

Recovery Plan for Stem Rust of Wheat caused by *Puccinia graminis* f. sp. *tritici* Ug99 (race TTKSK) and its derivatives

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Photos: T.D. Murray

Stem Rust Recovery Plan

Working Group & Process

Selection of participants

- **Subject matter expertise**
- **Geographic representation from affected areas**
- **OPMP guidelines and working group suggestions**

Working Group comprised of positive responses to invitation

Conference calls for overview of plan, to identify writing groups by topic based on expertise, and discuss relevant issues

Stem Rust Recovery Plan

Working group members

| | | | |
|------------------------|-------------------------------|-------------------------|-------------------------------|
| Heyward Baker | USDA-RMA | Yue Jin | USDA-ARS |
| Gary Bergstrom | Cornell University | Marcia McMullen | North Dakota State University |
| Bob Bowden | USDA-ARS | Roger Magarey | USDA-APHIS |
| Russ Bulluck | USDA-APHIS | David Marshall | USDA-ARS |
| Marty Carson | USDA-ARS | Gene Milus | University of Arkansas |
| Xianming Chen | USDA-ARS | Chris Mundt | Oregon State University |
| Erick DeWolf | Kansas State University | Tim Murray | Washington State University |
| Ruth Dill-Macky | University of Minnesota | Pierce Paul | Ohio State University |
| Chuck Divan | USDA-APHIS | Kent Smith | USDA-ARS, AO |
| Marty Draper | USDA-NIFA | Mark Sorrells | Cornell University |
| Jessica Engle | USDA-APHIS | Brian Steffenson | University of Minnesota |
| Prakash Hebbar | USDA-APHIS | Jeff Stein | South Dakota State University |
| Robert Hunger | Oklahoma State University | Les Szabo | USDA-ARS |
| Scott Isard | Pennsylvania State University | Stephen Wegulo | University of Nebraska |

Stem Rust

Historically one of the most important wheat & barley diseases worldwide

In the U.S., upper Great Plains suffered greatest damage

- major epidemics in ND, SD & MN from 1935-50s resulted in 250 million bushel loss (\$3.7B)

Effectively controlled since 1956 as a result of barberry eradication, effective disease-resistant varieties, and earlier maturity

→ Why stem rust – why now?

Stem Rust and Ug99

Race TTKSK of stem rust

- 1st discovered in Uganda, 1999
- Able to overcome widely used disease resistance gene *Sr31*, and since then, *Sr24* & *Sr36*
- Ug99 has formed several new races with different virulence genes = lineage
 - ➔ 80% of world wheat varieties are susceptible
- Spread within Africa and north to Iran

