits, such as harvest index. Offspring from these crosses are then tested in field conditions to determine if combinations of source and sink traits can be selected that further boost genetic gains in wheat. High performing lines are made available for distribution via the International Wheat Improvement Network (IWIN), as well as used as elite parents for prebreeding.

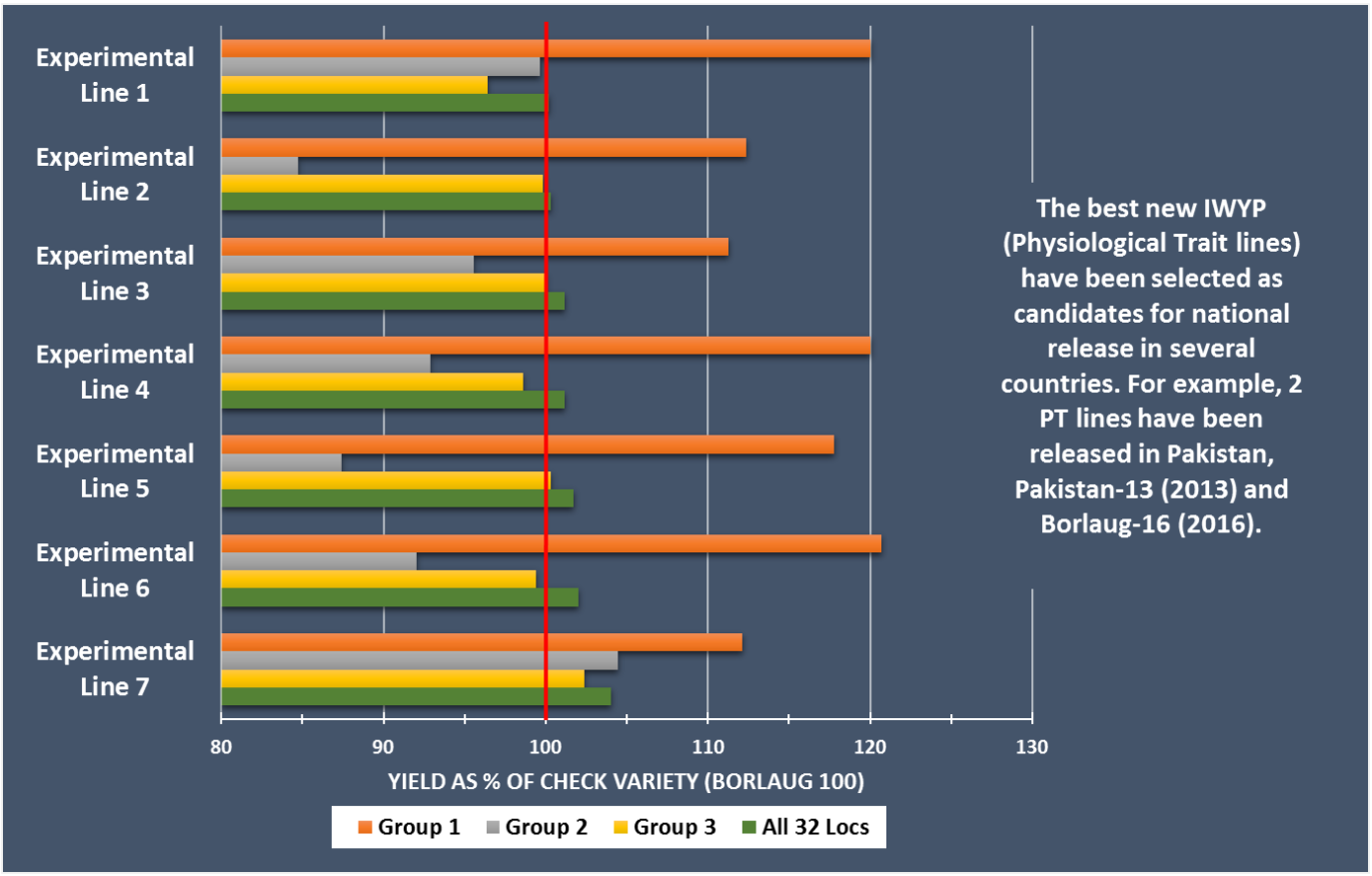
Selecting parents with high expression of biomass (source) and crossing to lines with good expression of harvest index and other yield components (sink) can accelerate genetic gains

Early Results

Results from trials at CIMMYT this past year show that genetic gains expressed by the best IWYP Physiological Trait lines (PT) consistently outperformed the best 3 elite check varieties (ECH), local check varieties (LCH), and the average of all new PT lines distributed outperformed the average of all check varieties for the Wheat Yield Collaboration Yield Trials (WYCYT) and Stress Adaptive Trait Yield Trials (SATYN). Results from the two WYCYT trials (2WYCYT vs 3 WYCYT) also show an increase in performance over time. This validates that continued genetic gains are possible using the IWYP approach.



