Potato Entomology Research 2012

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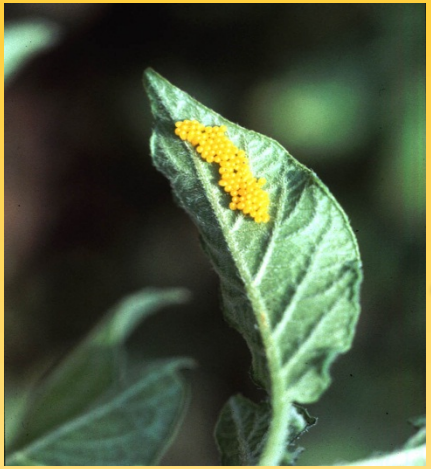
Driven to Discover℠

1. **Establishing a Resistance Monitoring Program for Neonicotinoid Insensitive Colorado Potato Beetle in Minnesota and North Dakota**
    1. Assessing resistance levels in CPB populations in multiple locations in MN & ND
    2. Management trials to assist in treating neonicotinoid resistant CPB
2. **Aphid Alert II – Monitoring Aphid Vectors of Virus in Potato**
    1. Establishing a monitoring network of suction traps across MN & ND



Lack of control = serious yield impact

Neonicotinyls

- **Very effective, systemic, flexible, low mammalian toxicity, good residual, broad spectrum**

  - Imidacloprid (Admire, Provado, Genesis, Gaucho), Thiomethoxam (Leverage, Actara, Platinum, Cruiser), Acetamiprid (Assail), Dinotefuran (Venom), Clothianidin (Belay), etc…
  - Mainstay in CPB management programs
- ***BUT* – all of these mean increasing reliance on this one Mode of Action (moa)**

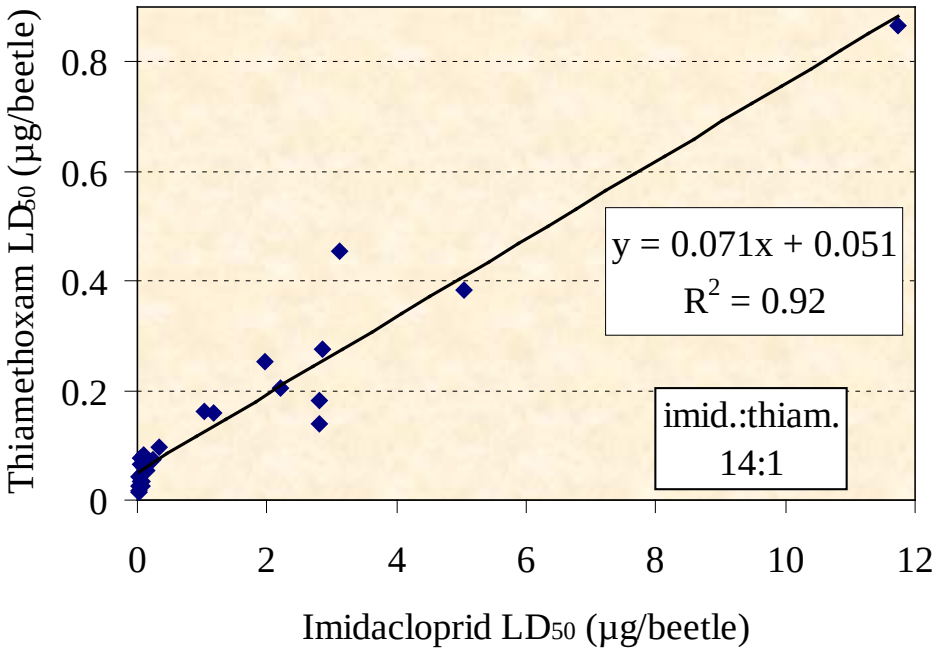
  - Increasingly used against wide variety of pests, multiple applications including seed treatment & foliar apps.
  - Need to manage if we're going to keep efficacy and restrict resistance

Neonicotinyl resistance well established in CPB

- **First noted in N.E. US late 90's**
  - Wasn't a surprise, CPB is poster child for resistance
    - 1998-2001 Imidacloprid resistance reported in U.S. but restricted to several locations in NE (remember, neonics introduced mid-1990's!)
    - 2003 – Imidacloprid resistance common in NE and 1st thiamethoxam resistance reported
    - 2004 – Imidacloprid resistance 1st found in midwest U.S.
    - 2009 – 95% of all CPB populations in NE and midwest had significantly higher LD_{50} values than known susceptible pops
  - Has spread since then to multiple locations including North Central region (WI, MI) and MN

MOA resistance in neonicotinoids

- **Typically, resistance to one neonicotinoid means resistance to the others.**
  - Historically, started first with Imidacloprid (Admire), followed by Thiomethoxam (Platinum) and then Belay (clothianadin) but this is reflective more of useage pattern than any chemical factor



From E. Grafius, U. Mich. 2005

CPB resistance trials

- **Adult beetles were collected by a number of cooperators and shipped to the lab at the NWROC**
- **Replicated trials involving direct exposure to different rates of insecticide were performed**
  - Beetles would have ~1µg of insecticide applied to underside of abdomen, held for 7 days and examined daily for mortality
  - Suspected resistant populations ran against known susceptible population (2011originally from N.J. and 2012 originally from Rosemont, MN)