Unlikely to spread via natural means to North America

Spread of the Ug99 Lineage

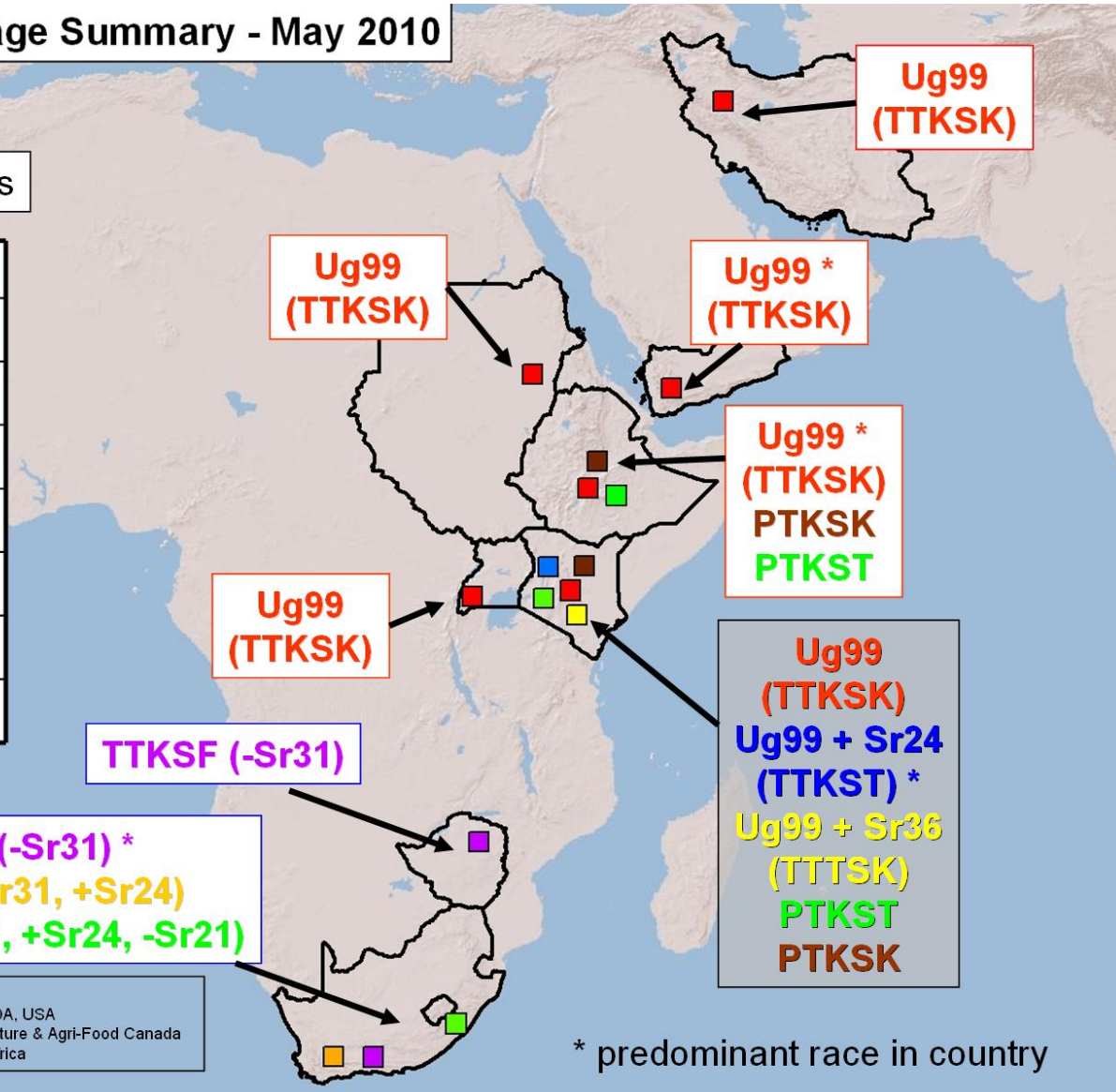
Ug99 Race Lineage Summary - May 2010

7 known variants

| RACE | YEAR |
|----------------------------|-------------|
| TTKSK (Ug99) | 1999 |
| TTKSF (-Sr31) | 2000 |
| TTKST (Ug99 + Sr24) | 2006 |
| TTTSK (Ug99 + Sr36) | 2007 |
| TTKSP (-Sr31, +Sr24) | 2007 |
| PTKSK | 2007 |
| PTKST | 2007 |

TTKSF (-Sr31) *
TTKSP (-Sr31, +Sr24)
PTKST (+Sr31, +Sr24, -Sr21)