The chart below shows the performance of the 7 best new IWYP Physiological Trait (PT) lines (Experimental lines 1 – 7) in the 3rd WYCYT trial (2015/16 wheat cycle) across 32 diverse international locations (environments), and when these locations were subdivided into 3 groups (Groups 1, 2 and 3) of similar environmental types (climate, soil types, agronomic practices, etc.). The chart shows the average yield of each of these 7 experimental lines as % of the elite check variety (Borlaug 100) across all 32 locations and within each of the 3 environmental groupings. The data clearly indicate that in many environments the yield of these experimental lines is equal to or greater than the check variety in the combined 32 locations group, with substantial performance increases in environmental group 1. In addition, experimental line 7 showed higher yields than the check variety in all environments tested.



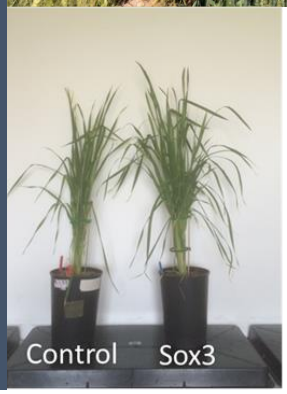
These examples demonstrate the potential impact of optimizing IWYP target traits to improve genetic yield potential. It is this genetic base into which further IWYP research outputs will be combined through a prebreeding strategy to make even greater gains in yield. The newest lines that have increased biomass and improved yield were entered into the CIMMYT Wheat Yield Collaboration Yield Trial (WYCYT) 2017 Trial for distribution to international collaborators via the International Wheat Improvement Network (IWIN).

EVALUATION OF KNOWN GENES ON KEY YIELD TRAITS

Evaluating Known Genes for Their Potential Impact

- Assessed promising genes in different genetic backgrounds
- Disseminated grain size trait mutants to some private industry partners for further evaluation

- Transferred a gene for increased grain size into multiple CIMMYT lines in combination with a gene for increased spikelet fertility to test if both genes increase yield in comparison to lines having neither of these genes
- Shared several mutant lines containing genes for spike yield components with private companies for study in their breeding programs to confirm that they increase yield in proprietary germplasm
- Developed new populations of wheat lines that minimize heading date (adapted to CIMMYT target environments) but maximize diversity in development phases prior to heading, to test the effect on yield
- Profiled hundreds of wheat lines for known phenology genes to determine the effect that different combinations of these genes have on plant development and harvest index
- Transferred new phenology genes into CIMMYT lines to evaluate their effects on development and harvest index in elite germplasm



FINDING OPTIMIZED TRAITS IN WHEAT GERMPLASM

Germplasm Screening for Novel Variation

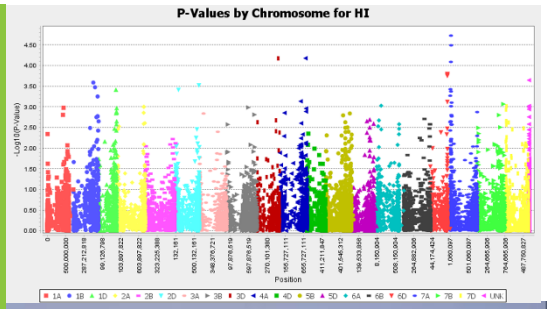
- Gained greater understanding of the contribution made by target traits to final grain yield and performance
- Identified individual plants / lines having the desired characters to incorporate into elite lines
- Generated data / information for IWYP researchers to identify the genes that control the target traits contributing to improved genetic yield potential

- Identified genotypes from a screen of thousands of lines that have greater photosynthetic efficiency which could contribute to increased biomass production
- Discovered genes affecting grain size that increase grain yield
- Identified considerable genetic variation for energy use efficiency from screening hundreds of diverse lines, thus enabling selection of those lines where more energy can be diverted to the grain
- Identified lines that have significantly higher biomass production than the elite check varieties, from screening of thousands of lines
- Revealed many lines that show more efficient use of light resources that may lead to higher biomass and yields
- Tested known photosynthetic genes and genes showing an effect on biomass production, tiller number and remobilization of carbon in the field, to confirm the positive effects on plant growth seen previously in the laboratory
- Screened thousands of lines in the field that had been selected for physiological traits and their effect on biomass and grain yield
- Identified lines with optimized source:sink balance leading to improved yields