Dip Test

- **Easy test to establish approximate tolerance limits – can calculate amount of mortality at a specific rate**
  - Provides starting point for establishing ‘discriminating rates’
  - Often used at field edge to quickly identify ‘resistant’ populations

Assessing resistance


Hamilton Micro-applicator

- **Beetles collected by cooperators and UMN staff.**
- **Compared LC_{50} of sampled population to known susceptible population**
- **Adult beetles tested with diff. rate of Imidacloprid (Admire Pro), Thiamethoxam (Platinum), & *Clothianidin* (Belay) applied in 1µl doses using a micro-syringe applicator**
- **Beetles then placed on potato leaves, stored for 7 days at 20C (CPB often recover within 3-5 days)**
- **Mortality rates compared using Probit Analyses (LDP & POLO Plus) software.**
- **Relative rates of resistance calculated and compared**

SITE	Admire	Platinum	Belay
Becker	4.095	1.867	0.96
Browerville Field 1	8.562	1.670	3.245
Browerville Field 3	1.385	0.319	0.21
Hubbard	1.021	0.164	0.606
Hatton	1.619	0.012	0.356
Danger Field	1.523	Product Not tested	3.20
Perham	5.480	1.977	0.64
Wadena	4.458	1.449	7.738
Grand Forks	3.818	0.687	1.60
Forest River	2.499	1.082	1.049

2012 - Relative resistance levels

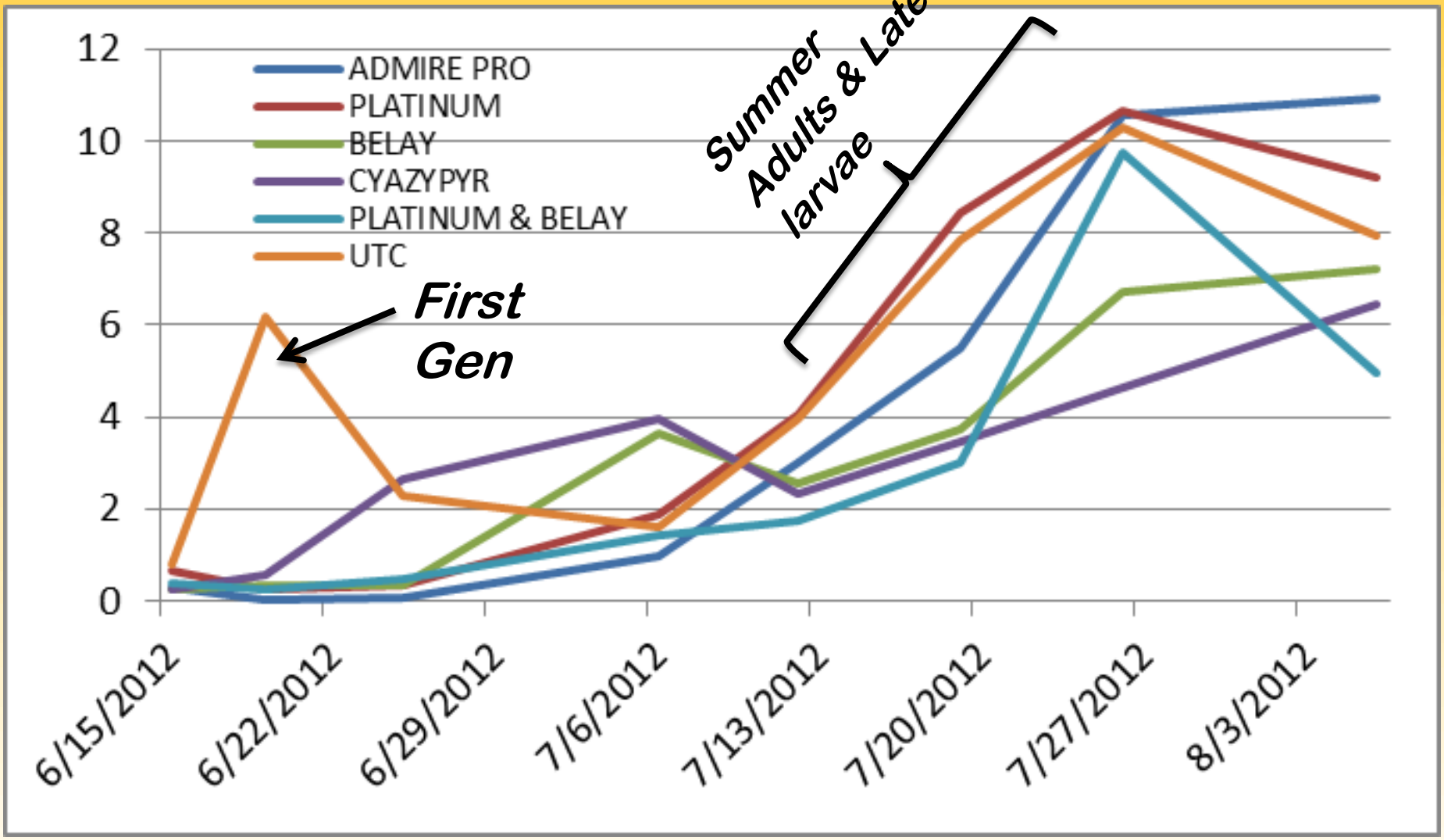
- again, ~300+ adult beetles /sample
- Tested imidacloprid (Admire Pro, Bayer Crop Science), thiamethoxam (Platinum, Syngenta Crop Protection), and clothianidin (Belay, Valent Agricultural Prod.)

