A photograph of a vast field of sunflowers stretching towards a clear blue sky. The sunflowers are in full bloom, with bright yellow petals and dark brown centers. The perspective is from a low angle, looking across the field.

New Sources of Phomopsis Stem Canker Resistance in USDA Plant Introductions

Tom Gulya, Gerald Seiler, USDA-ARS, Fargo,
Charlie Block, USDA-ARS, Ames, IA, and
Zahirul Talukder, NDSU, Fargo

Phomopsis symptom development



Mid-stem lodging resulting in yield loss

Objectives -

- To complete a multi-year test of 250 Plant Introductions & elite USDA inbreds for resistance to *Phomopsis* stem canker.
- Same group of germplasm that has been tested for *Sclerotinia* head rot and stalk rot at multiple locations.
- Data used to identify sources of resistance for breeding, *AND* to be used in Association Mapping.

Progress -

- 2011 - Four field trials planted, with aid of seed companies, in ND, MN and SD, relying upon natural infection.
- Three of four sites have disease and yield data.

2012 -

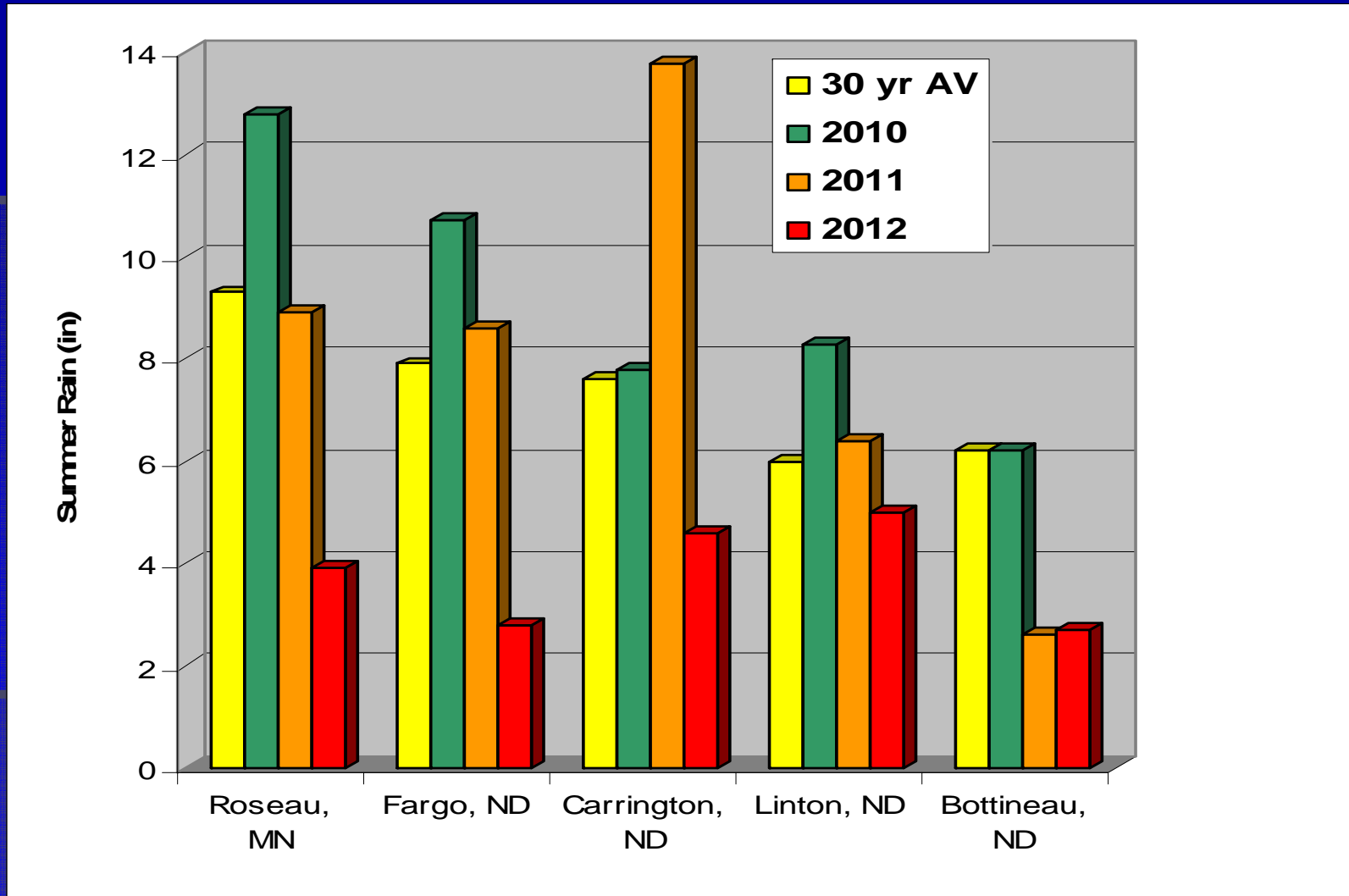
- Same material planted again in four sites (Grandin, ND; Crookston and Rothsay, MN and Eureka, SD), relying on natural infection.
- One of four sites had sufficient disease.
- Two years (8 plots) yielded four datasets.

