



# **Sunflower Rust Status - 2007**

## **Race Frequency across the Midwest & Resistance Among Commercial Hybrids**

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# 2007 Sunflower Rust Study

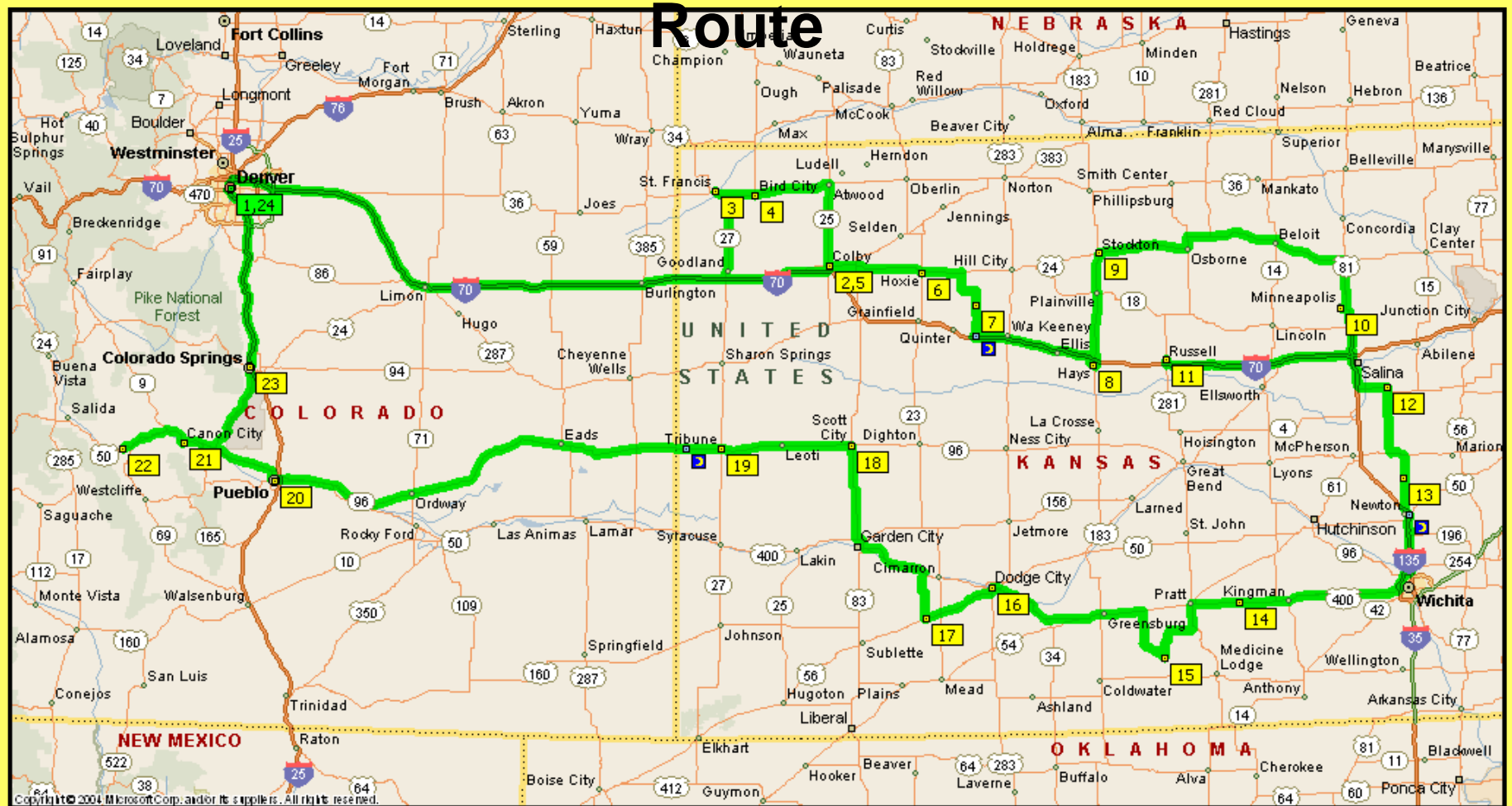
## Objectives:

- Collect rust & identify races
- Compare races from Northern Plains vs. Central High Plains
- Contrast races from wild sunflower vs. from cultivated sunflower
- Compare races over 2-3 year period
- Evaluate commercial hybrids for resistance to predominant race(s)