susceptible **= 0X-3X**
minor **= 3X-5X**
low **= 5X to 10X**
medium **= 10X-40X**
high **= 40X-160X**
extremely high **>160X.**

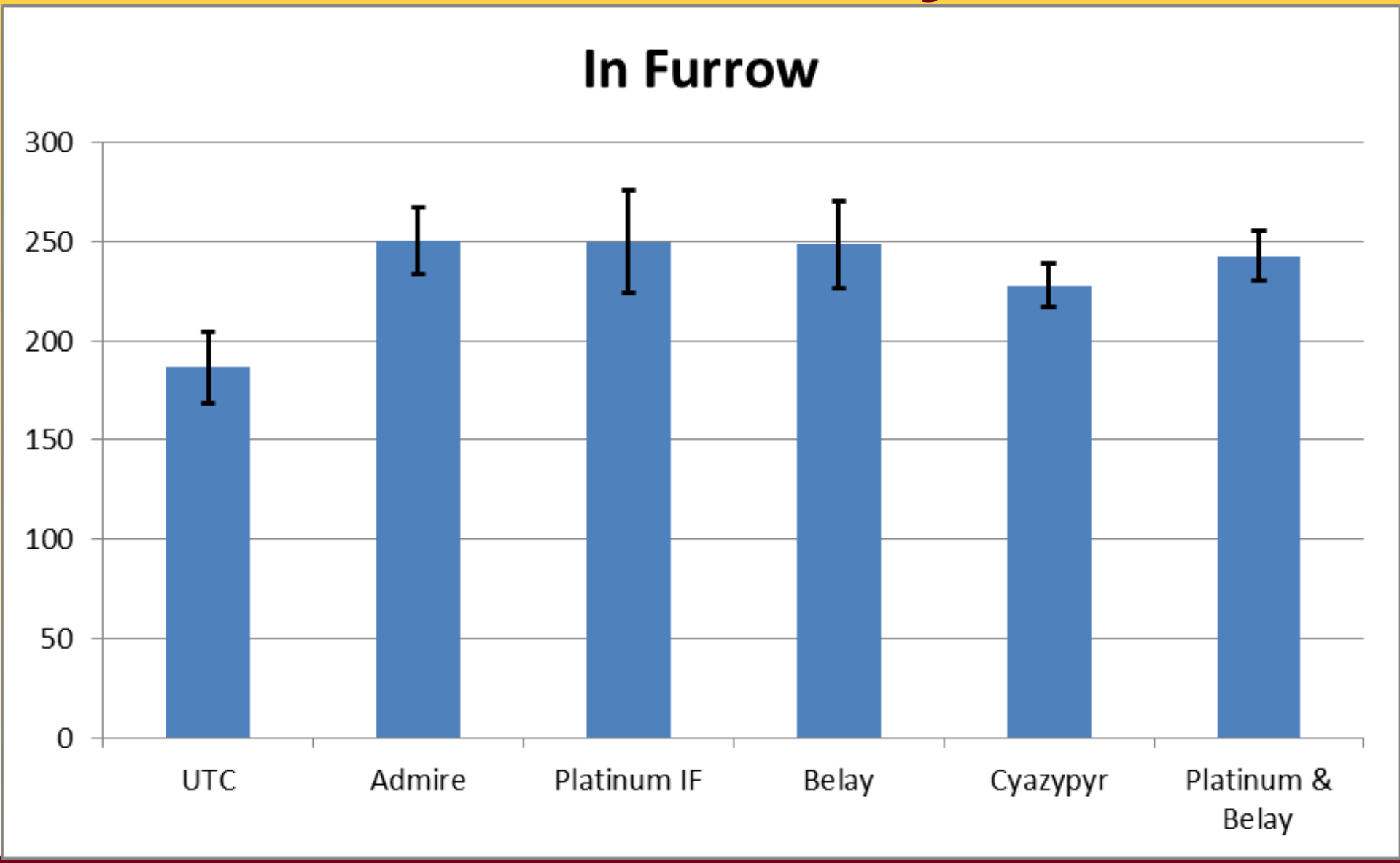
In-furrow Trail

Insecticide treatments included in in-furrow application tests.	
Insecticide	**Rate**
Untreated Control	**N/A**
Admire Pro	**8.7 fl.oz/ac**
Platinum	**8.0 fl.oz/ac**
Belay	**12 fl.oz/ac**
Cyzypyr	**.264 lbs ai/ac**
Platinum **& Belay** **(full rates of both @ plant)**	**8.0 fl.oz/ac** **& 12.0 fl.oz/ac**

In-furrow trials – CPB populations



In-furrow trials - yield



Aphid Alert II - Monitoring Aphid Vectors of Virus in Potato

- Establishing a monitoring network of suction traps across MN & ND
  - Monitoring aphid vectors more important now that soybean aphids major suspect in movement of PVY…

NOT WANTED!!