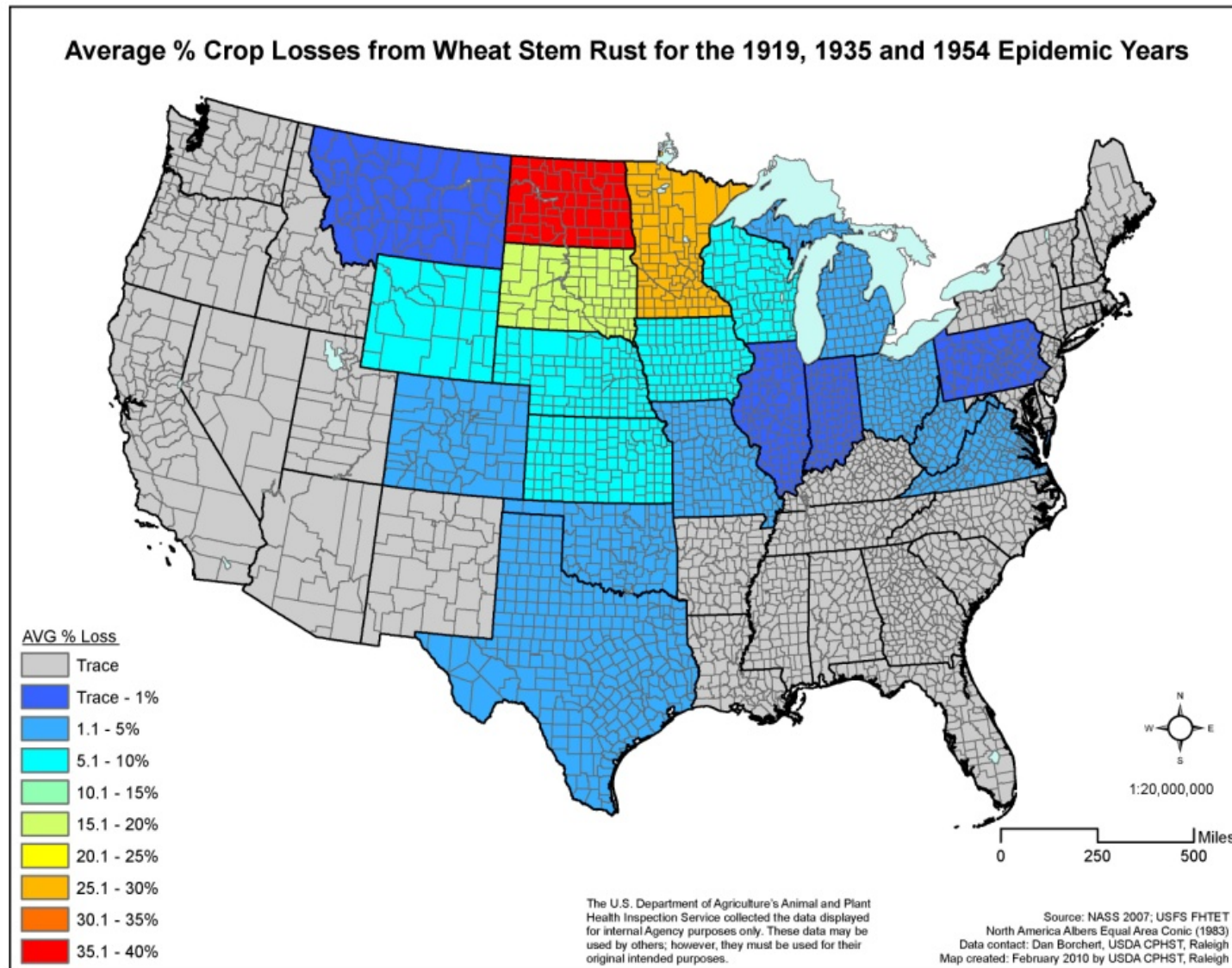
Data sources:
 Cereals Disease Laboratory, USDA, USA
 Cereals Research Centre, Agriculture & Agri-Food Canada
 University of Free State, South Africa



* predominant race in country

<http://www.fao.org>

Potential Crop Losses due to Stem Rust



Stem Rust Recovery Plan Recommendations

Research

1. Breeding: incorporate existing and new resistance genes, characterize adult plant resistance, and screen breeding lines for genetic resistance to new and emerging races of stem rust.
2. Surveillance: develop new tools to rapidly identify new variants and augment the existing surveillance network.
3. Epidemiology: conduct studies to develop and verify disease prediction models, pathogen movement models, and role of barberry in pathogen survival.
4. Chemical control: identify fungicides, application timing and methods for most effective control along with decision support tools.

Stem Rust Recovery Plan Recommendations

Extension

1. Develop 'Good Farming Practices' tools to help with risk management.
2. Produce education and training materials for farmers and agriculture professionals to help them diagnose and control stem rust.
3. Further engage the National Plant Diagnostic Network (NPDN) by developing a Standard Operations Protocol (SOP) for diagnostics.