# Changes in Sunflower Rust over the past five years

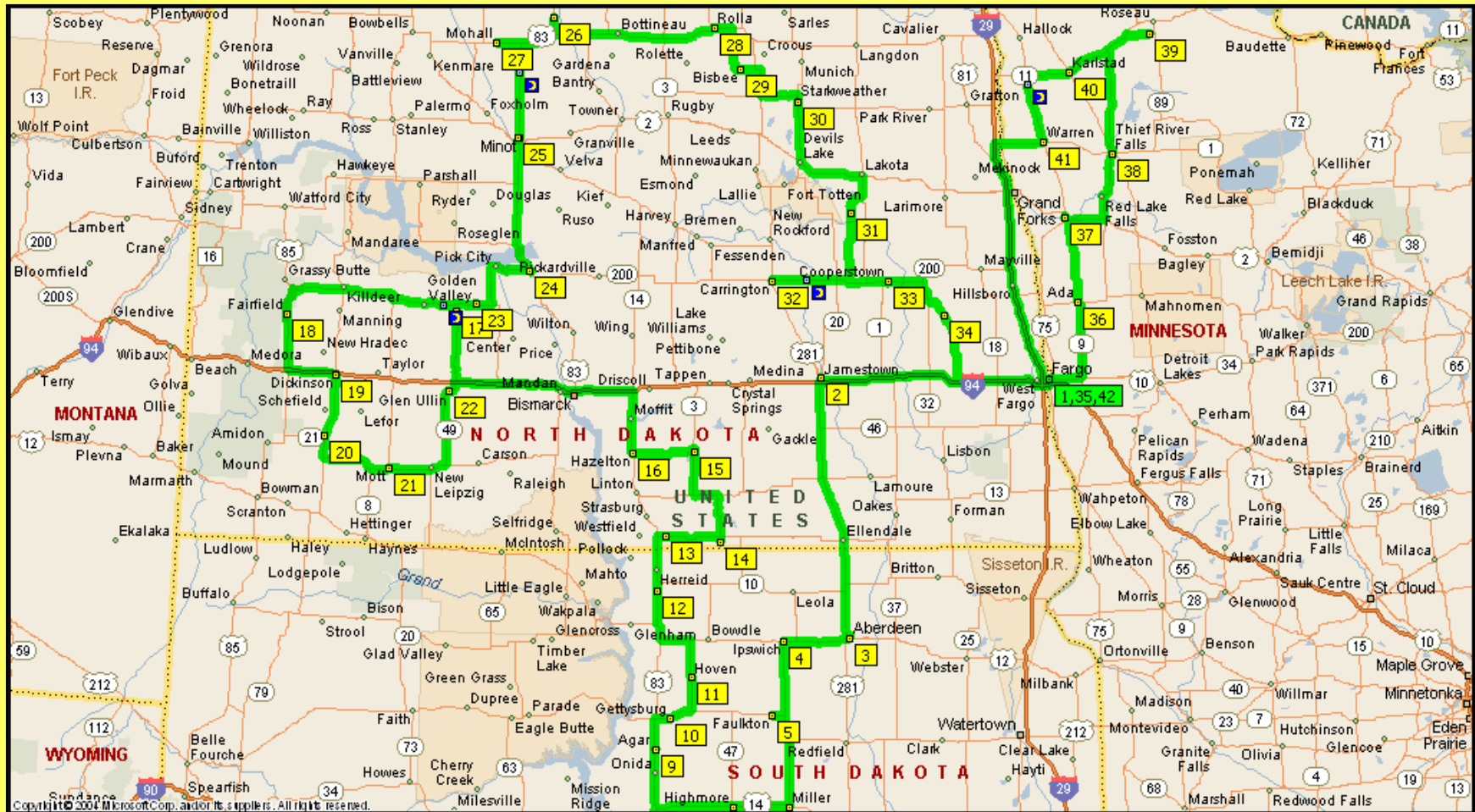
	2002	2003	2005	2006	2007
Rust Incidence (% of fields)	17%	44%	60%	68%	77%
Rust Severity (av. leaf area)	2.5%	1.4%	1.9%	2.5 %	2.2%
% fields with economic levels	3.3%	5%	5%	17%	24%
# races found/ samples collected	3/5	12/10	21/36	6/5	<b>17/ 120</b>

# 2007 KS-CO Sunflower Rust Collection



**8 days (8-15 Aug), 2300 miles, 45 collections from 157 sites, plus 24 from eastern KS – Helen Alexander**

# 2007 ND-SD-MN Rust Collection Route



**3 separate trips, 8 days, 2250 miles,  
97 samples from 223 sites**

# Rust was usually severe, when present, on cultivated sunflower



But, sometimes rust was just beginning to develop, as shown by the “flecks” on the leaf above.

Wild Sunflower most often found in sites with some disturbance





Some patches of wild sunflower (here *H. tuberosus*) were large, and easily found, but rust was usually found at one of every 3-4 stops, and also very scarce (1 out of 100 plants) in wild populations (except for clonal *H. tuberosus*).





