Karnal Bunt Research Update – Ecology and Epidemiology

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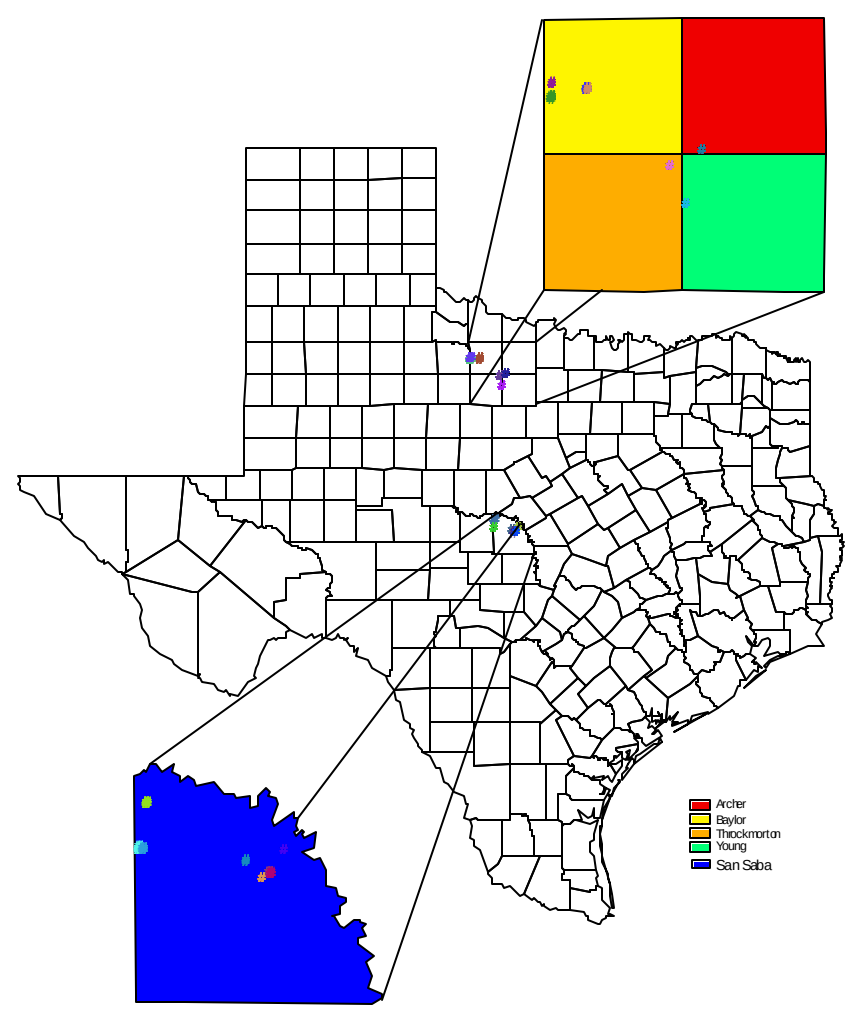
Detection and Quantification of T. indica in Field Soils

Research Objectives

- **Quantify the number of teliospores in each field sample.**
- **Determine the general soil type of the field sample.**
- **Determine the extraction efficiency for each soil type.**
- **Examine the relationship between soil type and teliospore presence or extraction efficiency.**

Materials & Methods



Fields sampled were positive in:

- 1997, 2001, or Both
- Never (neighboring)

Results Table: San Saba

Field ID #	Year(s) Positive	Mean # of Teliospores /25g	Standard Deviation	Soil Type	Extraction Efficiency (%)
10	2001	2.00	1.73	Silt Loam	3.3
11	1997	5.00	3.61	Sand	4.6
12	2001	0.00	N/A	Sandy loam	1.0
13	Never	0.67	1.15	Sandy Clay Loam	N/A
14	1997 & 2001	1.67	0.58	Loam	N/A
15	1997 & 2001	3.33	1.53	Sandy Clay Loam	5.3
16	Never	1.67	0.58	Sandy Clay Loam	6.5
17	1997	0.33	0.58	Loam	N/A
18	2001	0.33	0.58	Clay Loam	19.9
19	2001	1.00	1.00	Sandy Loam	4.1

