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CANADA — UNITED STATES — MEXICO

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Issue: **NAPPO Position on new races of wheat stem rust caused by *Puccinia graminis f. sp. tritici* into North America (UG99)**

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North American Plant Protection Organization (NAPPO)

A strategic plan to prepare for the arrival of new races of wheat stem rust caused by *Puccinia graminis f. sp. tritici* into North America

The North American Plant Protection Organization (NAPPO) Grains Panel developed this plan to assist the plant protection organizations in Canada, Mexico and the United States in their preparations for the eventual introduction of new virulent races of wheat stem rust. NAPPO is positioned to bridge country-specific regulatory concerns, and to help communicate how these new races are being investigated by the global research effort.

Background of the Disease

Wheat stem rust is not a new disease and has been largely controlled globally for the last half century by genetic resistance incorporated into all wheat varieties. However, this changed when a new virulent race of wheat stem rust, caused by *Puccinia graminis f. sp. tritici* Eriks. & E. Henn., was first discovered in Uganda in 1999 (designated as Ug99).

As with most pathogens, wheat stem rust has many races. All previously known races and available sources of resistance are well documented. However, as a new race evolves, such as Ug99, outbreaks can occur that can create losses in wheat yields throughout the world. For example, epidemics of wheat stem rust have resulted in large crop losses in areas such as North America and Australia in 1955 and 1977, respectively. Yield losses from this new race (Ug99) discovered in Africa could approach \$1 billion (USD), according to projections made by the International Center for the Improvement of Maize and Wheat (CIMMYT).

Since the first report from Uganda in 1999, this new rust race of wheat stem rust has spread to Kenya, Ethiopia, Yemen and just recently was confirmed to be in Iran (reported by Food and Agricultural Organization (FAO) March 5, 2008). As the wheat stem rust fungus is dispersed over large areas by wind, the continued spread of this disease is a concern to countries such as Afghanistan, India, Pakistan and Kazakhstan. These countries grow more than 65 million hectares (approx. 161 million acres) of wheat, accounting for 25 percent of the global wheat harvest.

Rust epidemics brought about by this new race have already led to yield losses in Africa. Recently new variants within Ug99 (also known as specific race TTKS) have been detected and will continue to put pressure on the remaining resistance genes available.

North American Impacts

While the discovery of new races of wheat stem rusts are of great concern to wheat producers worldwide, research on this new race and related variants has shown that over 70% of North American wheat cultivars are susceptible.

As the spores of this new race of wheat stem rust are disseminated great distances by wind, there is now more than ever a concern that this new race will soon spread throughout the wheat growing areas in the Middle East, Pakistan, India, Southeast Asia and eventually to North America. It is expected to cause crop losses that could impact local and global

food security. The aerial movement of stem rusts from east Africa into Yemen and Sudan is of particular concern as it suggests a pattern of dissemination similar to that of related pathogens (such as *Puccinia striiformis*) that were spread from country-to-country by wind currents.

Efforts to deal with new races of stem rusts are currently being coordinated through the Borlaug Global Rust Initiative (GRI). The BGRI is led by CIMMYT, International Centre for Agricultural Research in the Dry Areas (ICARDA), United States Department of Agriculture – Agricultural Research Service (USDA-ARS), Agriculture and Agri-Food Canada (AAFC), Kenyan Agriculture Research Institute (KARI) and wheat breeders worldwide. More recently the Bill & Melinda Gates Foundation provided funds to Cornell University to enhance the global research effort, with a special emphasis on Africa.

Phytosanitary Controls

In light of widespread scientific agreement that wheat stem rusts are primarily dispersed by wind, the members of NAPPO agree that it would not be appropriate or technically justified to apply phytosanitary measures to grain imports as a means to prevent the spread of this new race of wheat stem rust to non-infected areas. NAPPO countries recognize that should Ug99 (race TTKS) or any other new races become established in the Western Hemisphere that it would easily spread throughout the continent through natural wind currents or possibly extreme weather events.

Globalization and increased air travel raise the risk that traveler's clothing, luggage, packed items or other accessories might be a mode for the introduction of a disease into non-infested areas. This type of accidental or inadvertent introduction is of particular concern with travelers arriving from overseas areas where Ug99 (TTKS) is present. NAPPO countries should include, as part of their own specific action plans, an evaluation of the effectiveness of passenger screening procedures at ports-of-entry, and outreach to communicate these phytosanitary precautions.

This also holds true for germplasm that is being moved from areas where any new races of wheat stem rust occurs to North America for research purposes. Each NAPPO member country should ensure that they have the appropriate import controls in place to track and monitor this research material, and to ensure that other pests of concern are not inadvertently imported or associated with the germplasm. However, it is important to note that because *Puccinia gramininis* f.sp. *tritici* is an obligate fungal pathogen it requires green tissue to survive and germplasm imported as seed presents negligible risk.