*H. maximilliani* (13)



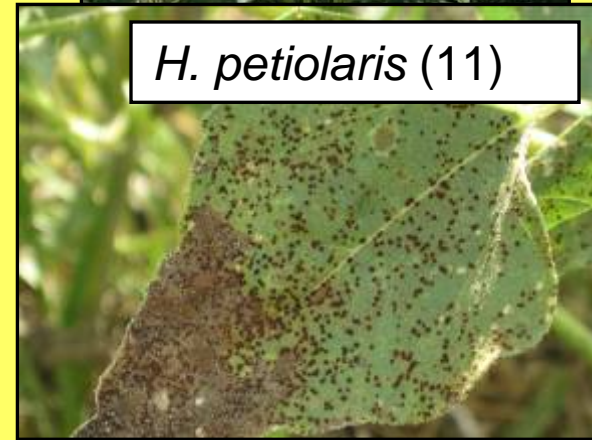
*H. petiolaris* (11)



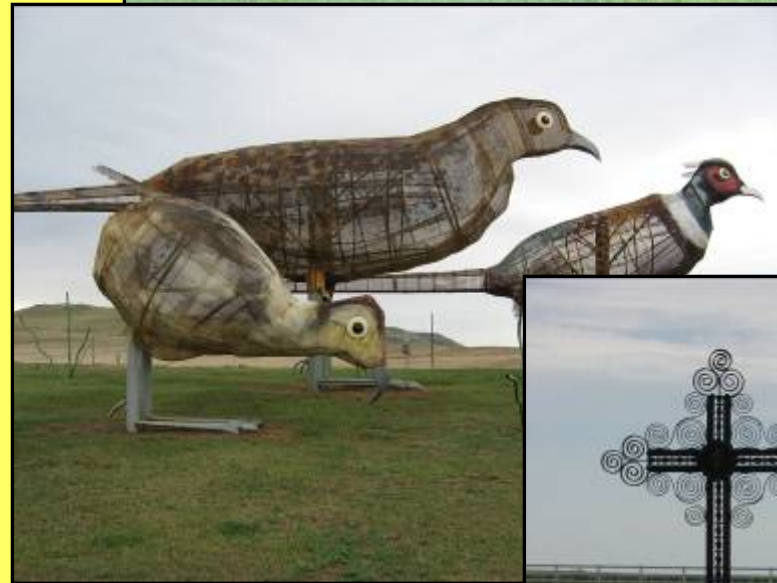
*H. nuttalli* (5)

*H. hirsutis* (1)

*H. tuberosus* (5)



**Rust was collected from six *Helianthus* species other than *H. annuus***

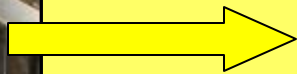


Some "interesting" sights seen in ND, SD, and KS

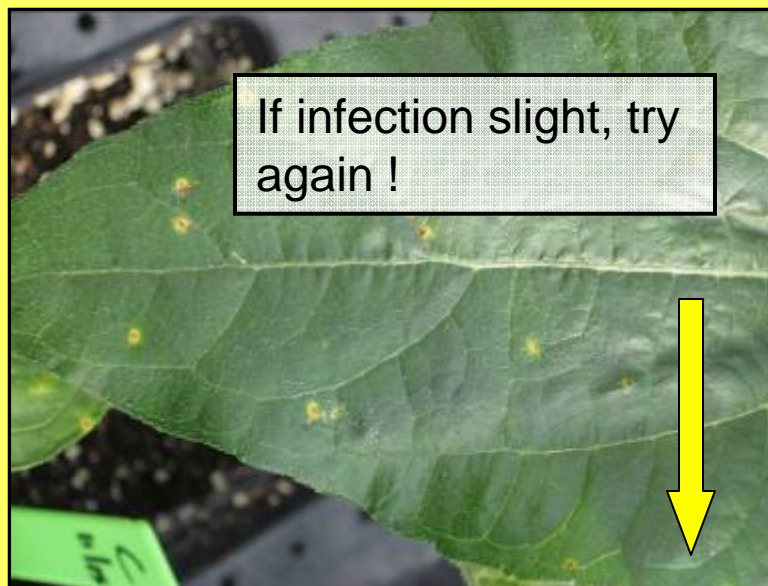
# Materials & Methods

- Collect rust samples from wild and cultivated sunflower (record GPS, disease incidence)
- Remove rust from diseased leaves & store
- Inoculate susceptible plants in greenhouse to produce fresh, viable spores (1, 2 or 3 cycles)
- Inoculate set of nine rust differential lines to identify races

Increase field collected spores on susceptible plants in greenhouse



If infection slight, try again !



Good infection ,  
then vacuum spores

Set of nine differential lines



Yes, you must use a clean inoculator for EVERY sample!