Molecular Methods for Detection and Quantification of T. indica

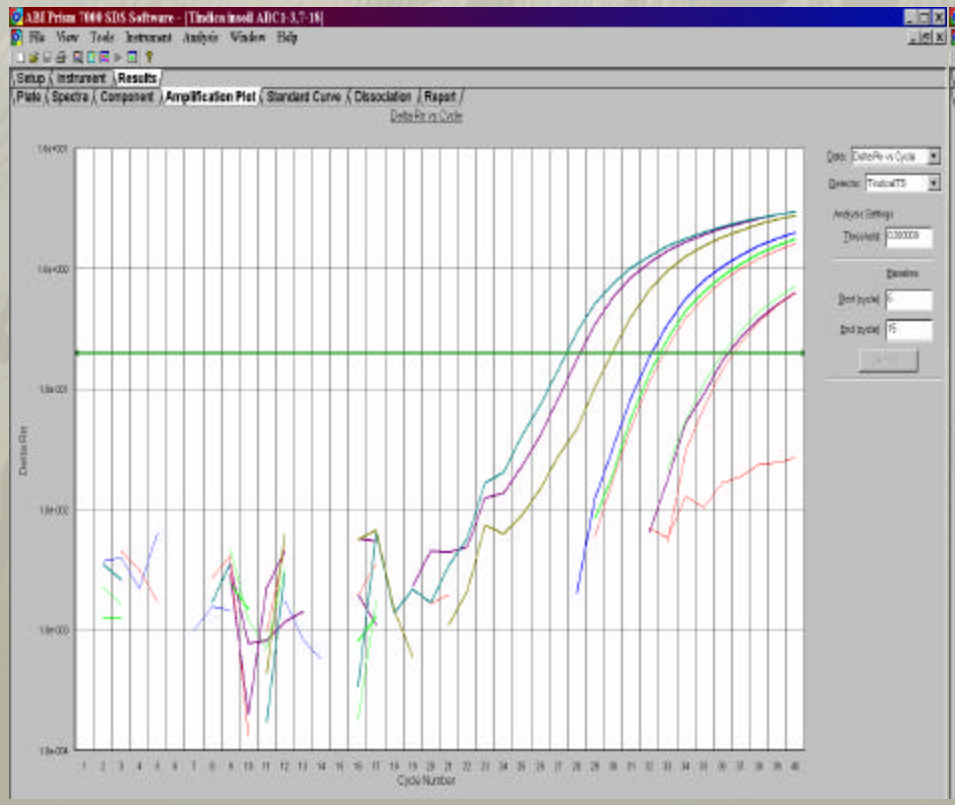
- **Can real-time PCR detect and quantify teliospores directly from soil?**
- **What is the detection threshold?**
- **Can method identify resistance to *T. indica* and be used as a selection tool?**

Results:

