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**Lead author is a graduate student.*

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**Lead author is a graduate student.*

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**Lead author is a graduate student.*

The CIMMYT-KARI-DRRW partnership in East Africa: Working together to beat the threat of stem rust race "Ug99"

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The international stem rust screening nurseries coordinated by CIMMYT, KARI and EIAR have made a significant impact on the global wheat community in addressing the threat of *Pgt* race Ug99. These institutions play key roles in the DRRW project in identifying new sources of resistance, pre-breeding, CIMMYT-Kenya shuttle breeding, pathogen surveillance and race surveys, varietal release, genetic mapping, and genomic selection. Close to 300,000 lines have been screened against race Ug99 and derivatives since 2005, and the screening capacity at KARI has increased from 20,000 to 50,000 lines each year. Similarly, close to 75,000 lines have been screened at EIAR, Debre-Zeit. Significant investment in infrastructure and facilities has ensured reliable phenotypic data over years. The results from international nurseries show a shift to higher frequencies of lines with resistance. The KARI-CIMMYT screening nursery has produced global benefits in the release of eight new high yielding resistant varieties in Kenya and over 40 varieties and advanced lines world-wide. The training course organized at KARI every year under the DRRW project is designed to train wheat breeders from the public and private sectors about stem rust, evaluation of germplasm, and standardization of note taking, as well as to update participants on rust pathology, breeding and innovative techniques that will enhance progress and efficiency in national breeding programs. The long-term partnership between CIMMYT, KARI and EIAR is making huge strides in the fight against the Ug99 race group and is producing outcomes that benefit the entire global wheat community.

The OSAU – CIMMYT shuttle breeding program: Results and prospects

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In 2009 a shuttle breeding program was initiated between CIMMYT and Omsk State Agrarian University. OSAU coordinates the KASIB program in Russia, tests CIMMYT soft spring wheat populations, selects the best samples, and disseminates them among Russian breeding institutions. OSAU collects information on stem rust responses, and has created a collection of genotypes for stem rust tests in Western Siberia and in Kenya (for race *Ug99* responses). Candidate genes are also postulated by use of molecular markers. Lines with effective *Sr* genes are allocated to the Siberian region where stem rust can be a problem. Thus far 4,085 populations from 921 crosses have been tested. The top 400 populations have been sent to Russian breeding institutions where they are used in selection for drought and disease resistances and in breeding. Exchange of material between CIMMYT and research institutions in Russia and Kazakhstan enhances the genetic diversity of local varieties and contributes to the achievement of high yields and disease resistance. OSAU offers vocational training workshops for Russian breeders and since 2013 trains Masters students for Eurasian countries (Uzbekistan, Tajikistan, Kirghizia, Armenia). Sustainable development of wheat production in Russia will contribute to global food security, an objective to which Norman Borlaug devoted his life.

Results of stripe (yellow) rust trap nurseries in rainfed environments of Central Mexico

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Wheat grows well during the spring-summer season on the high plateau of Central Mexico. As the growing time coincides with the rainy season the environment is suitable for the development of the rusts. Field trap nurseries are good indicators of the presence of rust and effectiveness or non-effectiveness of particular resistance genes. During the 2013 summer crop season, stripe rust trap nurseries were planted at Nanacamilpa, Terranate and Velasco in the state of Tlaxcala; Veloz in Hidalgo; and at Santa Lucia and Juchitepec in the state of Mexico. Disease severities reached 100% on Morocco and other susceptible checks at all locations. Virulence for *Yr6*, *Yr7* and *Yr9* was present at all locations. Virulence for *Yr2* (Kalyansona) was identified only at Nanacamilpa. Virulence for *Yr8* and *Yr28* was present only at Terrenate, and virulence for *Yr31* (Avocet*3/Pastor) occurred at Nanacamilpa, Terrenate and Velazco in Tlaxcala. The Avocet S differentials carrying *Yr5*, *Yr10*, *Yr15*, *Yr17*, *Yr24*, *Yr26* and *Yr27* were resistant at all locations indicating lack of virulence for these resistance genes during the 2013 growing cycle. The different responses of entries in the trap nurseries at different locations indicated considerable pathogenic variation across a relatively small geographic area. Final disease severities on differentials and other entries indicated different races compared to previous years. Several samples were taken from each location for race identification under the greenhouse conditions, and in particular, to confirm avirulence for *Yr2*. Regular stripe rust trap nurseries provide a reliable means of surveillance and a source of samples for race analysis.