Twenty sets of differentials per week...  
only 8-9 weeks to go to finish 160 😊

# Race Coding, using 9 Differential

Line (coded value)	100	300	324	374	336	704	777
Susc (1)	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
CM90 (2)		<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
CM29 (4)						<b>S</b>	<b>S</b>
P-386 (1)				<b>S</b>	<b>S</b>		<b>S</b>
HAR-1 (2)			<b>S</b>	<b>S</b>	<b>S</b>		<b>S</b>
HAR-2 (4)				<b>S</b>			<b>S</b>
HAR-3 (1)							<b>S</b>
HAR-4 (2)					<b>S</b>		<b>S</b>
HAR-5 (4)			<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
<i># lines infected</i>	<b>1</b>	<b>2</b>	<b>4</b>	<b>6</b>	<b>6</b>	<b>4</b>	<b>9</b>

# Sampling Results and Processing

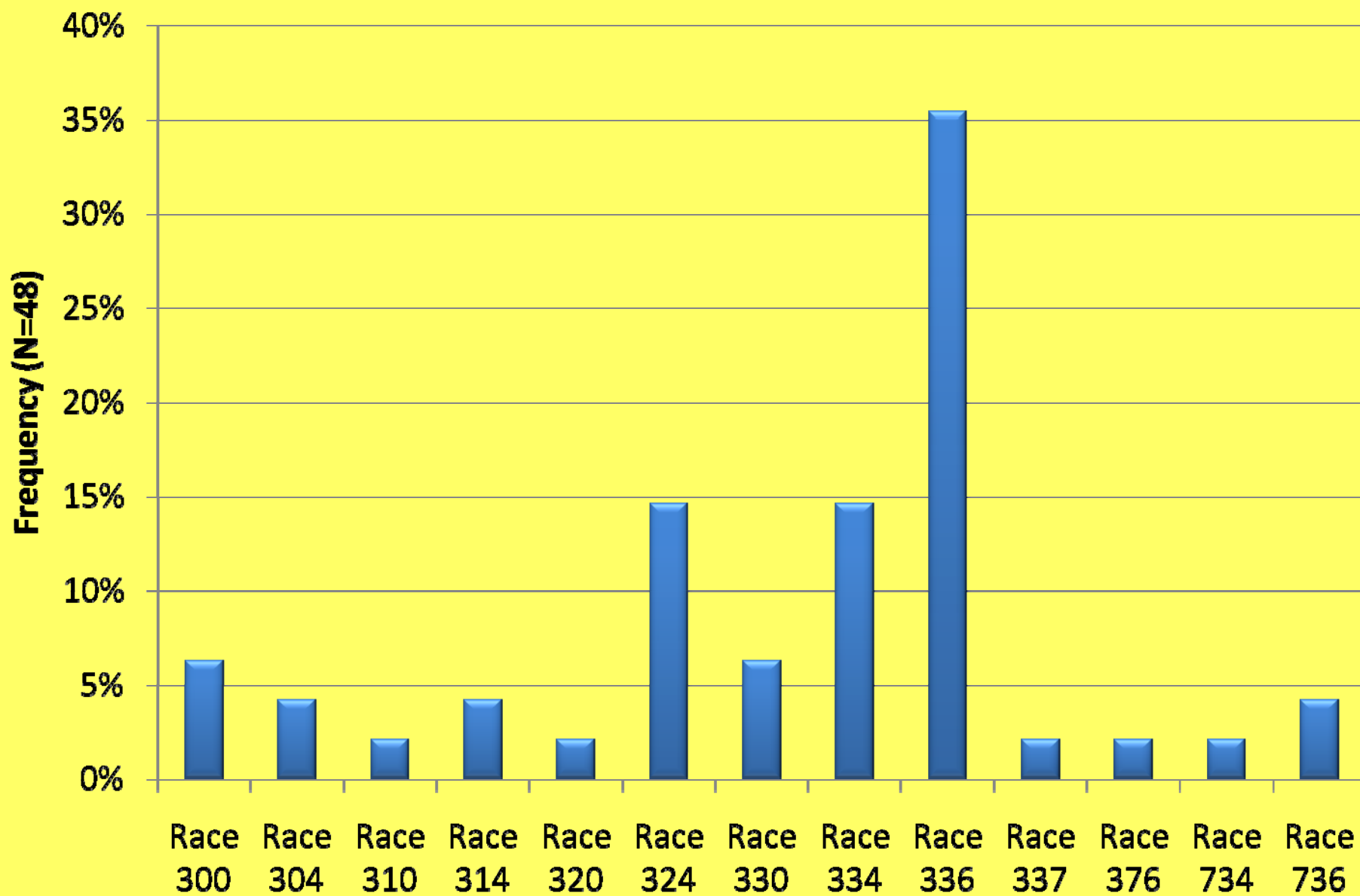
- 166 samples collected, but made 500+ stops to find samples. Collection trip spanned 16 days.
- Spores collected from diseased leaves by scraping, vacuuming or rinsing.
- 166 samples will eventually require ~ 500 separate plantings of ~ 26,000 plants to complete race identification, and will have taken five months to finish.
- Spores will be stored in liquid nitrogen for future studies.