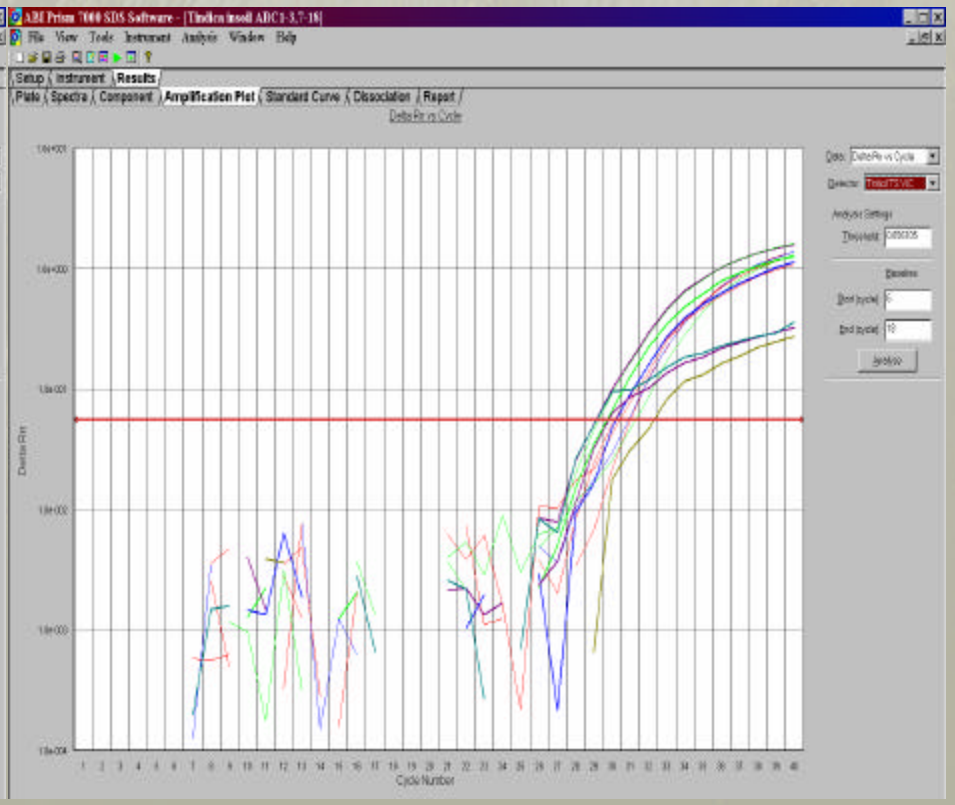
Soil (DNA) Extraction Method

Sucrose float *T. indica* teliospore dilution series

T. indica-specific



T. tritici-specific



New Research Activities:

- **Inoculum Density/Disease Incidence Relationships**
- **Inoculum Distribution Studies**
- **Use of Doppler Radar in Disease Forecast Modeling**

Bunted Kernel Frequency in KB Positive Fields

Location	Number of Fields Within Each Bunted Kernel / Field Range				
	1[z]	2-10	11-100	>100	Total
Arizona	131	145	43	5	324
California	8	6	2	1	17
Texas	46	11	0	1	58
Total	185	162	45	7	399

[z] The number of bunted kernels (BK) per field was typically enumerated from a 1.81kg sample harvested from one location at the edge of a field. Data in this format was not collected for each field at each location every year because in some instances counting stopped after detection of the first bunted kernel..

Data Supplied by USDA-APHIS.