Soybean aphid, AKA Aphis glycines. An invasive species from northern China. Usually feeds on soybeans, known to travel in gangs (really, really LARGE gangs), known to travel long distances, known to land in potato fields and probe potatoes. Known to carry and can vector the PVY virus to potatoes!

Vector control

- **Monitor regional vector populations**
  - Vector control is an important step in stemming the epidemiology of PVY in potatoes
- **PVY impacting commercial potato production, PVY^{N}, PVY^{NTN}: new strains of virus**
  - No visual symptoms when summer scouting!
    - Replacement of the ordinary strain of PVY by necrotic strains and introduction of strains that combine genes from both ordinary and necrotic strains
  - Potato Tuber Necrotic Ringspot Disease (PTNRD) now impacting commercial potatoes, so PVY now a problemoutside of seed production…

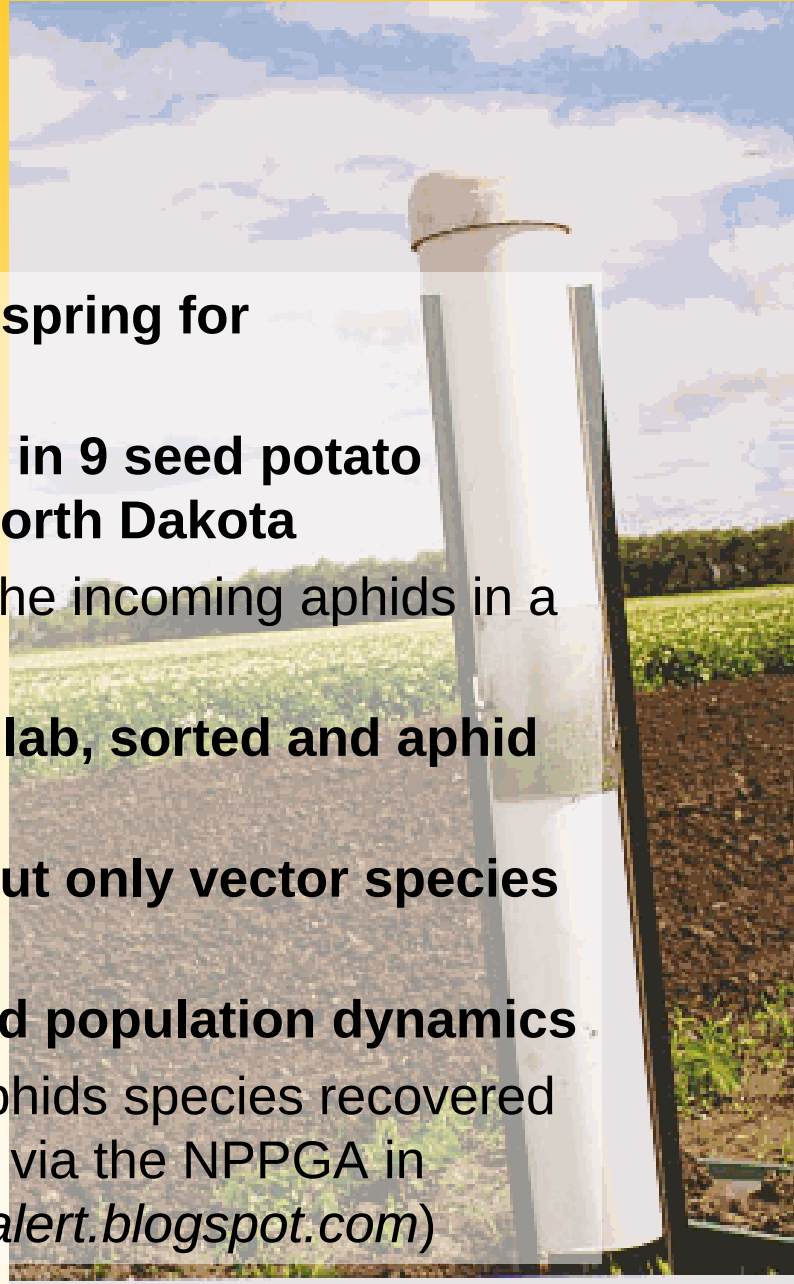
Soybean Aphid

- A new insect pest of soybeans 1st recorded in MN in 2000
- Populations develop through summer
- Readily disperses
- Can overwinter here…