# Summary of 2007 Sunflower Rust Collections

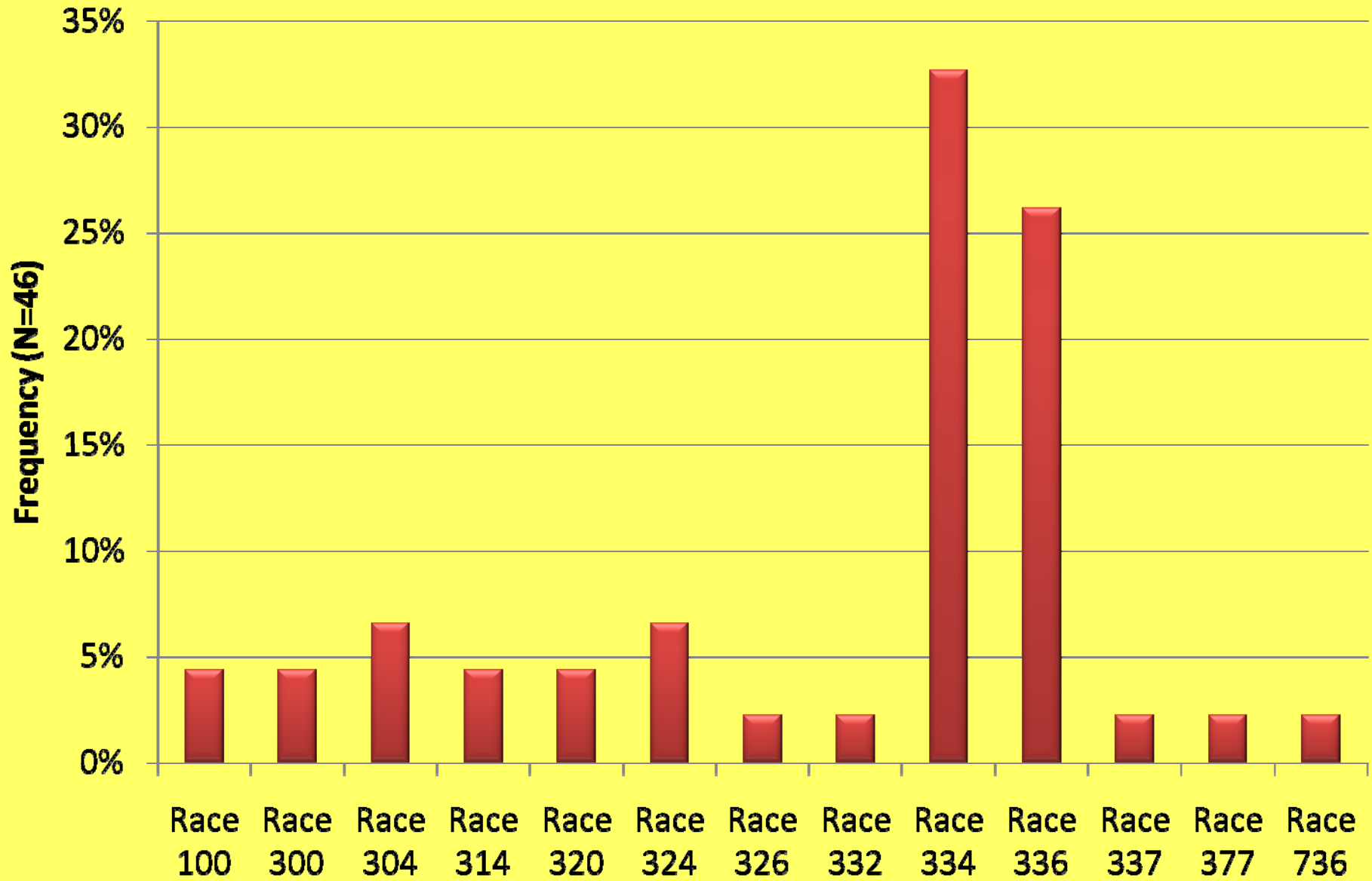
	Total # of rust isolates	Cult	Wild annuus	Petiolaris	Perennial Species
KS-CO-NE	69	8	48	6	7
ND-SD-MN	97	58	15	5	19
Total	166	66	63	11	26



