ASSESSING POLLEN FLOW AND OUTCROSS IN MAIZE

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Pollen flow studies in corn

- Frequency of outcross due to proximity to a source field (Jones and Newel, 1946; Hutchcroft, 1958; Raynor et al., 1972)

- Minimum isolation distance to prevent outcross (Burris and Lauer, 2001; Luna, et al. 2001; Ma et al., 2004)

Factor affecting genetic purity

- Biology of flowering and pollination
  - Tassel development
  - Pollen shed
  - Pollen survival
  - Flowering synchrony
- The physical component of pollen transport
  - Weather conditions
  - Topography

Objectives

- General
  - To predict the level of outcross in a corn field
- Specific
  - To predict timing and intensity of field-scale pollen production
  - To predict atmospheric transport of pollen away from the source
  - To determine the risk of outcross by adventitious pollen entry

Methodology

- Hybrids
  - DKC69-71
    - Yellow
    - Roundup Ready
    - Bt
  - RX792 WAF2
    - White
    - Non-transgenic

Methodology

- Two levels of pollen density considered
  - Low local pollen density
    - Seed production field
  - High local pollen density
    - Grain production field

Methodology

- Transects
  - N, NE, NW, S, SE, SW, E, W
- Distances
  - 1 m
  - 10 m
  - 35 m
  - 100 m
  - 150 m
  - 200 m
  - 250 m

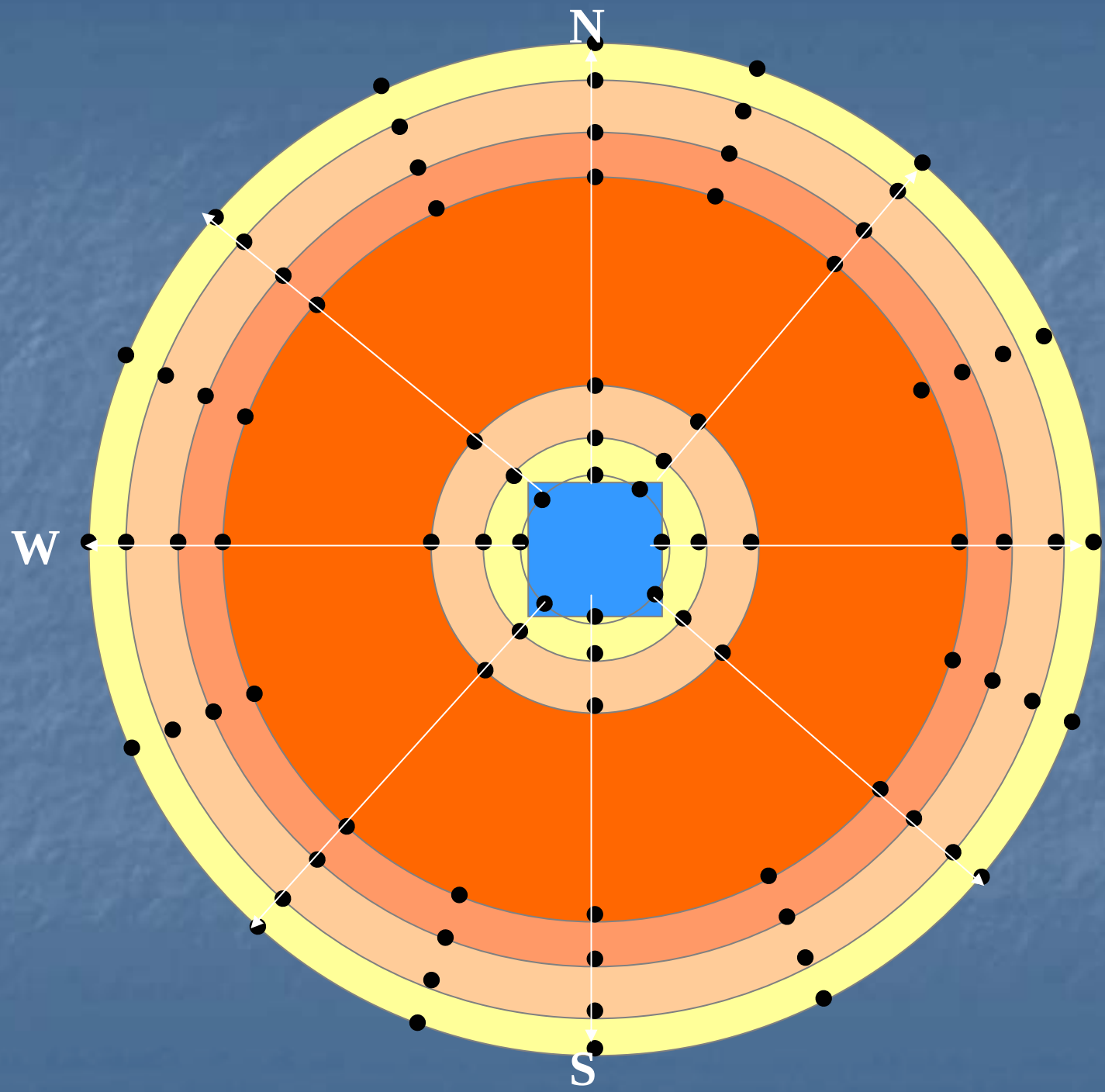
Methodology

- **Pollen**
  - Pollen grains/cm^2
  - Quantification of transgenic-pollen
- **Seed**
  - Color sorting - Yellow seed
  - Roundup Ready seedlings – RR biological
  - RR susceptible - Bt ELISA determination
- **Sample size**
  - Increases as outcross probability decreases (away from the source)