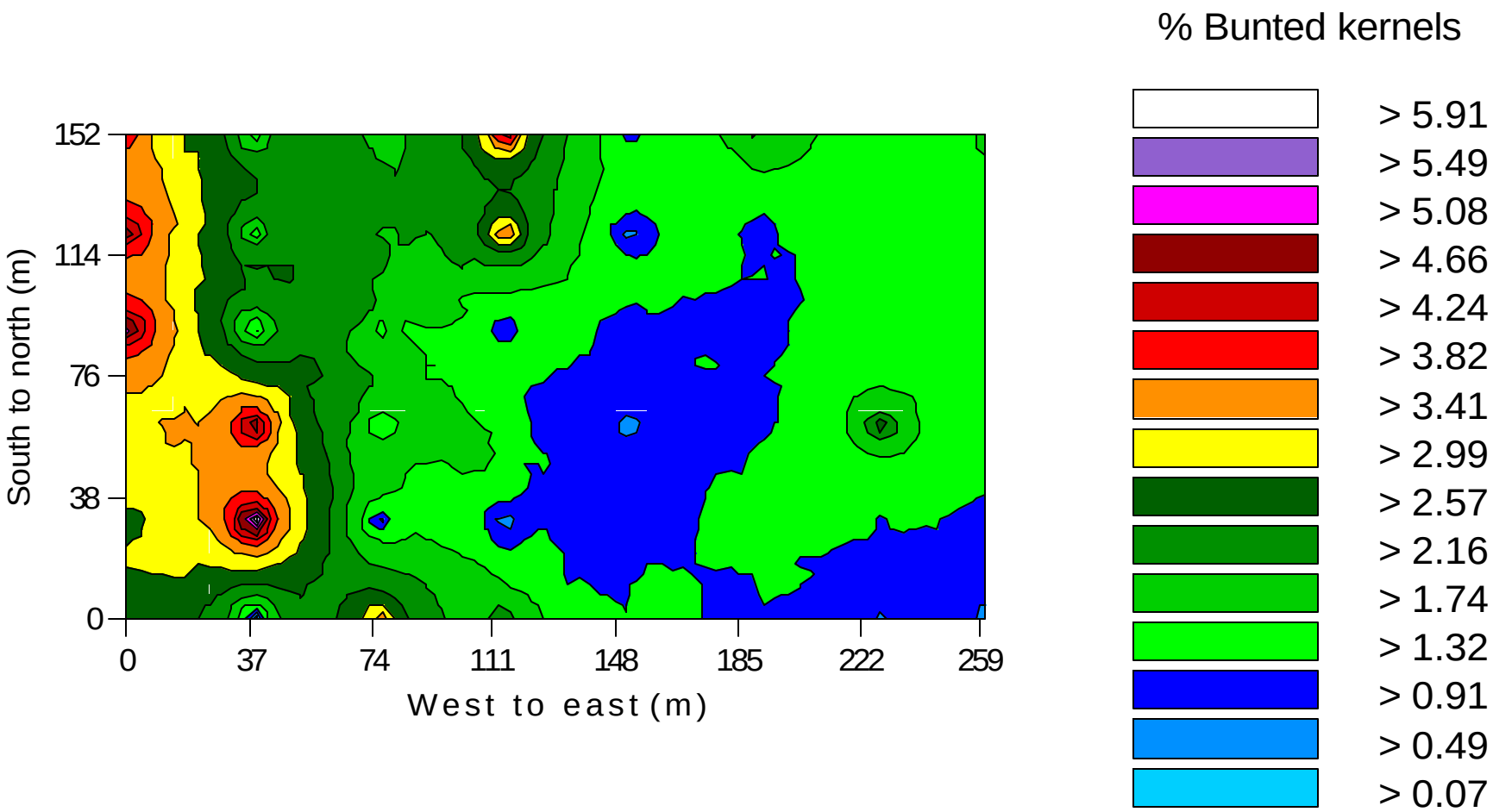
Bunted Kernel Distribution In An Arizona Durum Wheat Field

Cont.	Cont.	Trt.	Trt.	Trt.	Trt.	Cont.	Cont.	
Block Average								
4.26	1.28	1.62	5.43	0.89	2.36	1.42	2.44	2.45
5.31	1.13	2.06	4.79	0.31	0.88	1.30	1.38	2.14
6.05	0.51	1.37	0.90	0.96	0.95	1.61	1.00	1.72
3.32	5.84	1.12	1.73	0.48	1.19	3.44	2.12	2.26
2.71	7.32	0.31	0.20	0.85	1.90	1.28	0.92	1.96
2.91	0.10	4.07	2.61	1.32	1.32	0.73	0.07	1.71
Column Average								Overall %
4.28	2.40	1.86	2.67	0.80	1.44	1.63	1.29	2.05