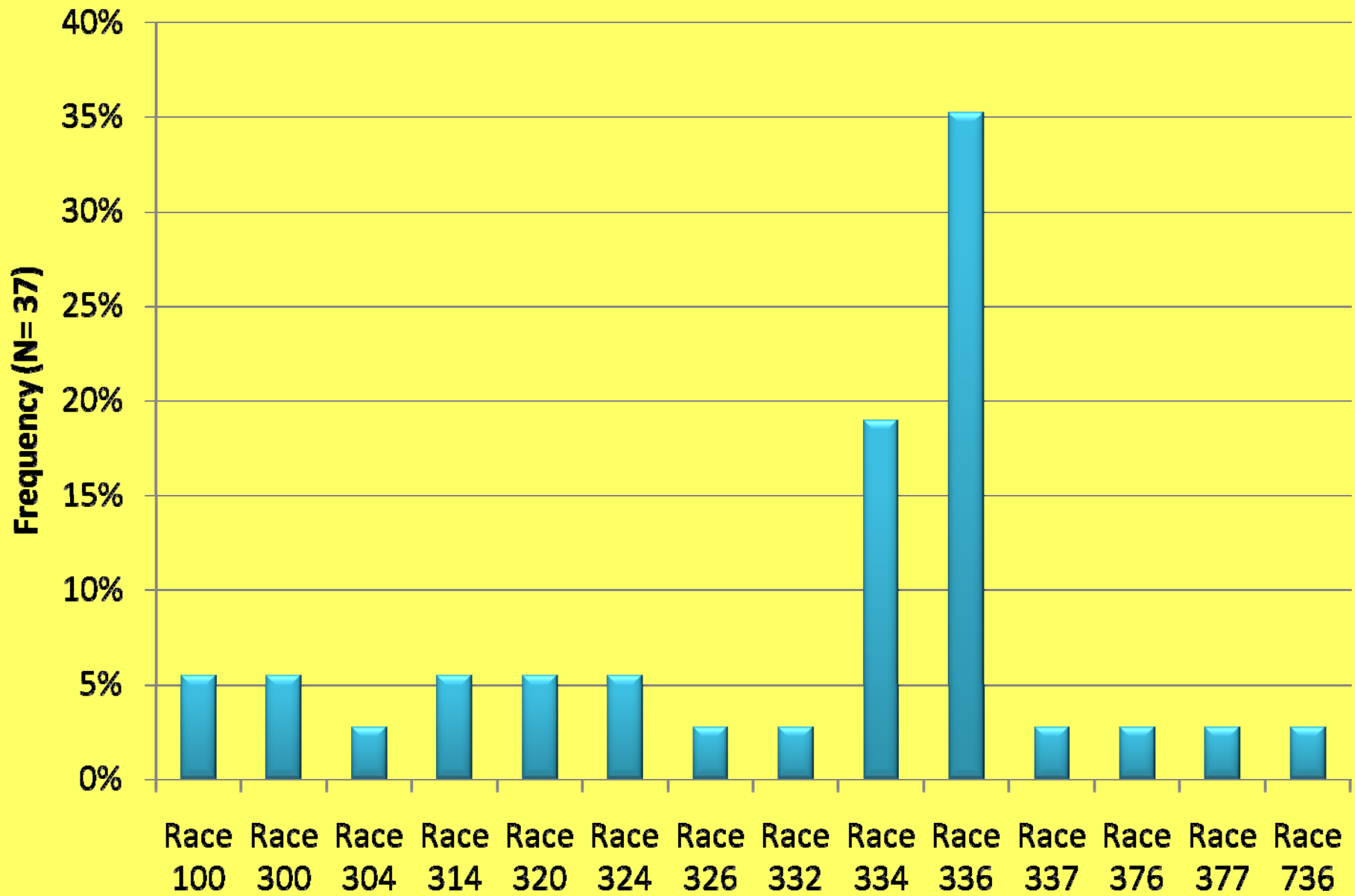
## Rust Races from Cultivated Sunflower - 2007