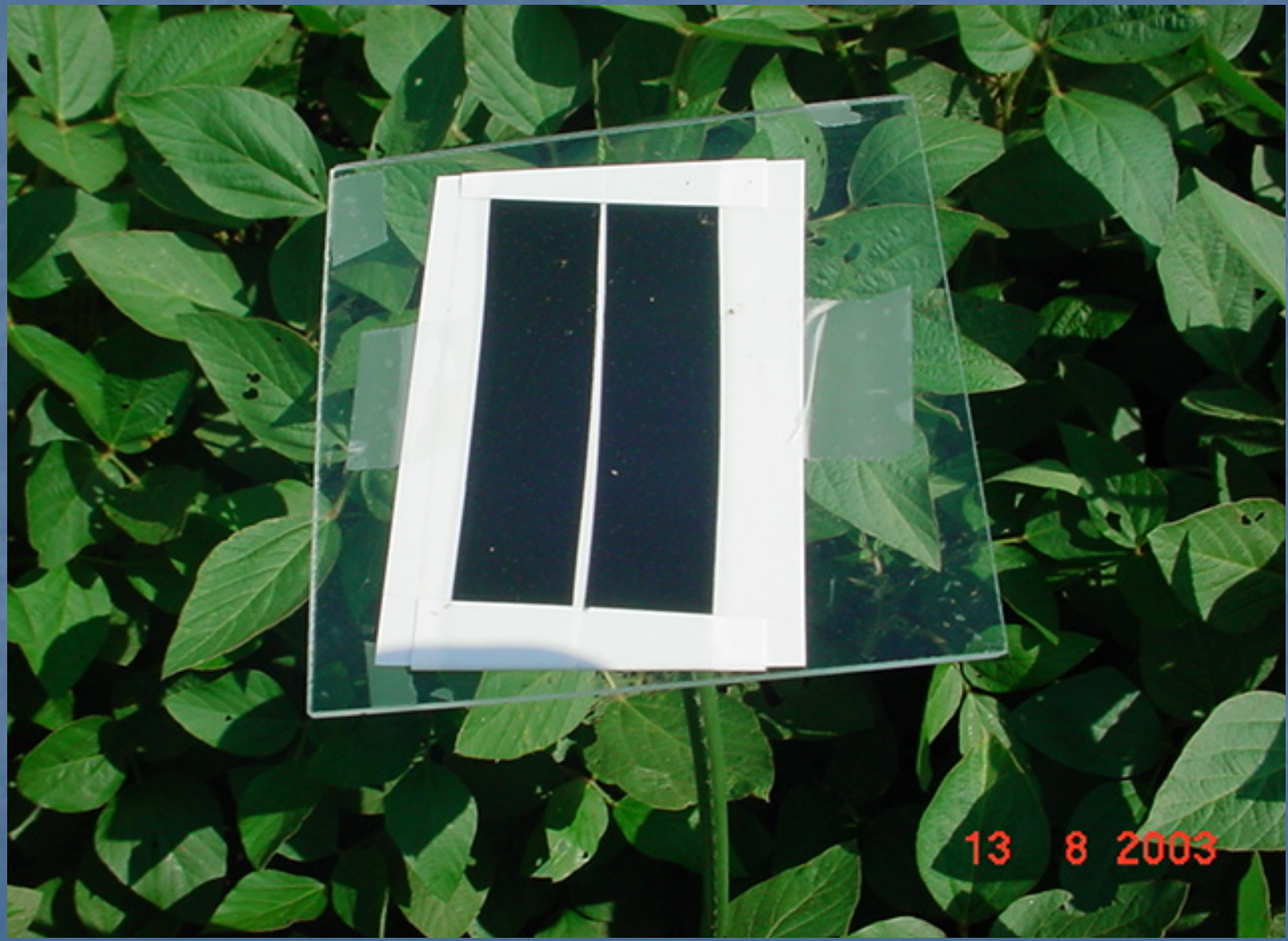
Roundup Ready Test

Roundup Ready Test in White seed

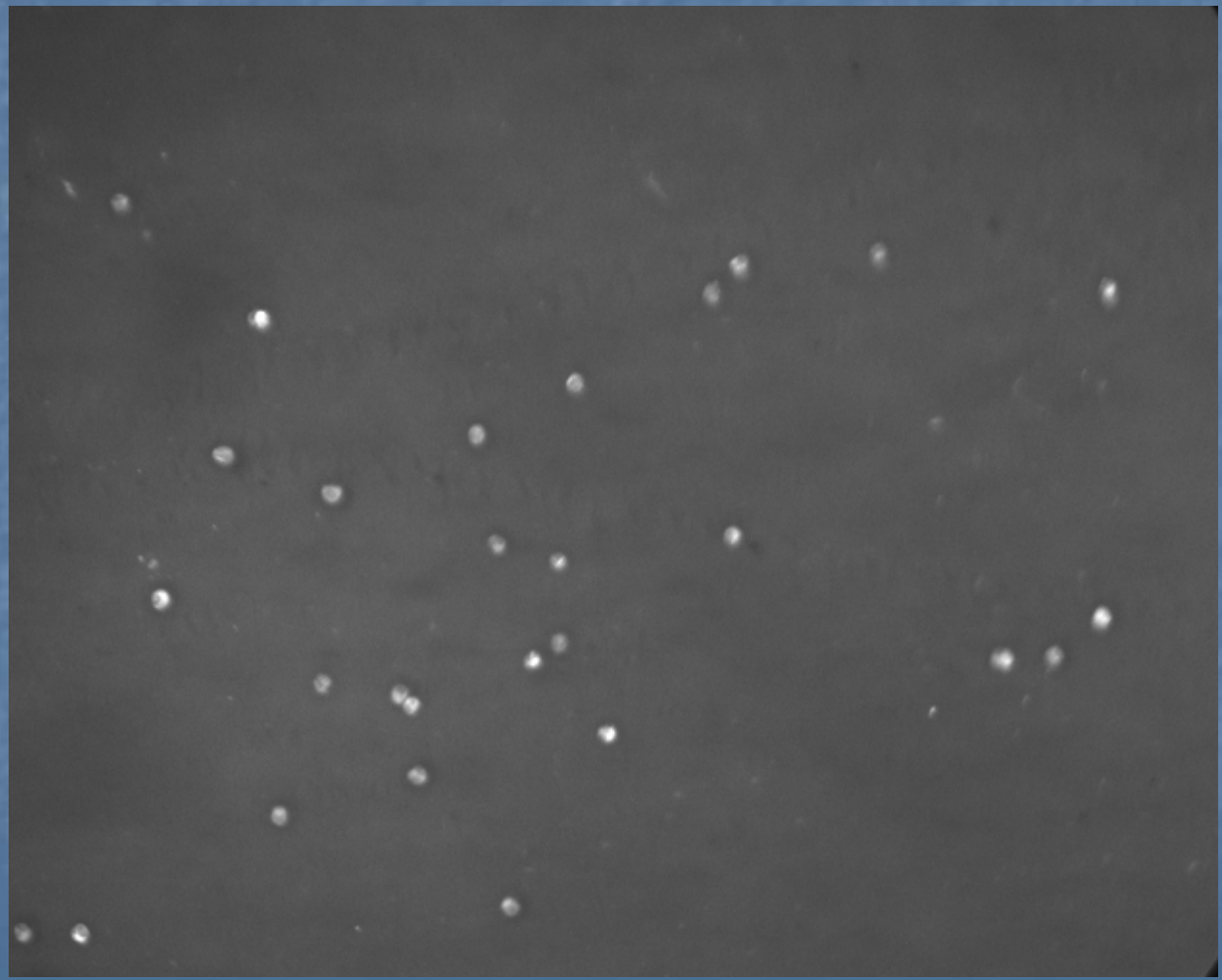