Soybean aphid in spuds

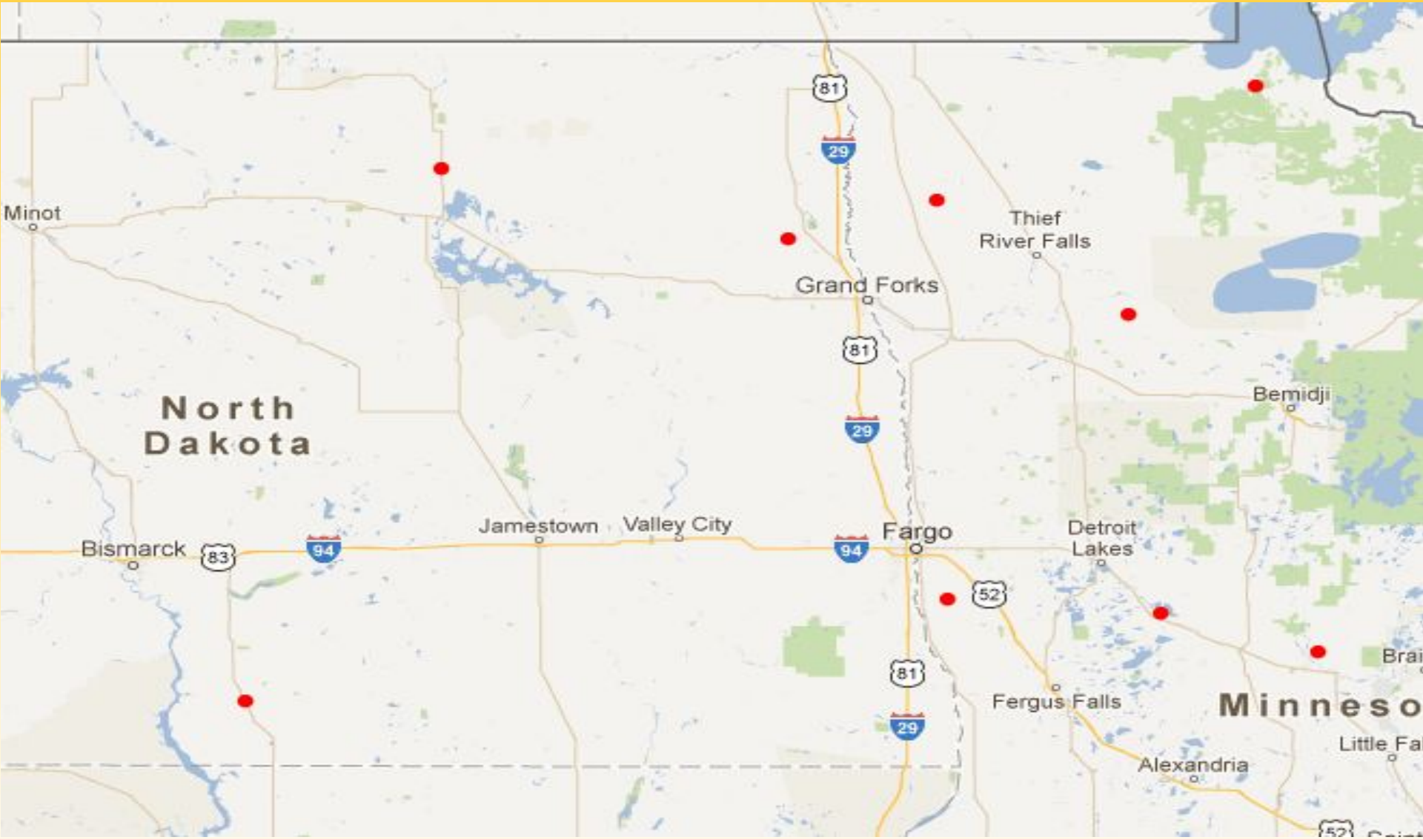
- **Soybean aphid (SBA) has been shown to be effective in transmitting Potato Virus Y (PVY)**
- **Anecdotal evidence indicates we're starting to see this insect 'branch out' into new territory**
  - Presence of PVY and field certification failure in years with low populations of traditional vectors (green peach aphids, cereal aphids, potato aphid, etc)
  - BUT, those years had high SBA numbers

Trap network

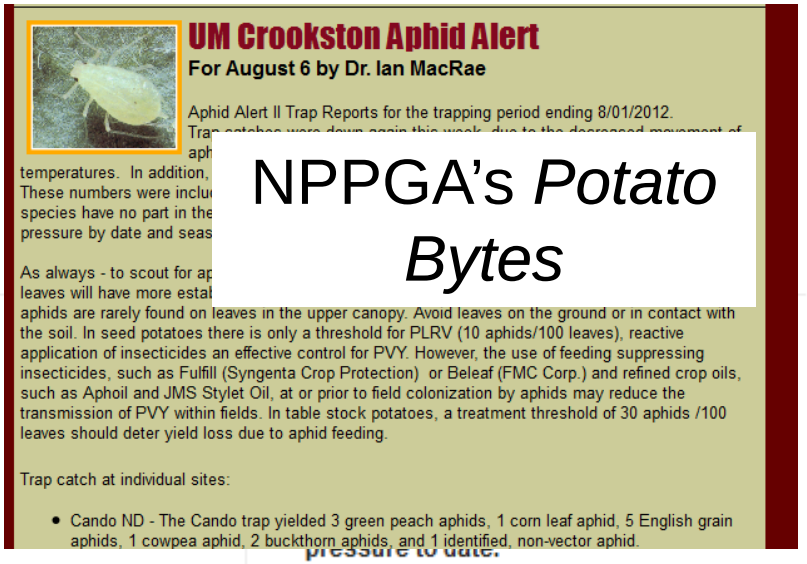


- **Buckthorn stands in RRV scouted in spring for overwintered soybean aphid.**
- **2m tall suction traps was established in 9 seed potato production areas of Minnesota and North Dakota**
  - fan draws air into trap and trapping the incoming aphids in a sample jar (changed weekly)
- **Samples returned weekly to NWROC lab, sorted and aphid species ID'd**
- **All species identified and counted but only vector species were reported**
- **Data used to determine regional aphid population dynamics**
  - Graphs prepared weekly showing aphids species recovered at each location and made available via the NPPGA in *Potato Bytes* and on website (*aphidalert.blogspot.com*)