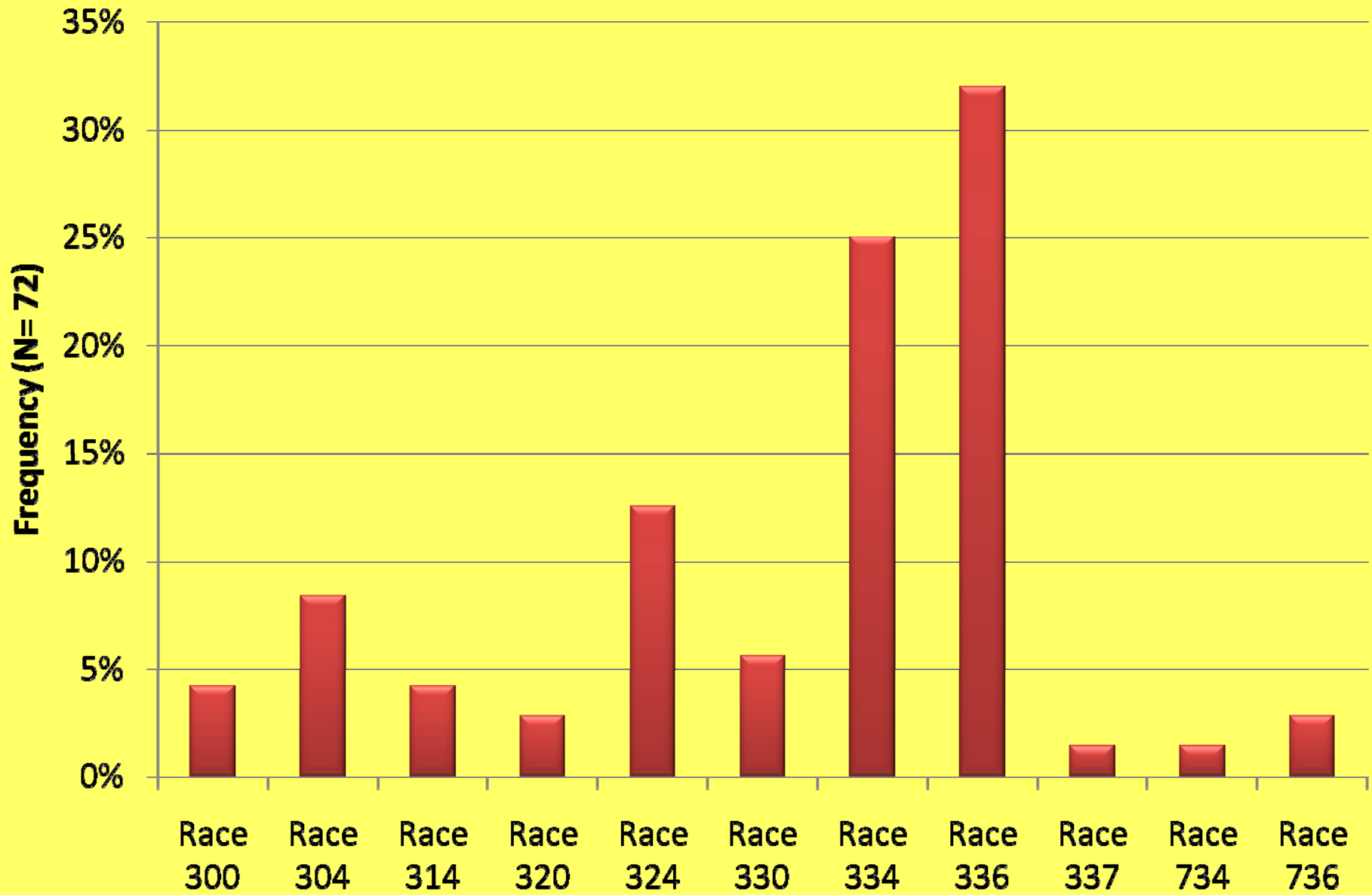
## Rust Races from Wild Sunflower - 2007



## Race Frequency in Central Plains - 2007

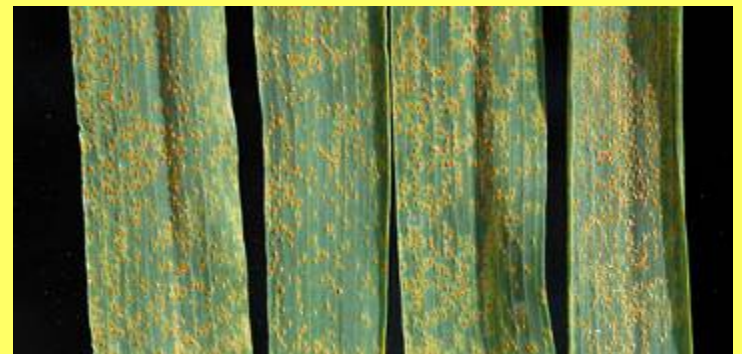


## Race Frequency in Northern Plains - 2007



# Results and Discussion

- Sunflower Rust
  - 16 Races found
  - no new races
- Stripe rust wheat
  - 2003: 31 Races – 10 new
  - 2004: 28 Races – 6 new
  - 2005: 27 Races – 6 new
- Leaf Rust of Wheat
  - 2006: 45 Races
  - 2005: 62 Races



# Results and Discussion

- Races 334 and 336 are predominant (50%+)
  - Virulent on 7/9 differentials
  - Genes found within CM-29 and HAR-3 effective against both races
  - All differentials susceptible to at least one race found
- Most Virulent Races
  - Race 337(2 samples): KS & SD on cultivated
  - Race 377 (1): eastern KS, on wild *H. annuus*
  - Race 734 (1): Pierre, SD on cultivated
  - Race 736 (3): ND- cultivated, and CO (Denver Botanical garden ornamental)

# Results and Discussion

- Changes?
  - 1996 (KS/CO) : Races 304 (17%) and 364 (15%)
  - Reduction in races virulent of CM-29 (23% - 4%)
- Races on wilds/cultivated are similar
  - No reservoir of 'new' races
- Races in N and S Great Plains are similar
  - Breeding in Northern Great Plains should effectively identify germplasm which will also be resistant in Central Great Plains
  - Movement throughout U.S?