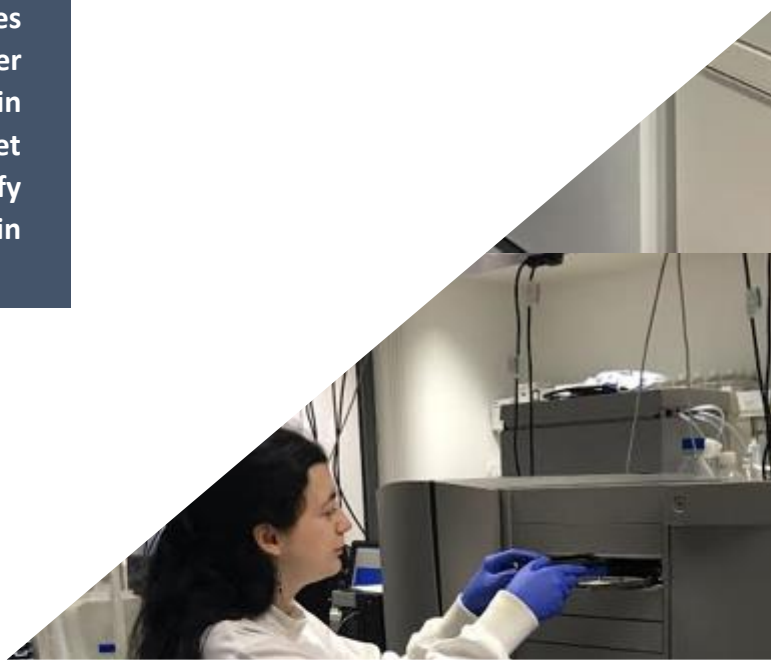
FINDING NEW GENES AND MARKERS FOR BREEDING

Gene / Marker Discovery and Deployment

- Identified several genes controlling key physiological traits of interest
- Developed cost effective, robust and diagnostic molecular genetic markers
- Implemented marker systems in a high throughput Marker Assisted Selection (MAS) pipeline to identify individuals with the best characters



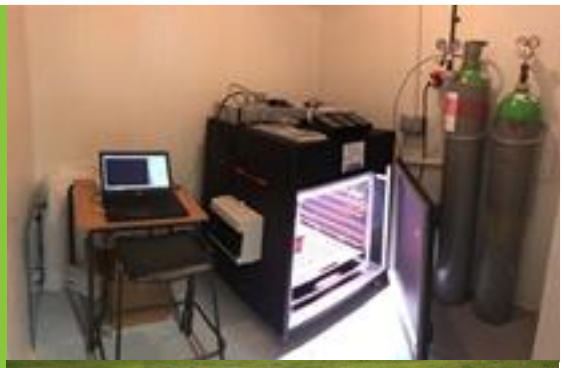
- Identified 10 new genes influencing components of spike yield from a screen of mutant wheat lines. Their overall effect on final grain yield to be tested.
- Developed a set of molecular genetic markers linked to field traits, including photosynthetic traits, that can be used as diagnostic markers to select genotypes with increased photosynthetic efficiency and yield potential
- Identified new genes for extreme earliness and corresponding high yields in CIMMYT material. These will be tested alongside other phenology genes to identify the optimal combinations that can be used to predict optimized harvest index.
- Determined the wheat native genes corresponding to those identified in other species that show a positive effect on grain yield, roots, tiller number and other target traits. These have been used to identify favorable alleles for these genes for selection in breeding.