Surveillance & Monitoring (from a North American perspective)

From a NAPPO standpoint, there needs to be ongoing surveillance and monitoring for any new races of wheat stem rusts so that should a new race arrive in North America it would be detected as soon as possible.

To this point, each NAPPO member country should identify within their own country the appropriate body that could lead surveillance and monitoring programs. The implementation of monitoring and surveillance should be coordinated between NAPPO member countries in advance to clarify the roles of all parties involved. It is important to

have a system that allows for reporting and communicating the surveillance and monitoring information in order to achieve synergy in a national and international effort. It would also be necessary to establish a method to evaluate surveillance programs in order to recognize the implementation impact and to identify potential improvements.

Utilizing the current research expertise in each country would be key to ensure that all involved in surveillance and monitoring would have the tools required to understand the biology of this pest and be able to recognize it in a field environment.

Continually feeding surveillance and monitoring information to the policy makers within each country needs to occur so that should any new races be detected the appropriate actions and communications plans can be activated.

Detection and Identification

Each NAPPO member country should also focus on building capacities in detection and identification. These two aspects are essential parts of an early response strategy. Each country needs to ensure they have trained experts that can detect and identify, where possible, any of the new races of wheat stem rust. NAPPO member countries should also try to harmonize diagnostic protocols and techniques to ensure research efforts are shared and not duplicated.

For this purpose, Table 1 lists the organizations responsible for coordinating research, developing diagnostic tools and working on resistance screening within each of the NAPPO member country. It is important that NAPPO ensure communication linkages are coordinated between these groups on a regular basis.

Table 1

Country	Organization	Responsibility	Location
United States	Agriculture Research Services (ARS)	Research, diagnostic development and resistance screening	St. Paul, MN
Canada	Agriculture and Agri-Food Canada's Cereal Research Centre (AAFC-CRC)	Research, diagnostic development and resistance screening	Winnipeg, Man.
Mexico	Centro Nacional de Referencia Fitosanitaria. (CNRF)	Research and diagnostic development	Mexico City, MX
	Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP)	Resistance screening	

Disease Management

In order to globally manage this pest effectively into the future, there is a need for an integrated approach that includes the screening and development of new rust resistant cultivars. This strategy will require a coordinated and aggressive international effort in research, breeding, testing and multiplication to be able to provide new resistant varieties down to the farm level.

Resistance breeding is recognized as the only practical long term means of controlling new strains of wheat stem rust globally and has proven effective in North America for over the last 50 years. However, the evolution of this new strain of wheat stem rust has shown that the reliance of these historic resistance genes have begun to fail. The primary disadvantage of resistance breeding is the length of time required to determine new sources of resistance, breed them into varieties and make them available to growers. North American wheat breeders have already begun to look for sources of resistance to this new race of wheat stem rust. However, the long road to finding new resistant genes has just begun and more research is still needed.

It is recognized that chemical control through the use of effective fungicides will be the primary method to control any immediate outbreaks of this pathogen. However, there is a need for research to determine what effectiveness the current available fungicides have on this new stain of wheat stem rust or any new races that might be found. There is also a need for regulatory officials to ensure that there is harmonization, where possible, in the fungicides available between the NAPPO countries. This will ensure that the entire North American grain industry has all the tools required to combat this pest when it arrives.

Role of NAPPO

The North American Plant Protection Organization (NAPPO) is a Regional Plant Protection Organization of the International Plant Protection Convention that coordinates efforts among Canada, the United States and Mexico to protect their plant resources from the entry, establishment and spread of regulated plant pests, while facilitating intra/interregional trade.

NAPPO has prepared this plan to complement the respective member countries' specific action plans. It is designed to facilitate a harmonized, effective approach by each NAPPO member country's policy and research organizations so that they can manage the threat these new races of wheat stem rust pose. To this end, each NAPPO member country can use this North American strategic plan as a base for their own country specific action plan for addressing the threat posed by new races of wheat stem rust.

NAPPO will remain abreast of any developments related to the spread of any new races of wheat stem rust and any efforts being undertaken to minimize its global impact. It will ensure that as any new information becomes available it is provided to all NAPPO member countries. NAPPO will also encourage linkages and collaboration among research communities, the private sector and regulators aimed at protecting global wheat production from this new pest.

Additional Information

Agricultural Research Service (ARS)

<http://www.ars.usda.gov/main/main.htm>

ARS Wheat Stem Rust Recovery Plan

http://www.ars.usda.gov/SP2UserFiles/1/109/00000000/cnmp/wheat/wst_rust_02006-28-revised

Agriculture and Agri-Food Canada - Cereal Research Centre

<http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1180643854086&lang=e>

Centro Nacional de Referencia Fitosanitaria.(CNRF)

<http://148.243.71.63/default.asp?id=672>

Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP)

<http://www.inifap.gob.mx>

Borlaug Global Rust Initiative

<http://www.globalrust.org/>

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