# Hybrid Screening

- Voluntary submission process
- 86 total entries
- Greenhouse
  - 4 reps / 4 plants rep
- Race 367
  - ‘more virulent’ than 336 and 337

## Participants:

- Advanta
- CHS
- Croplan
- Dahlgren
- Monsanto
- Mycogen
- Nidera (Arg.)
- Pannar (S. Africa)
- Pioneer
- ProSeed
- Red River
- Seeds 2000
- Triumph



# Hybrid Screening Results

- 18 entries resistant
- Triumph
  - S672, 859HOCL, R657, R664, 636
- Pannar
  - 7813NS, 7924NS
- CHS
  - 316RT, 3126RT
- Monsanto
  - DK 3901, DK 38-80, 6 experimental lines
- Slow rusting?



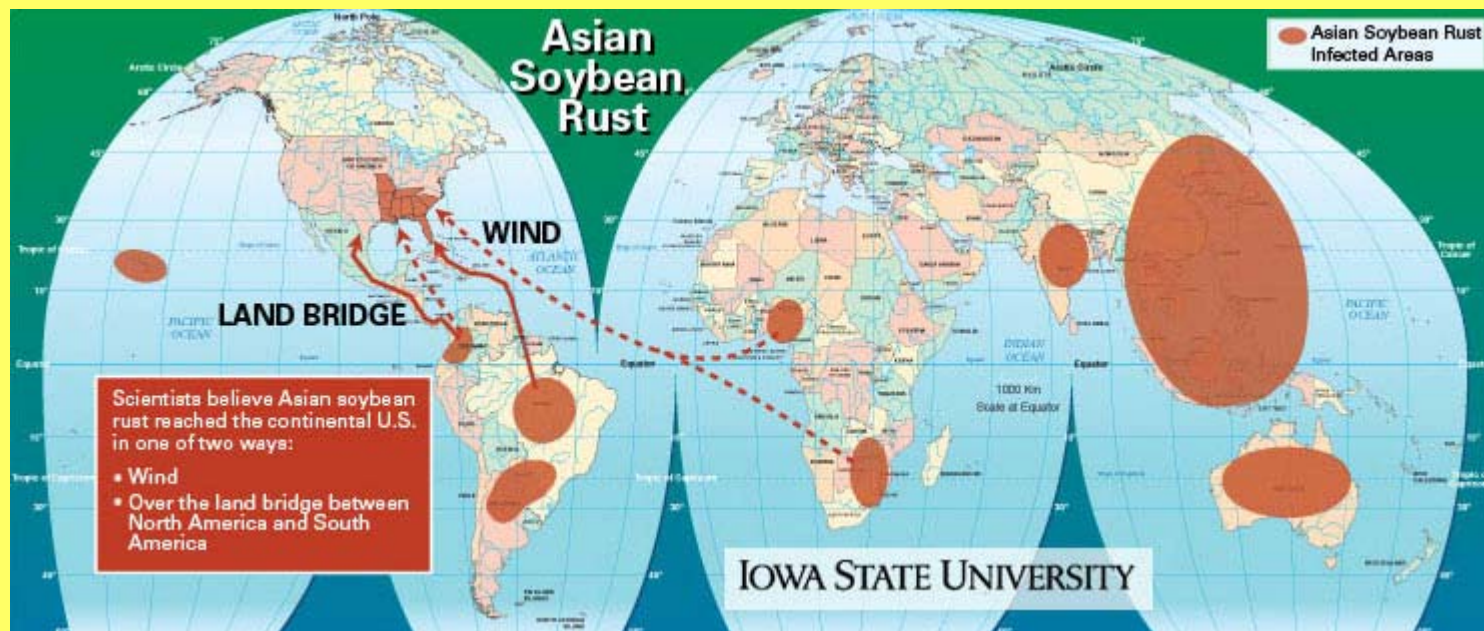
# Why Rust Surveys are Important

## Race Changes

- Essential for hybrid screening
- Occur over time
- Overcomes current resistance

## Foreign Introductions

- Soybean Rust
- New stripe rust of wheat race
- New stem rust of wheat (Ug99)
- Argentina Sun. Rust
- Races very different
- Predominant race(s) can overcome CM-29 and HAR-3



**Thank You**