Bt Test


N
W
E
S
Distances
1 m
10 m
35 m
100 m
150 m
200 m
250 m

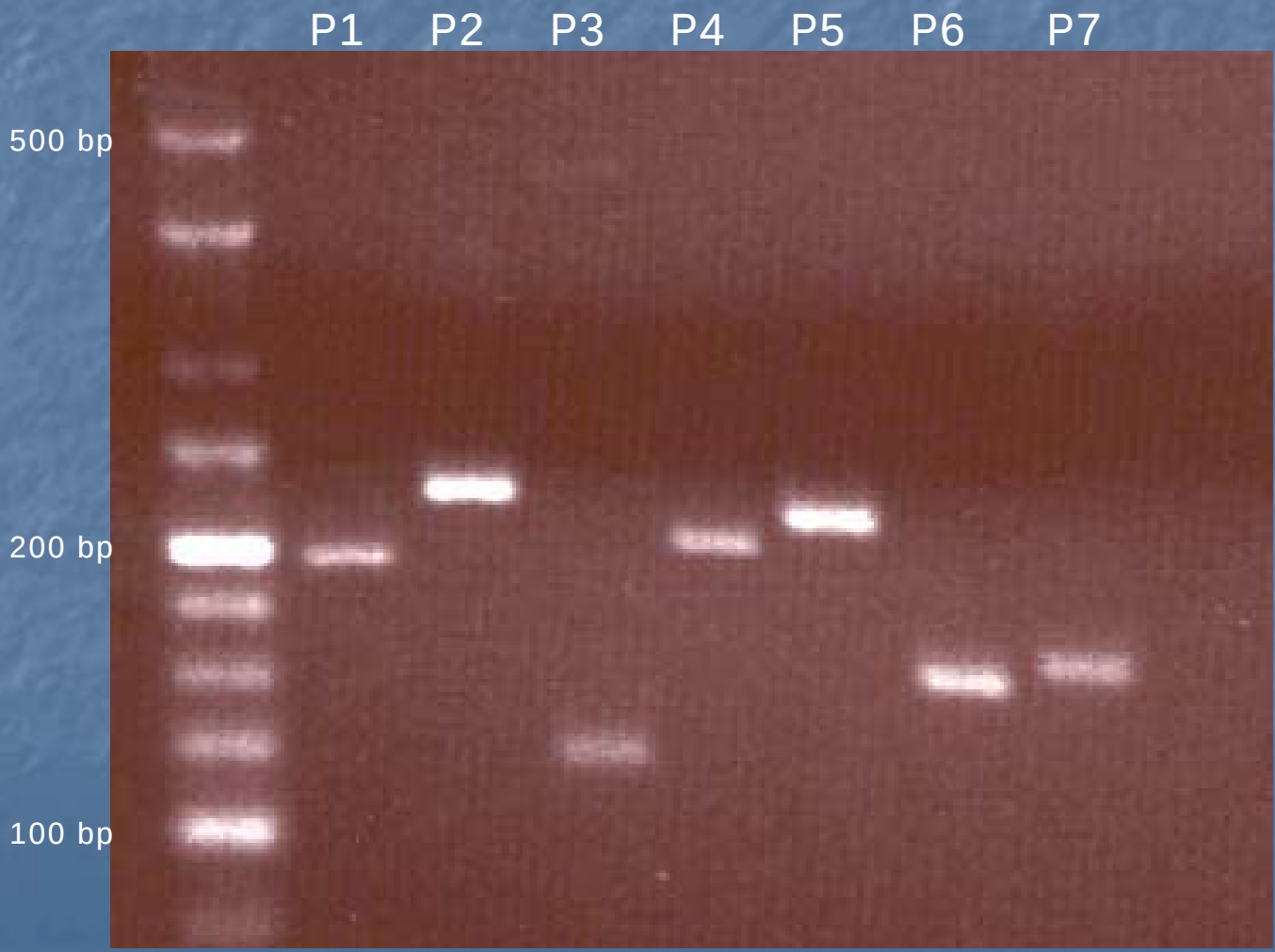
Pollen Trap

