

## 2014 Hancock Agricultural Experiment Station Field Day; Potato and Vegetable Insect Research

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### I. Colorado Potato Beetle; Neonicotinoid Statewide Insensitivity Among 5 Populations (Fig. 1)<sup>1</sup>.

| Year | Population | County   | Generation | N   | Slope±SEM  | LD <sub>50</sub> | (95% CL)       | RR <sup>2</sup> |
|------|------------|----------|------------|-----|------------|------------------|----------------|-----------------|
| 2014 | WI-1       | Columbia | 1          | 500 | 1.46±0.13  | 2.56             | (0.646 - 21.3) | -               |
| 2014 | WI-A       | Waushara | 1          | 500 | 1.26±0.04  | 8.9              | (4.66- 19.0)   | 3.47            |
| 2014 | WI-B       | Waushara | 1          | 500 | 1.18±0.051 | 16.5             | (6.92- 16.5)   | 6.44            |
| 2014 | WI-C       | Waushara | 1          | 500 | 1.15±0.017 | 21.8             | (15.4-31.9)    | 8.51            |
| 2014 | WI-D       | Waushara | 1          | 455 | 1.11±0.046 | 29.6             | (12.1- 87.2)   | 11.5            |

<sup>1</sup> Special thanks to all cooperating growers and pest management practitioners for their assistance with the CPB insensitivity project (Mr. Randy Van Haren Pest Pros Inc., Plainfield, WI & Mr. Andy Merry, Antigo, WI, Mr. Anders Huseth, Department of Entomology)

<sup>2</sup> Resistance ratio estimates were calculated against a reference control strain (WI-1) of Colorado potato beetle adults from Arlington Agricultural Experiment Station (LD<sub>50</sub> = 2.56).

<sup>3</sup> LD<sub>50</sub> is represented as PPM imidacloprid in acetone

### II. Full Season – Reduced-Risk, Colorado Potato Beetle Control, Large Plot Demonstration Trials (Hancock Agricultural Experiment Station, Field K9)