Aphid Alert II – 2012 Sites



Aphid Alert 2012



UM Crookston Aphid Alert

For August 6 by Dr. Ian MacRae

Aphid Alert II Trap Reports for the trapping period ending 8/01/2012.

temperatures. In addition,
These numbers were inclu
species have no part in the
pressure by date and seas

As always - to scout for ap
leaves will have more estab
aphids are rarely found on leaves in the upper canopy. Avoid leaves on the ground or in contact with the soil. In seed potatoes there is only a threshold for PLRV (10 aphids/100 leaves), reactive application of insecticides an effective control for PVY. However, the use of feeding suppressing insecticides, such as Fulfill (Syngenta Crop Protection) or Beleaf (FMC Corp.) and refined crop oils, such as Aphoil and JMS Stylet Oil, at or prior to field colonization by aphids may reduce the transmission of PVY within fields. In table stock potatoes, a treatment threshold of 30 aphids /100 leaves should deter yield loss due to aphid feeding.

Trap catch at individual sites:

- Cando ND - The Cando trap yielded 3 green peach aphids, 1 corn leaf aphid, 5 English grain aphids, 1 cowpea aphid, 2 buckthorn aphids, and 1 identified, non-vector aphid.

pressure to date.

NPPGA's *Potato Bytes*

THURSDAY, JANUARY 24, 2013

WED. SEPT 5, 2012 (GRAPHS UPDATED JAN 24/2013)

Here's the catch for the Trapping Period ending Sept. 05/2012.

No green peach or soybean aphids were recovered from any trap location in this period. Several trap locations had flights of corn leaf aphids; Linton (1) and Cando (2) in ND and Gully (32) , Sabin (10), Perham (8), and Staples (5) in MN. Gully (4) and Staples (13) also recovered cowpea aphid.

Website updated weekly, available at: Aphidalert.blogspot.com

older leaves will have more established colonies and aphids prefer the balance of nutrients found here; aphids are rarely found on leaves in the upper canopy. Avoid leaves on the ground or in contact with the soil. In seed potatoes there is only a threshold for PLRV (10 aphids/100 leaves), reactive application of insecticides an effective control for PVY. However, the use of feeding suppressing insecticides, such as Fulfill (Syngenta Crop Protection) or Beleaf (FMC Corp.) and refined crop oils, such as Aphoil and JMS Stylet Oil, at or prior to field colonization by aphids may reduce the transmission of PVY within fields. In table stock potatoes, a treatment threshold of 30 aphids /100 leaves should deter yield loss due to aphid feeding.

BLOG ARCHIVE

▼ 2013 (2)

▼ January (2)

Wed. Sept 5, 2012 (graphs updated Jan 24/2013) Her...

Wed., August 29, 2012 (graphs updated Jan 24, 2013...

► 2012 (7)