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Revitalization of the CDRI Murree laboratory and its results for 2012-13

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The rusts are the main constraints to wheat production in Pakistan. The introduction and use of resistant germplasm from CIMMYT and the national breeding effort have saved millions of dollars. CDRI has collaborated with national breeders since the Green Revolution to save Pakistan's wheat against rusts and to increase its productivity. Genetic resistance is the most effective way of control of the rusts, providing annual savings of approximately 450 million US dollars. Recent upgrading of CDRI Murree laboratories has strengthened the rust research effort with support of the Wheat Productivity Enhancement Program. Staff from both provincial and federal organizations are being trained and engaged at CDRI. The laboratory is actively collaborating with BGRI in its efforts to monitor rust pathogen variability and movement at the global level, and screening national and international wheat germplasm for rust response. In 2013 following restructuring and upgrading, the laboratory has pathotyped rust samples from all over the country. Our poster will present results for the 2013 survey and will summarize the results of our germplasm screening efforts for national breeders and researchers.

Guidelines for development of comprehensive national policies for integrated management of the wheat rusts

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Management of wheat rusts is a complex challenge, due to the transboundary nature and formation of new strains by the fungal pathogens, for farmers to address alone, especially in developing countries. Coordinated support from governments and international institutions is necessary to address these threats to wheat production. As a member of the Borlaug Global Rust Initiative, FAO, through its global wheat rust program, has been assisting vulnerable countries to strengthen their capacities in various areas, but particularly with surveillance and policy development. Experience in numerous countries has demonstrated that development of comprehensive national policies will improve management of the rusts. Thus the FAO wheat rust program aims to support countries in their efforts to formulate and implement national policies and strategies for integrated disease management measures to address rust challenges. The main objective of this initiative is to promote a participative and collective working approach to ensure effective collaboration among related institutions and disciplines. To achieve this, expertise and resources of all related institutions and disciplines must be mobilized through a participatory process with the aim of preparing effective national strategies. This process needs to consider the following:

- Engagement of all relevant stakeholders and institutions, identification of their roles, and coordination arrangements
- Establishment of a platform for information exchange, dialog, evaluation and decision making
- Situation analysis and identification of strengths, weaknesses and areas that need improvement
- Development of a collective action plan outlining the interventions needed for effective management and emergency responses

The interventions considered could include the areas of surveillance, race analysis, development and promotion of resistant cultivars, seed production systems, as well as fungicide availability and safe use, capacity development, research-extension linkages, and farmer training. National strategies will need to be reviewed regularly and updated as necessary.

Contingency plan for management of wheat rusts in Morocco

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In Morocco, wheat encounters many biotic constraints, the major ones being stripe (yellow) rust and leaf rust that are capable of causing up to 80% yield losses in individual fields of susceptible cultivars such as the widely grown Achtar. Despite the participation of many national institutions in the wheat value chain there is no effective strategy to deal with rusts due to lack of co-operation. A workshop of 85 scientists and officials from relevant institutions developed a contingency plan to achieve effective control of the rusts. As well as covering specific topics such as the status of rusts, research and breeding, surveillance, seed systems, extension and planning, ways of improving collaboration and coordination among institutions were discussed. As an outcome, a draft contingency plan outlining the short, medium and long term actions necessary for management of wheat rusts was prepared and validated. The study recommended establishment of a steering committee comprising the Director Generals of institutions involved in wheat production and protection to ensure oversight and coordination of implementation of the plan. A technical committee was proposed to coordinate technical work. The specific priority areas identified were development and promotion of rust resistant cultivars, integrated variety registration and improved seed production system, and establishment of a rapid rust surveillance and information exchange system. In addition, the fungicide registration and management process was identified as an area to be improved along with standardization of technical and economic impact assessment methodologies. The roadmap document produced was submitted to the Moroccan Ministry of Agriculture for implementation. It is expected that the approach will serve as an example for other developing countries.

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