| Treatments                          | Active Ingredient               | Application Rates    | Application Number        | Plot Numbers    |
|-------------------------------------|---------------------------------|----------------------|---------------------------|-----------------|
| <i>At-plant systemic programs:</i>  |                                 |                      |                           |                 |
| 1) Platinum 75SG                    | thiamethoxam                    | 2.67 fl oz / A       | 1 (25 April 2014)         | (101, 201, 301) |
| Besiege 1.25ZC                      | lambda-cyhalothrin              | 9.0 & 7.5 fl oz / A  | 2 (TBD)                   |                 |
| 2) Belay 2.13SC                     | clothianadin                    | 12.0 fl oz / A       | 1 (25 April 2014)         | (102, 202, 302) |
| Blackhawk 36WG (resue trt)          | spinosad                        | 3.3 oz wt / A        | 1 (10 July 2014)          |                 |
| Agri-Mek 0.75C                      | abamectin                       | 3.5 & 3.0 fl oz / A  | 2 (TBD)                   |                 |
| 3) Verimark 20SC                    | cyazypyr (cyantraniliprole)     | 7 fl oz / A          | 1 (25 April 2014)         | (103, 203, 303) |
| Blackhawk 36WG (resue trt)          | spinosad                        | 3.3, 3.0 oz wt / A   | 2 (3, 10 July 2014)       |                 |
| Assail 30SG                         | acetamiprid                     | 4.0 & 3.0 oz wt / A  | 2 (TBD)                   |                 |
| 4) Verimark 20SC                    | cyazypyr (cyantraniliprole)     | 10 fl oz / A         | 1 (25 April 2014)         | (104, 204, 304) |
| Blackhawk 36WG (resue trt)          | spinosad                        | 3.3 oz wt / A        | 2 (3 July 2014)           |                 |
| Assail 30SG                         | acetamiprid                     | 4.0 & 3.0 oz wt / A  | 2 (TBD)                   |                 |
| 5) Verimark 20SC                    | cyazypyr (cyantraniliprole)     | 13.5 fl oz / A       | 1 (25 April 2014)         | (105, 205, 305) |
| Blackhawk 36WG (resue trt)          | spinosad                        | 3.3 oz wt / A        | 2 (3 July 2014)           |                 |
| Actara 25WD                         | thiamethoxam                    | 3.0, 2.5 oz wt / A   | 2 (TBD)                   |                 |
| 6) AdmirePro 4.6 SC                 | imidacloprid                    | 8.7 fl oz / A        | 1 (25 April 2014)         | (106, 206, 306) |
| Blackhawk 36WG (resue trt)          | spinosad                        | 3.3 oz wt / A        | 2 (3 July 2014)           |                 |
| Coragen 1.67SC                      | rynaxypyr (chlorantraniliprole) | 5.0 & 5.0 fl oz / A  | 2 (TBD)                   |                 |
| <i>Foliar insecticide programs:</i> |                                 |                      |                           |                 |
| 7) Rimon 0.83EC                     | novaluron                       | 10.0, 10.0 fl oz / A | 2 (19, 27 June 2014)      | (107, 207, 307) |
| Exirel 10SE                         | cyazypyr (cyantraniliprole)     | 6.75, 5.0 fl oz / A  | 2 (TBD)                   |                 |
| 8) Coragen 1.67SC                   | rynaxypyr (chlorantraniliprole) | 5.0 & 3.5 fl oz / A  | 2 (27 June, 10 July 2014) | (108, 208, 308) |
| AdmirePro 4.6SC                     | imidacloprid                    | 1.3 & 1.0 oz / A     | 2 (TBD)                   |                 |
| 9) Agri-Flex 1.55EC                 | abamectin + thiamethoxam        | 8.5, 6.0 fl oz / A   | 2 (27 June, 10 July 2014) | (109, 209, 309) |
| Besiege 1.25ZC                      | lambda-cyhalothrin              | 9.0, 7.5 fl oz / A   | 2 (TBD)                   |                 |
| 10) Blackhawk 36WG                  | spinosad                        | 3.3 & 2.5 oz / A     | 2 (27 June, 10 July 2014) | (110, 210, 310) |
| Exirel 10 SE                        | cyazypyr (cyantraniliprole)     | 5.0 & 5.0 fl oz / A  | 2 (TBD)                   |                 |
| 11) Radiant SC                      | spinetoram                      | 8, 6 fl oz / A       | 2 (27 June, 10 July 2014) | (111, 211, 311) |
| Actara 25WD                         | thiamethoxam                    | 3.0, 2.5 oz wt / A   | 2 (TBD)                   |                 |
| 12) Athena 0.87EC                   | bifenthrin + avermectin         | 17, 14 fl oz / A     | 2 (27 June, 10 July 2014) | (112, 212, 312) |
| AdmirePro 4.6 SC                    | imidacloprid                    | 1.3 & 1.0 fl oz / A  | 2 (TBD)                   |                 |

<sup>1</sup> Foliar insecticides applied with a 24' boom operating at 30 psi delivering 19.9 gpa through 12 flat-fan nozzles (8002VS-XR) spaced 18" apart. Applications of foliar insecticides timed to control 1<sup>st</sup> and 2<sup>nd</sup> generation Colorado potato beetle.



**III. Foliar Insecticide Evaluations for the Control of Colorado Potato Beetle, (Hancock Agricultural Experiment Station, Hancock, WI Fields C24-26)<sup>1,2</sup>.**