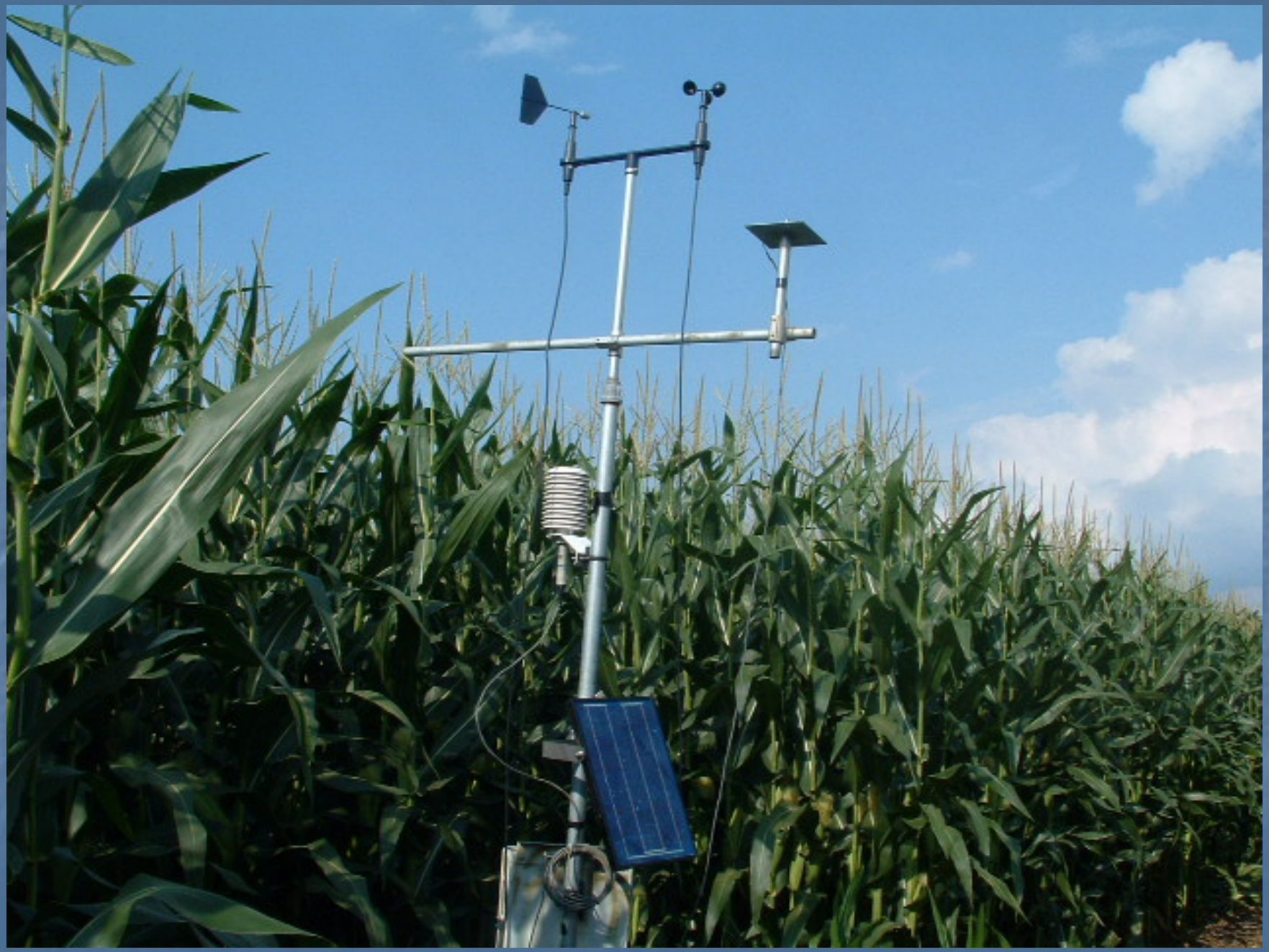


Pollen grains in pollen traps



Genetic markers

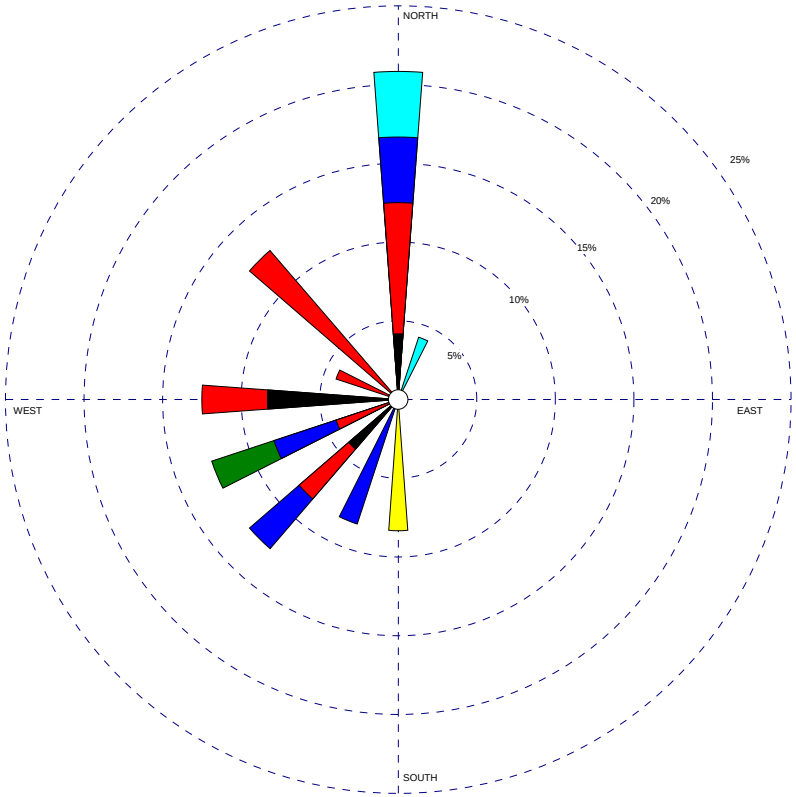