TOOLS AND PROTOCOL DEVELOPMENT

Tools & Protocols

- Further developed publicly available tools and protocols to more accurately measure, at higher throughput, traits that are traditionally more difficult to assay in the field or in controlled environments
- Developed tools to help IWYP scientists and other researchers more easily query and visualize the wealth of genomics data that are being generated by IWYP and other research groups



- Developed technology to screen light interception and other photosynthetic traits in wheat canopies faster and more cheaply than current commercial alternatives
- Developed the first high throughput chlorophyll fluorescence screen to enable rapid screening of wheat populations for photosynthesis and photoprotection
- Developed a novel whole plant gas exchange system that rapidly and accurately measures leaf water use efficiency
- Identified several useful high throughput proxy traits that can be used in breeding strategies to screen for improved stem partitioning index, harvest index and yield components

PUBLIC PRIVATE PARTNERSHIPS (PPPs)

Partnership with the private sector is an important aspect of IWYP due to the many applied strengths and commercial focus they bring. Our private partners help guide the overall strategic direction and aid to ensure that our science and research targets remain commercially relevant. They keenly understand what growers need, how to efficiently manage complex projects, build and manage portfolios, and have first-hand knowledge of the applicability of the latest technologies being deployed for crop improvement. Further, private companies are a key delivery mechanism for outputs resulting from IWYP research that is complementary to the validation and prebreeding activities undertaken at the IWYP Hub at CIMMYT.

To have access the broadest knowledge and commercial reach of private seed companies, IWYP is keen to partner not only with those that are global players with significant R&D investments in cereals research, but also with a diverse set of local and regional wheat breeding companies.

Over the last year, we have added two new wheat seed / breeding companies to IWYP, i.e., SeedCo and RAGT. This brings the current number of IWYP Private Partners to nine (see panel on right). Five of these seed companies have a global footprint while the other 4 have a focus on the seed market at a regional level, e.g. Europe, Africa, Australia, and India. This combination helps bring together different perspectives in terms of the seed market and product requirements.

"KWS is proud to be partnering with IWYP to substantially raise the genetic yield potential of wheat. Increasing wheat yield is a fundamental component of our wheat business strategy. It is essential that industry work with academics to drive forward this major societal goal of food security. KWS believes in engaging with the best science through public private partnerships such as IWYP as these represent the most effective method for combining the scientific excellence of the academic community and the technology transfer and product delivery capability of industry."

"Farmers expect complete solutions for managing their farms and consumers want a plentiful and healthy food supply. At DuPont Pioneer, we believe that public-private partnerships like the International Wheat Yield Partnership (IWYP) allow us to collaborate with leading experts in the pursuit of transformational agricultural innovations to meet the growing demands of our customers and consumers. We're pleased to be actively involved with IWYP and its research efforts to increase the genetic yield potential of wheat."

2ND ANNUAL IWYP PROGRAM CONFERENCE

The IWYP Program Conference is an annual event bringing together IWYP researchers, IWYP Management, advisory and Executive Board members, private industry partners and other relevant invited parties. Its objective is to provide a platform to inform and share research discoveries, to facilitate interaction and collaboration among all participants, reveal additional ways to generate added value and to provide a forum for consensus decision making.

The second Program Conference, held in March 2017 in Obregon, Mexico and in conjunction with CIMMYT, was attended by 74 participants that included IWYP researchers, IWYP Management, members of the Science and Impact Executive Board (SIEB), members of the Scientific Advisory Committee (SAC), private sector representatives and invited guests. It was organized over four days. Although the current venue is preferable, in some year the venue may change to give IWYP participants the opportunity to visit other research institutions and field locations.

Day One

- Research updates from the Project Leads of the first 8 IWYP funded and 7 IWYP Aligned Projects
- Group discussion of the perspectives from the attendees of how the IWYP Science Program is coming together with a view on the value and impact being created by the primary science

Day Two

- Presentations of planned research activities from Project Leads of the 7 NIFA-IWYP projects
- Discussion on the strategy and use of molecular markers at the IWYP Hub
- Update on deployment of an IWYP data management system
- Update on progress and functions of the IWYP Hub

Day Three

- Visit to the CIMMYT field station to tour trials of various IWYP projects and functions of the IWYP Hub, such as screening of specific germplasm panels, prebreeding activities, methods of evaluation and selection, and high-throughput precision phenotyping techniques

Day Four

- Open discussion on ways to facilitate engagement and collaboration among the IWYP team and shaping of the Science Program
- Communication needs and mechanisms
- Strengthening engagement with private industry



IWYP 2ND COMPETITIVE CALL FOR PROPOSALS

The Second IWYP Competitive Call for Research Proposals was launched 19 December 2016 with the final selection of new projects expected at the end of 2017. Research topics sought include:

- Increasing carbon capture before flowering
- Increasing biomass
- Optimizing harvest index
- Enhancing photosynthetic pathways
- Specific changes in plant architecture
- Modifying phenology, e.g., flowering time
- Increasing carbon flow into grains
- Hybrid wheat development (traits, genetics, breeding methods, heterotic groups, etc.)
- Root structure and growth
- Faster / alternative breeding methods
- Modelling to define the optimal traits / combinations per environment

Pre-Proposals were first sought and were received by the end of April 2017. These were peer reviewed by a panel of 6 internationally recognized scientists with demonstrated expertise in wheat germplasm, photosynthesis, breeding, plant genetics, genomics and a good knowledge of current ongoing worldwide wheat research. Three of these were from the public sector and 3 from private industry. IWYP Management also reviewed all Pre-Proposals bringing a total 9 independent assessments per Pre-Proposal. Using these assessments along with other IWYP criteria such as research portfolio consideration, the IWYP Science and Impact Executive Board selected the best Pre-Proposals and invited these authors to submit a Full Proposal in early June 2017.

Full proposals were received in mid-August and are currently being peer reviewed using a similar review process as before. Review assessments will be completed by the end of October 2017 followed by selections of which proposals to recommend for funding by the end of 2017.



TRAINING & CAPACITY BUILDING

TRAINING

IWYP views frequent interaction and scientific development of IWYP researchers, and the training of the next generation of wheat scientists, as essential for the IWYP Science Program to create impact for the future. These current and future scientists will build on the valuable scientific contributions made in basic and applied research in IWYP projects and could be the architects of the groundbreaking discoveries needed in the future. All IWYP research projects are fully engaged in training activities by involving PhD Students and Post-Doctoral Research Scientists in generating the research outputs that will enable IWYP to realize its overall goals and objectives.

To foster interaction and team building among IWYP research groups, BBSRC has provided financial support to IWYP to enable the exchange of IWYP researchers among different laboratories. Scientists spend time in each other's labs and fields to exchange knowledge, learn new skills and forge more effective collaborative relationships. Last year, financial support was provided to IWYP researchers in the UK to train with colleagues at CIMMYT and conversely for a number of CIMMYT researchers to train with IWYP scientists and laboratories in the UK. Over the coming months, IWYP will seek to secure additional funds to serve other IWYP researchers in this way.

CAPACITY BUILDING

Over the last 18 months, IWYP funds have assisted in building research capacity within CIMMYT that aids both the IWYP research project and the IWYP Hub. These include:

- A multi-spectral camera and software for high throughput phenotyping using drones
- A harvester modification for collecting biomass more efficiently from field plots thereby increasing the number of plots that can be studied in the field
- An additional plant drying unit for biomass determinations

CONCLUDING REMARKS

This report details the second full year of operations for IWYP. The objective of the first Annual Report was to provide comprehensive detail on IWYP, why IWYP exists, the global challenges wheat faces, how IWYP is structured and how it operates (see www.iwyp.org). This second Annual Report places greater emphasis on the most important aspect of IWYP, its science and initial progress. It shows that the IWYP Science Program is targeting traits that will underpin gains in genetic yield potential. The outputs are the consequences of the hard work and dedication of all the scientist stakeholders in IWYP in meeting their individual milestones and progressing the Science Program towards reaching its goals and objectives. The dedication and sense of urgency exhibited by all researchers that IWYP seeks has been inspiring.

The coming months herald new exciting events such as the completion of our 2nd Competitive Call for Research Proposals, organizing the 3rd IWYP Program Conference and fully integrating the recent NIFA-IWYP Research Projects into the IWYP Science Program. Most importantly, in the next few months additional research outputs will arrive at the IWYP Hub to be validated and enter the prebreeding pipeline. With the active engagement by CIMMYT, improved germplasm targeting the traits that we believe will make a step change in genetic yield potential are already having impact in national programs. We intend for this impact to accelerate as new research discoveries flow through the pipeline.

The Management of IWYP hopes that this Annual Report has been an interesting read and has provided a satisfying overview of IWYP progress over our second year of operation.

For more details about IWYP, and particularly our science, please visit www.iwyp.org

IWYP International Wheat Yield Partnership

Research to Deliver Wheat for the Future

IWYP represents a long-term collaborative effort with the goal to increase the genetic yield potential of wheat by up to 50% in 20 years. IWYP will do this via a unique partnership of public sector agencies with private industry by supporting research that is innovative and high risk, but when successful will substantially boost global wheat productivity and contribute to meeting rising global demand.

IWYP | International Wheat Yield Partnership

Research to Deliver Wheat for the Future