ABOUT THE AUTHORS

Ian Mac Rae

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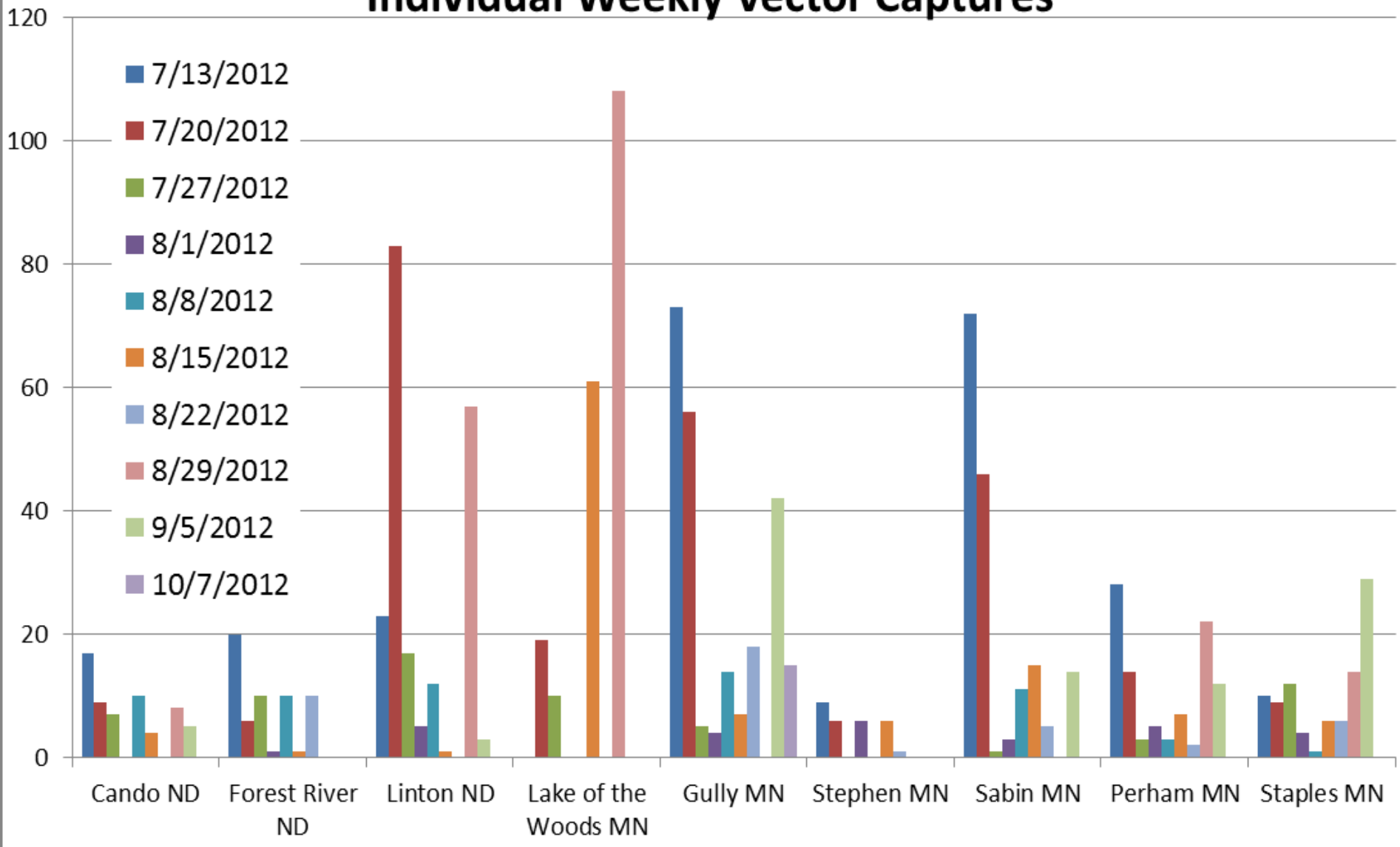
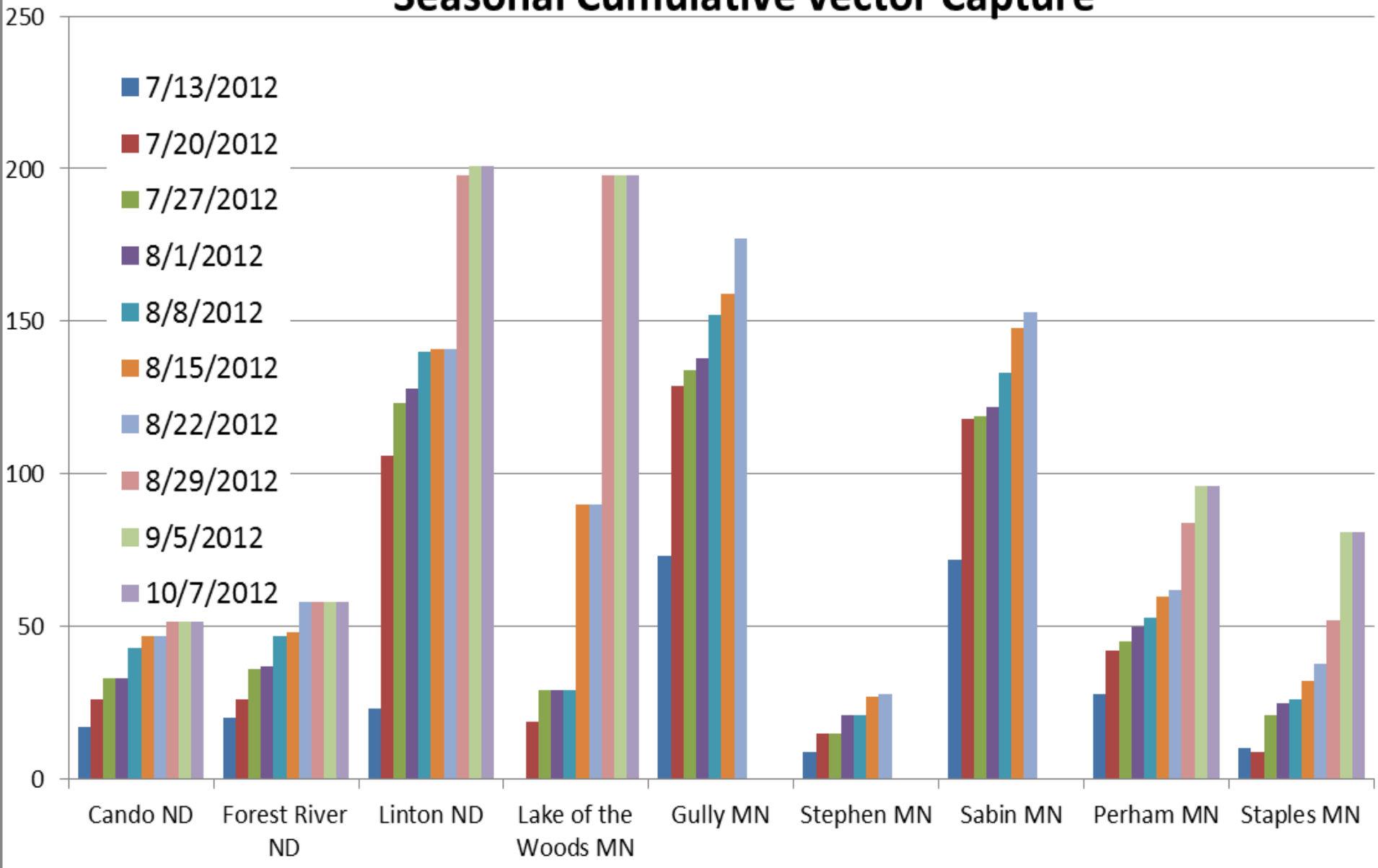
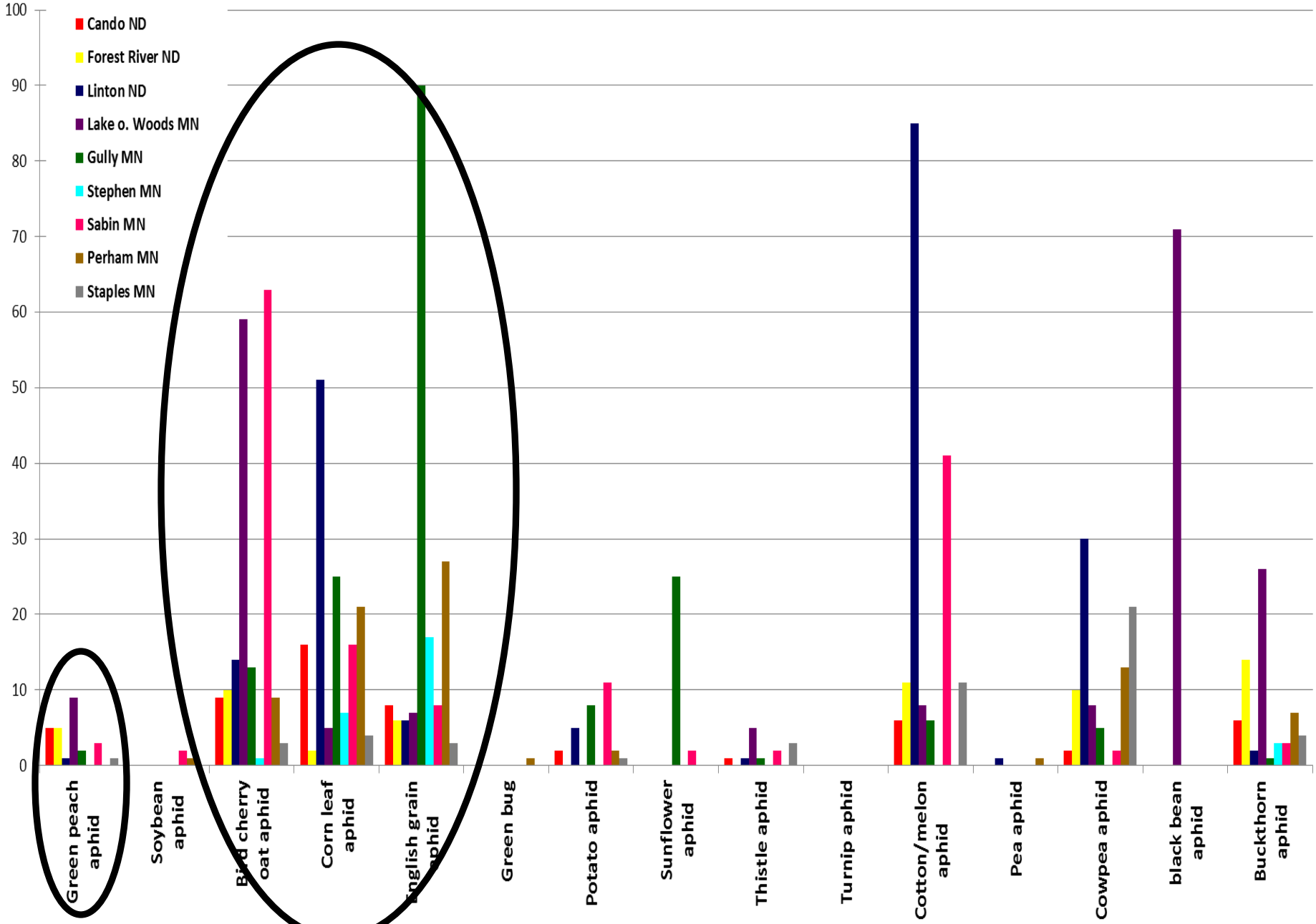
Individual Weekly Vector Captures



Seasonal Cumulative Vector Capture




100
90
80
70
60
50
40
30
20
10
0
Cando ND
Forest River ND
Linton ND
Lake o. Woods MN
Gully MN
Stephen MN
Sabin MN
Perham MN
Staples MN
Green peach aphid
Soybean aphid
Bird cherry oat aphid
Corn leaf aphid
English grain aphid
Green bug
Potato aphid
Sunflower aphid
Thistle aphid
Turnip aphid
Cotton/melon aphid
Pea aphid
Cowpea aphid
black bean aphid
Buckthorn aphid

Aphid populations - 2013

While populations of the most efficient vector (green peach aphid) and the potentially most commen vector (soybean aphid) were both low, there were other aphid vector species present this year. These populations, combined with the presences of inoculum from last year, meant we did see PVY…