Results

WIND ROSE PLOT

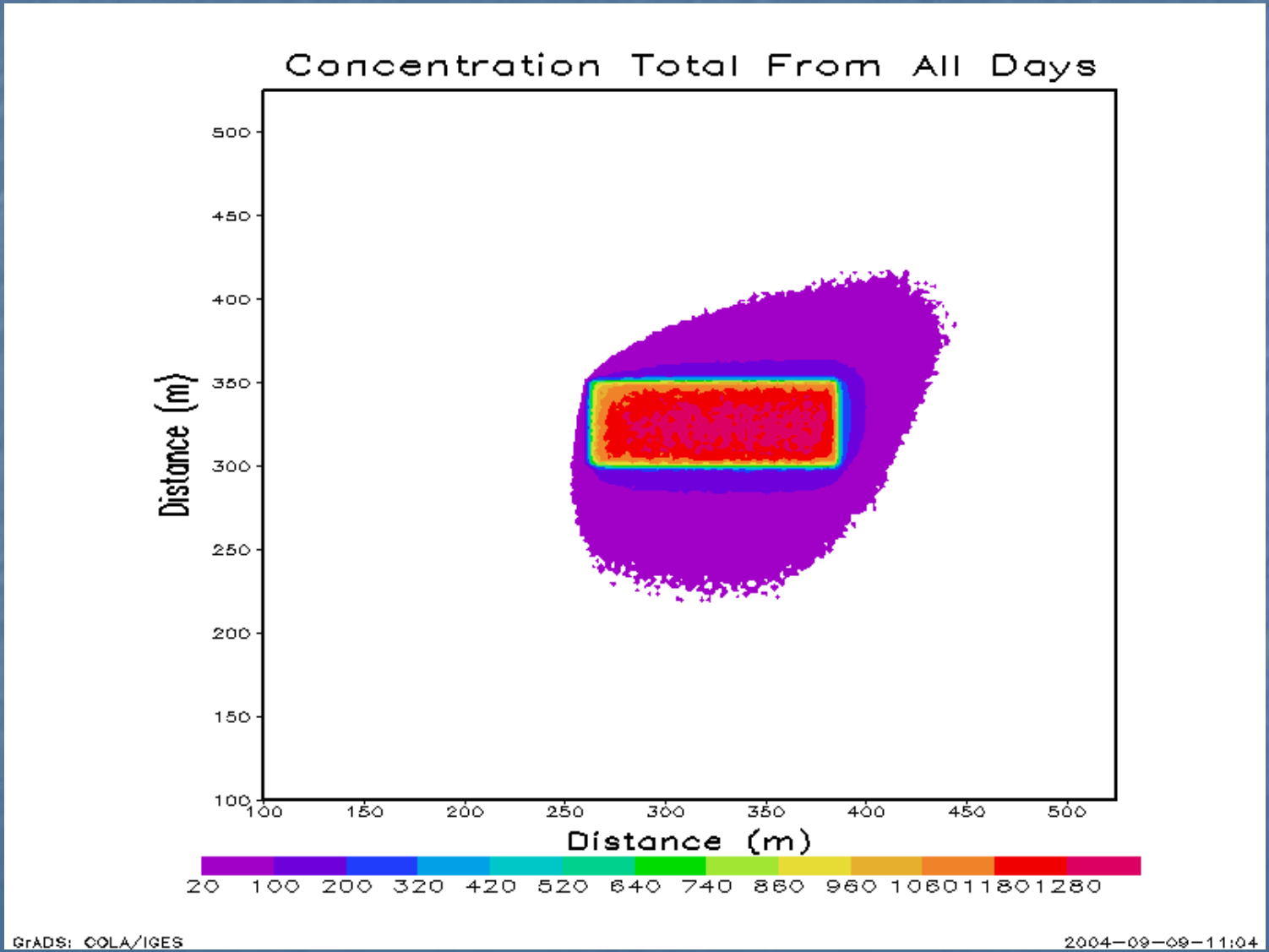
Station #14848 - SOUTH BEND/MICHIANA REGIONAL, IN