| Treatments          | Active Ingredient | Application Rate | Plot Numbers         | Treatments       | Active Ingredient        | Application Rate | Plot Numbers         |
|---------------------|-------------------|------------------|----------------------|------------------|--------------------------|------------------|----------------------|
| 1) UTC              | Untreated         |                  | (101, 201, 301, 401) | 16) UTC          | Untreated                |                  | (116, 216, 316, 416) |
| 2) Benevia OD       | cyantraniliprole  | 5.0 fl oz /A     | (102, 202, 302, 402) | 17) Blackhawk WG | spinosad                 | 2.5 oz wt / A    | (117, 217, 317, 417) |
| 3) Exirel SE        | cyazypyr          | 5.0 fl oz /A     | (103, 203, 303, 403) | 18) Blackhawk WG | spinosad                 | 3.3 oz wt / A    | (118, 218, 318, 418) |
| 4) Exirel SE        | cyazypyr          | 5.0 fl oz /A     | (104, 204, 304, 404) | 19) Actara WG    | thiamethoxam             | 3.0 oz wt / A    | (119, 219, 319, 419) |
| 5) Exirel SE        | cyazypyr          | 6.75 fl oz /A    | (105, 205, 305, 405) | 20) IKI-3106 SL  |                          | 11 fl oz /A      | (120, 220, 320, 420) |
| 6) Coragen SC       | rynaxypyr         | 4.5 fl oz /A     | (106, 206, 306, 406) | 21) IKI-3106 SL  |                          | 16.4 fl oz /A    | (121, 221, 321, 421) |
| 7) Coragen SC       | rynaxypyr         | 5.0 fl oz /A     | (107, 207, 307, 407) | 22) Besiege ZC   | lambda-cyhalothrin       | 9.0 fl oz / A    | (122, 222, 322, 422) |
| 8) Exp 1            | experimental      | LOW              | (108, 208, 308, 408) | 23) Agri-Flex SC | abamectin + thiamethoxam | 6.0 fl oz / A    | (123, 223, 323, 423) |
| 9) Exp 1            | experimental      | HIGH             | (109, 209, 309, 409) | 24) Athena EC    | abamectin+bifenthrin     | 17, 13 fl oz / A | (124, 224, 324, 424) |
| 10) Avaunt WG       | indoxacarb        | 3.5 fl oz /A     | (110, 210, 310, 410) | 25) Athena EC    | abamectin+bifenthrin     | 17, 17 fl oz / A | (125, 225, 325, 425) |
| 11) Avaunt WG       | indoxacarb        | 6.0 fl oz /A     | (111, 211, 311, 411) | 26) Gladiator    | abamectin+bifenthrin     | 19, 12 fl oz/a   | (126, 226, 326, 426) |
| 12) AdmirePro FS    | imidacloprid      | 1.3 fl oz /A     | (112, 212, 312, 412) | 27) Gladiator    | abamectin+bifenthrin     | 19, 19 fl oz/a   | (127, 227, 327, 427) |
| 13) Provado F       | imidacloprid      | 3.8 fl oz / A    | (113, 213, 313, 413) | 28) Brigadier    | bifenthrin+imidacloprid  | 6.4, 5 fl oz/a   | (128, 228, 328, 428) |
| 14) Leverage 360 SC | imidacloprid      | 2.8 fl oz / A    | (114, 214, 314, 414) | 29) Rimon EC     | novaluron                | 6, 6, 6 fl oz/a  | (129, 229, 329, 429) |
| 15) Belay SC        | clothianadin      | 3.0 fl oz /A     | (115, 215, 315, 415) | 30) Rimon EC     | novaluron                | 10, 8, 8 fl oz/a | (130, 230, 330, 430) |

<sup>1</sup> Foliar insecticides applied with a 6' boom operating at 30 psi delivering 19.9 gpa through 3 flat-fan nozzles (8002VS-XR) spaced 18" apart. Two applications of each foliar insecticide applied 19 June and 26 June, 2014.  
<sup>2</sup> Rimon applications applied 11 June, 19 June and 26 June 2014.