Comparison of 2011 vs 2012 Phomopsis infection (natural) across 12 most susceptible PIs

	2012 Data			
	Grandin	Rothsay	Eureka	Crookston
2011 average = 42%	13%	61%	35%	18%
Range: 29 – 62%	3-70%	24-94%	0-100%*	9-32%

2012 Eureka: 61% of rows had no *Phomopsis*, plus confounding with downy mildew infection

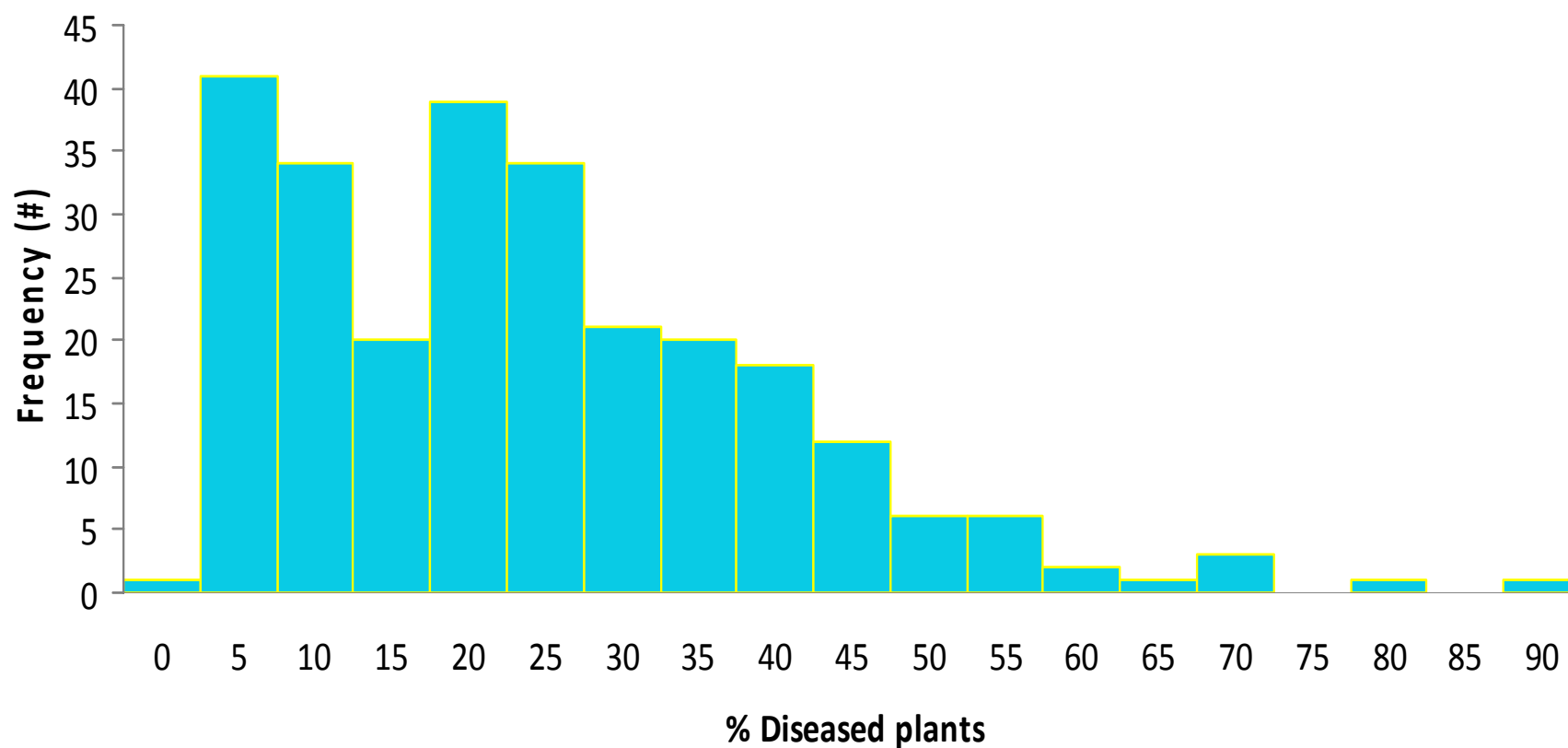
Summer Rainfall Trends 2010 to 2012



2010 was 128% of the 30 yr average, while 2012 was 47%.