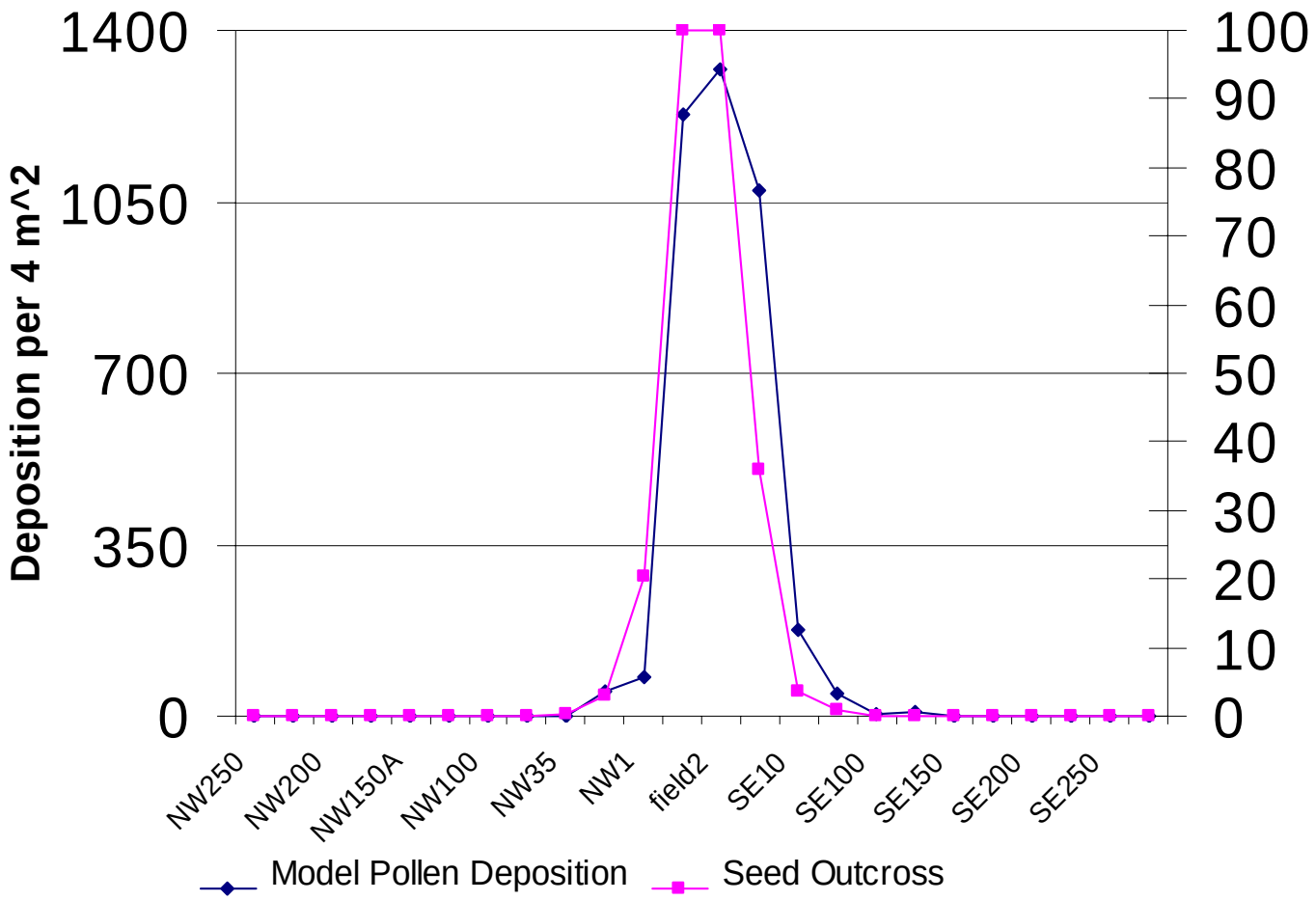
Wind Speed (m/s) > 3.00 2.50 - 3.00 2.00 - 2.50 1.50 - 2.00 1.00 - 1.50 0.50 - 1.00	MODELER	DATE **9/9/04**	COMPANY NAME
	DISPLAY **Wind Speed**	UNIT **m/s**	COMMENTS
	AVG. WIND SPEED **1.61 m/s**	CALM WINDS **4.17%**	
	ORIENTATION **Direction (blowing from)**	PLOT YEAR-DATE-TIME **2003** **Jan 1 - Dec 31** **Midnight - 11 PM**	PROJECT/PLOT NO.