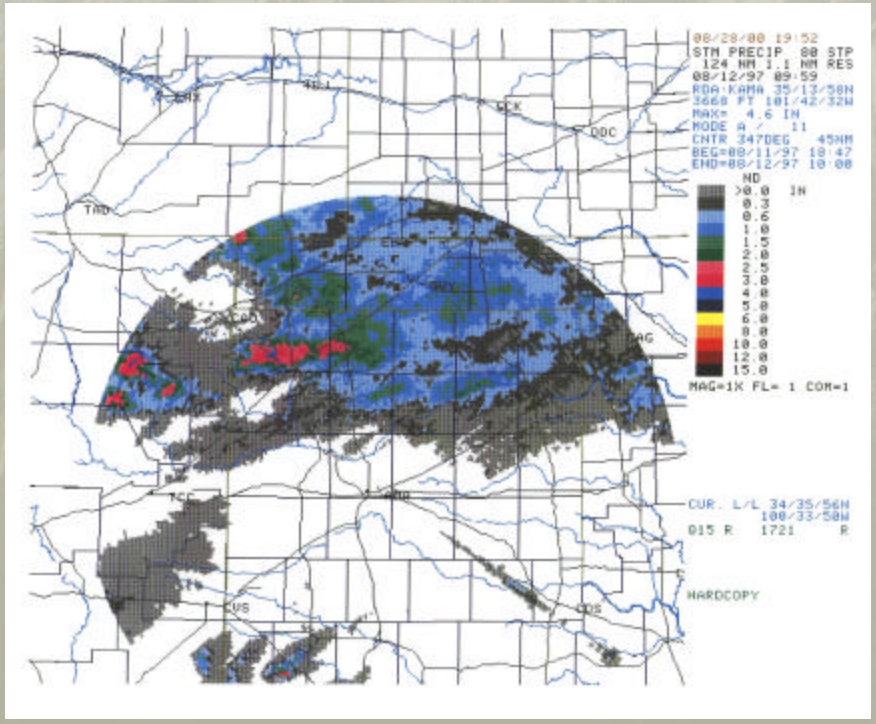
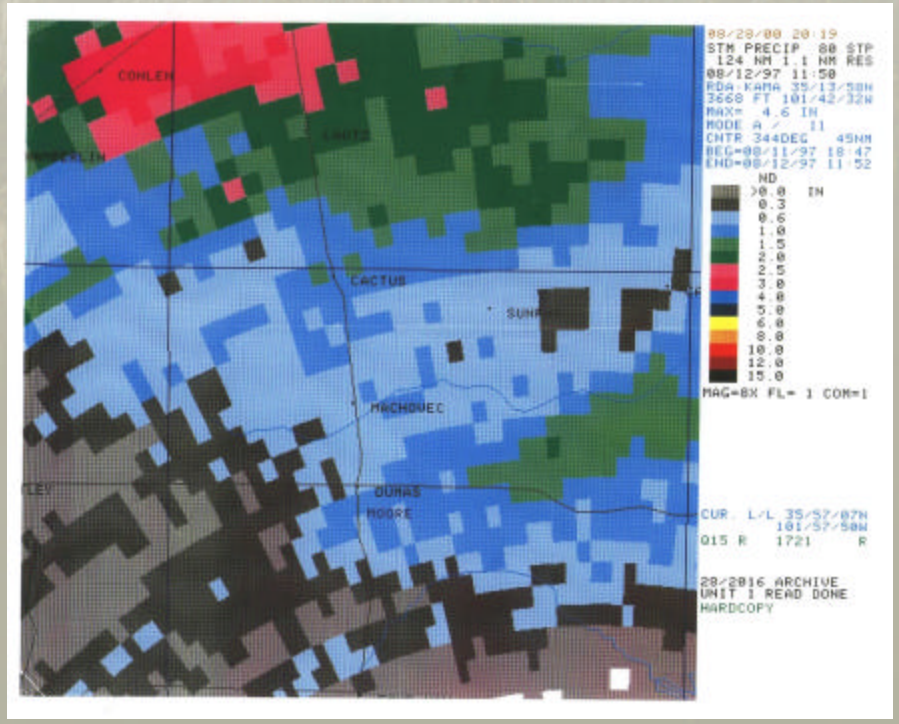
Row Average

Boratynski and Ykema, 2004

Bunted Kernel Distribution In An Arizona Durum Wheat Field



Boratynski and Ykema, 2004

Improved Disease Risk Assessment and Forecasting with Doppler Radar

- **Two square mile resolution**
- **Real-time and Archived data readily available from NWS**