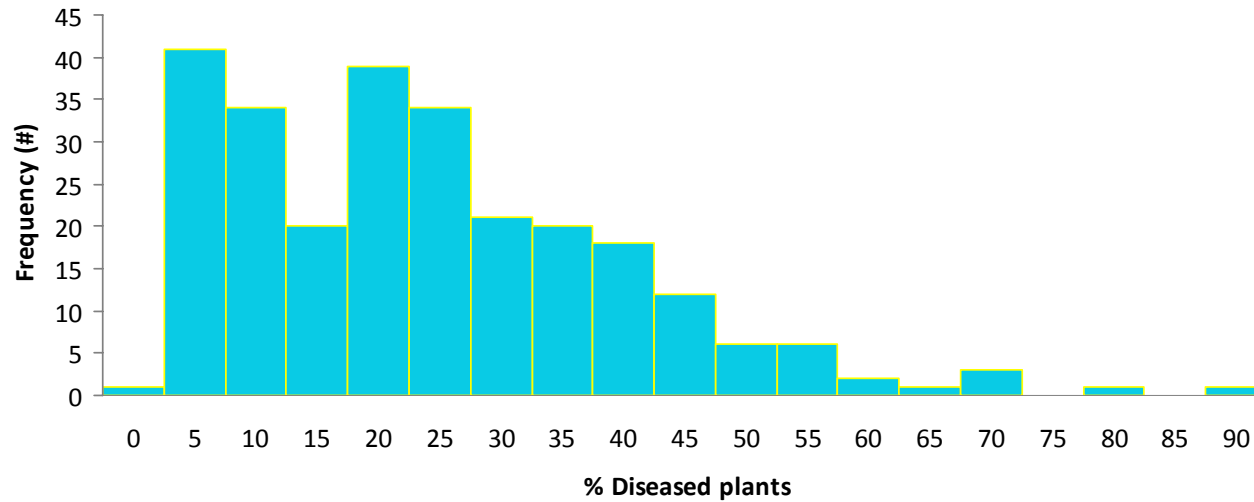
Histograms of four *Phomopsis* datasets

Phomopsis - mean of 4 datasets



Comparison of Phomopsis and Sclerotinia head rot data on same PIs

Phomopsis - mean of 4 datasets



Sclerotinia Head Rot - 4 location mean



Comments on top 25 entries

- Top entries had 0 to 3% *Phomopsis* infection, averaged across 4 trials.
- Countries represented: Hungary (11), Spain (8), Zimbabwe (2), Netherlands (1), Poland (1), and Zambia^{s7} (1).
- Eleven of the top 25 for *Phomopsis* were also in the top 25 for head rot resistance.
- PI 531366 from Poland combined good stalk rot, head rot and *Phomopsis* resistance.

Phomopsis & Head Rot resistant entries ^{s10}

PI	Country	Phomopsis (%)	Head Rot (%)	Head Rot Rank
507917	Hungary	1	0	1
507919	Hungary	1	1	3
507907	Hungary	2	2	4
507900	Hungary	3	3	5
507920	Hungary	2	6	9
507911	Hungary	3	6	11
531366	Poland	2	6	12
507912	Hungary	2	10	16
526254	Zimbabwe	1	15	21
507894	Hungary	1	15	23
650839	Netherlands	2	16	25

Conclusions

- Large group of PIs and inbreds (250) evaluated in multiple field trials over two years.
- Moderate levels of natural infection have identified material with apparently good resistance, but need further tests with artificial inoculation for confirmation.
- Reliance upon natural infection and sufficient rainfall is chancy, as shown by 50% success rate (4 of 8 trials over two years).
- Unknown whether “resistant” accessions will stand up to both *Phomopsis* species.

Plans for 2013

- Natural infection by *Phomopsis* is unpredictable, and rain dependent.
- Lab trials to develop mass production of *Phomopsis* inoculum on natural substrates.
- Trials at Carrington, ND & Staples, MN will compare different inoculation methods & duplicate trials will be under overhead irrigation and dryland conditions.

Acknowledgements

- Plot land, planting and plot maintenance graciously supplied by *Croplan* (Crookston), *CHS* (Grandin), *Mycogen* (Rothsay) and *Seeds2000* (Eureka and Java, SD)
- *Megan Ramsett* and other USDA technicians
- *Laura Marek*, Sunflower Curator, for multiple years' of seed requests from PI Collection.
- *NSA* for funding of this project.