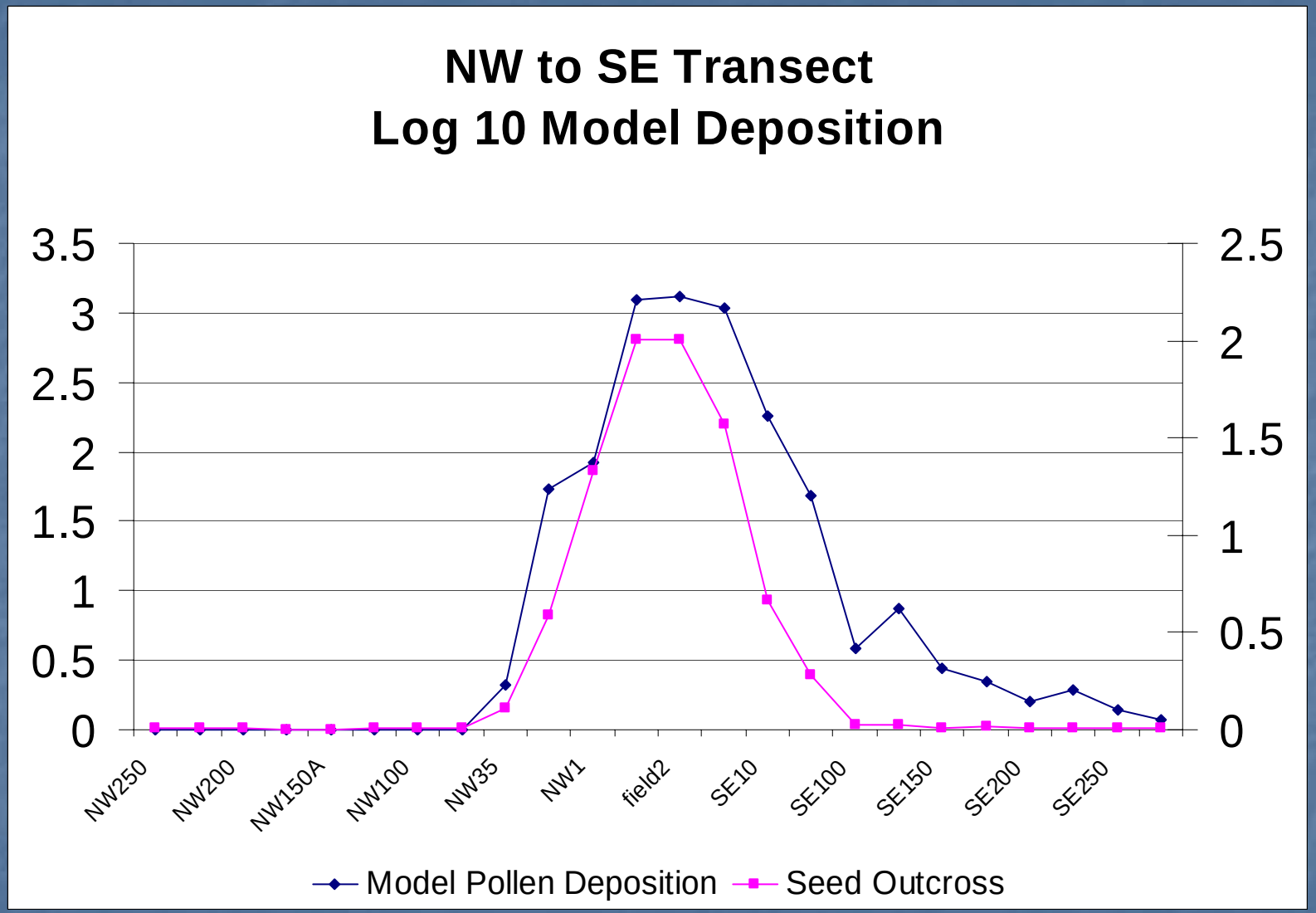
WRPLOT View 3.5 by Lakes Environmental Software - www.lakes-environmental.com

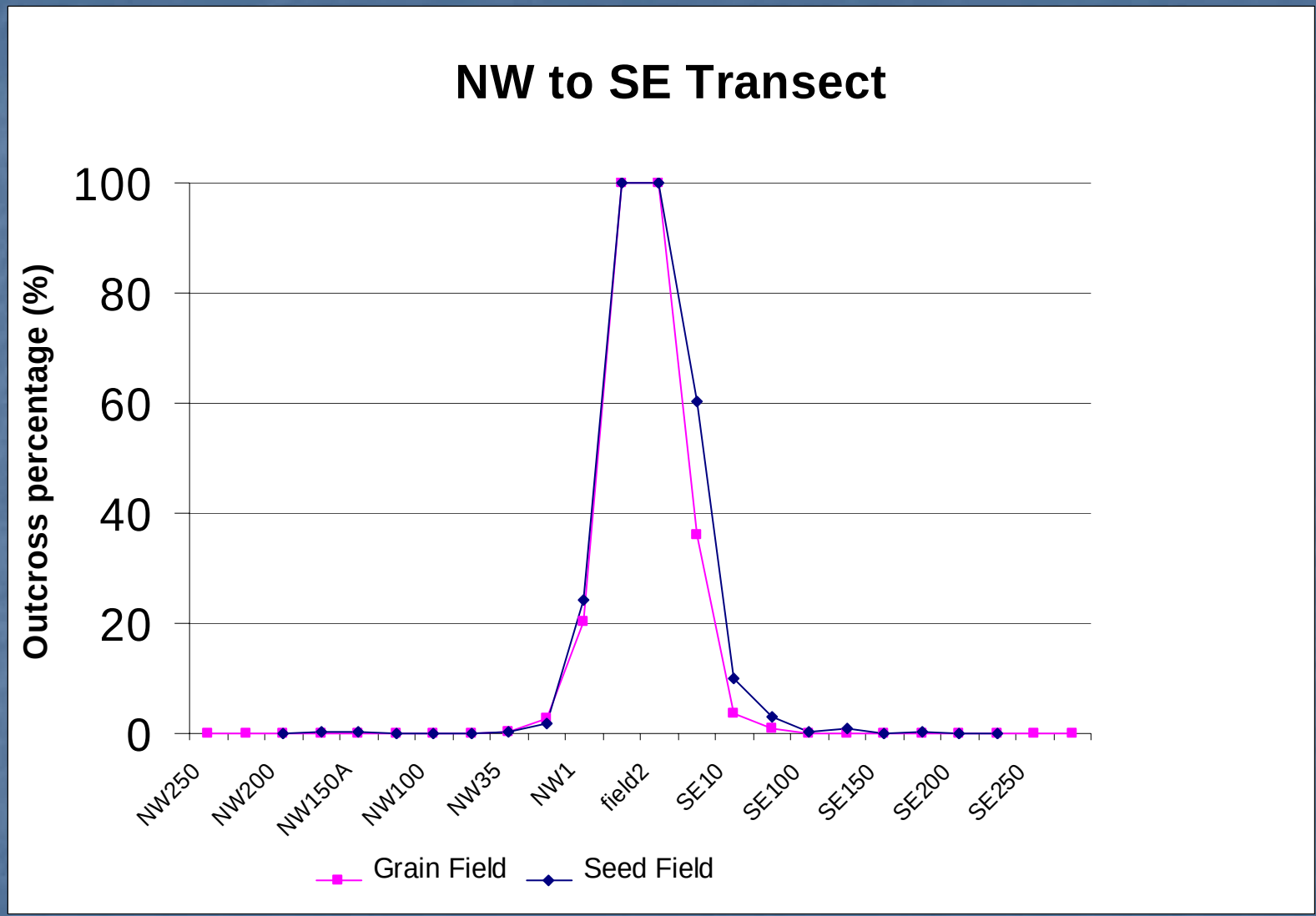
Results

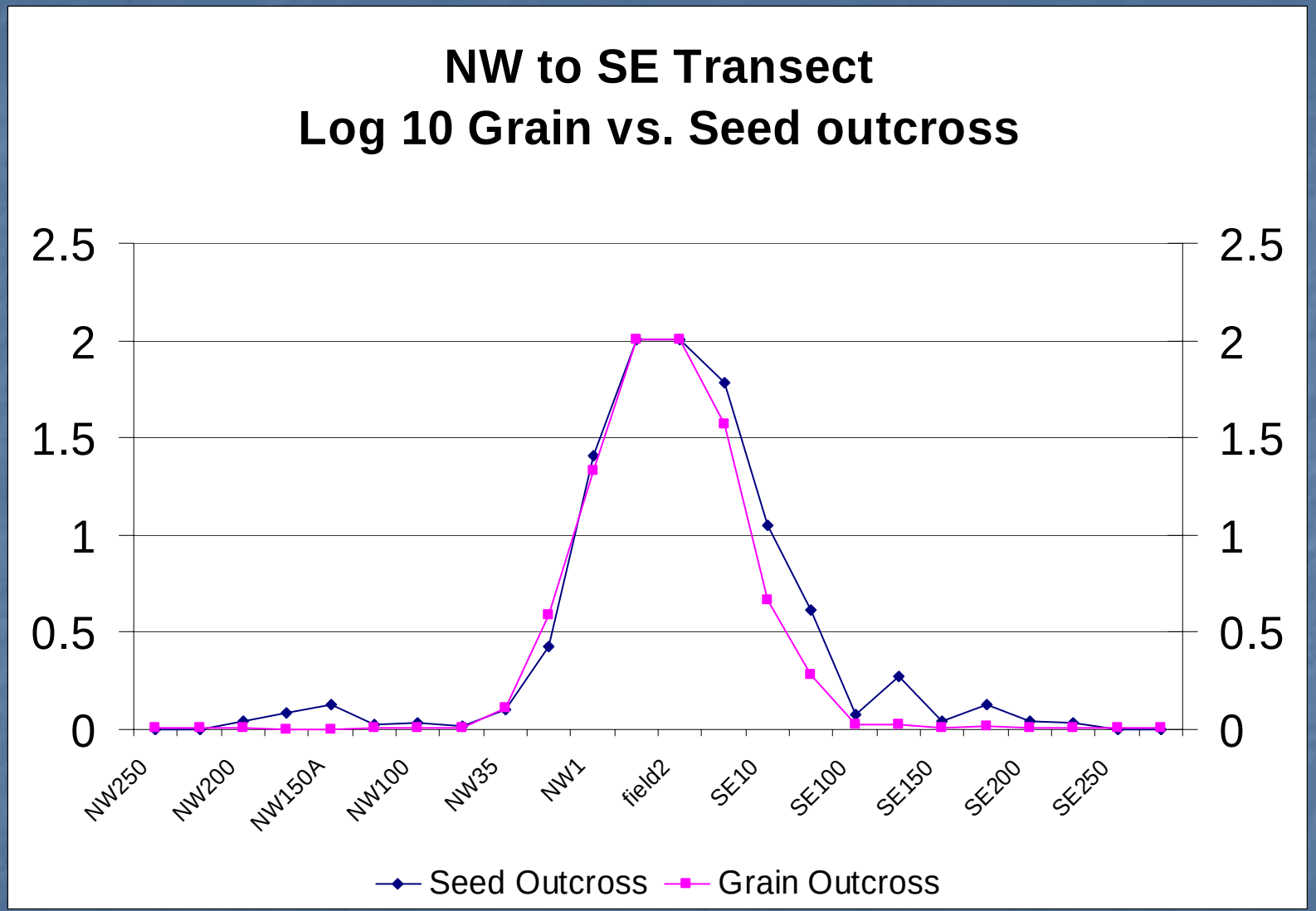

Concentration Total From All Days
Distance (m)
500
450
400
350
300
250
200
150
100
100 150 200 250 300 350 400 450 500
Distance (m)
20 100 200 320 420 520 640 740 860 960 1060 1180 1280
GrADS: COLA/IGES
2004-09-09-11:04

NW to SE Transect Model Deposition




NW to SE Transect
Log 10 Model Deposition
3.5
3
2.5
2
1.5
1
0.5
0
2.5
2
1.5
1
0.5
0
NW250
NW200
NW150A
NW100
NW35
NW1
field2
SE10
SE100
SE150
SE200
SE250
Model Pollen Deposition
Seed Outcross


NW to SE Transect
Outcross percentage (%)
100
80
60
40
20
0
NW250
NW200
NW150A
NW100
NW35
NW1
field2
SE10
SE100
SE150
SE200
SE250
Grain Field
Seed Field


NW to SE Transect
Log 10 Grain vs. Seed outcross
2.5
2
1.5
1
0.5
0
NW250
NW200
NW150A
NW100
NW35
NW1
field2
SE10
SE100
SE150
SE200
SE250
Seed Outcross
Grain Outcross

Results

- The frequency of outcross is higher when local pollen density is low (seed field), and lower when local pollen density is high (grain field)
- The frequency of outcross in both the seed field and grain field was higher down-wind
- Comparing the grain field (high pollen density) and the seed field (low pollen density), frequency of outcross down-wind is higher in the seed field