**VI. 2014, Additional Vegetable Insect Research.**

**I. European corn borer (*Ostrinia nubilalis*) and corn earworm (*Helicoverpa zea*) control in succulent snap bean (Del Monte Foods, Plover, WI (Don Caine and Brian Flood):**

**II. Current season management of Potato Virus Y (PVY) in seed potato production (Stephanie Plaster, CES UWEX):**

**III. Characterizing Potato Virus Y (PVY) resistance in seed potato production by exploiting mature plant resistance (Chen Zhang, UW Plant Pathology):**

**IV. Landscape patterns of Potato virus Y (PVY) incidence in Wisconsin seed production regions (Amy Charkowski, Alex Crockford, Wisconsin Seed Certification).**

**V. Determining the spatial and temporal extent of neonicotinoid insecticides in groundwater resources in Wisconsin (Ben Bradford, UW Entomology):**

**VI. Performance of novel genetic solutions for the control of Colorado Potato Beetle:**

More information can be found at.....<http://labs.russell.wisc.edu/vegento/>



Appendix 1. Topical bioassay estimates for selected *L. decemlineata* populations in Wisconsin (2007-14).

| Year | Population  | County                | Generation | N   | Slope±SEM | LD <sub>50</sub> | (95% CL)          | $\chi^2$ | df | RR                    |
|------|-------------|-----------------------|------------|-----|-----------|------------------|-------------------|----------|----|-----------------------|
| 2007 | WI-1        | Columbia <sup>b</sup> | 1          | 75  | 6.93±1.69 | 0.03             | (0.03 - 0.036)    | 3.8482   | 3  | - -                   |
| 2008 | WI-10       | Adams                 | 1          | 76  | 2.5 ±1.99 | 0.92             | (-)               | 20.3459  | 3  | 24.73 (11.35 - 53.89) |
| 2008 | WI-10       | Adams                 | 2          | 76  | 4.35±1.1  | 0.33             | (0.21 - 0.41)     | 5.0929   | 3  | 8.78 (2.15 - 35.78)   |
| 2008 | WI-11Potato | Waushara              | 1          | 75  | 1.25±0.43 | 0.26             | (0.15 - 0.69)     | 5.1914   | 3  | 7.06 (3.85 - 12.95)   |
| 2008 | WI-11       | Waushara              | 2          | 75  | 1.43±0.58 | 0.01             | (0.00002 - 0.031) | 5        | 3  | 0.34 (0.08 - 1.52)    |
| 2008 | WI-11       | Portage               | 2          | 75  | 0.53±0.49 | 2.2              | (-)               | 1.717    | 3  | 59.26 (1.24-2842.83)  |
| 2008 | WI-12       | Portage               | 1          | 64  | 0.5±0.6   | 0.01             | (-)               | 4.0534   | 3  | 0.25 (0-36.04)        |
| 2008 | WI-13       | Adams                 | 1          | 75  | 1.88±0.5  | 0.43             | (0.26 - 0.64)     | 0.7348   | 3  | 11.6 (7.52-17.91)     |
| 2008 | WI-14       | Waushara              | 1          | 75  | 2.67±0.6  | 0.32             | (0.21 - 0.42)     | 1.8682   | 3  | 8.52 (5.86-12.38)     |
| 2008 | WI-14       | Waushara              | 2          | 73  | 2.98±0.67 | 0.41             | (0.29 - 0.52)     | 4.1882   | 3  | 10.9 (7.88-15.08)     |
| 2008 | WI-15       | Oconto                | 2          | 59  | 3.69±1.64 | 0.03             | (-)               | 10.9638  | 3  | 0.88 (0.52-1.49)      |
| 2008 | WI-16       | Portage               | 1          | 73  | 1.98±0.66 | 0.48             | (0.20 - 0.69)     | 4.395    | 3  | 12.93 (8.08-20.67)    |
| 2008 | WI-17       | Portage               | 1          | 150 | 1.98±0.6  | 0.03             | (0.0036 - 0.045)  | 13.6198  | 8  | 0.75 (0.39-1.42)      |
| 2008 | WI-18       | Waushara              | 1          | 75  | 2.55±0.55 | 0.53             | (0.38 - 0.72)     | 5.0992   | 3  | 14.13 (9.95-20.07)    |
| 2008 | WI-19       | Portage               | 1          | 149 | 1.66±0.29 | 0.3              | (0.21 - 0.41)     | 5.6677   | 8  | 8.09 (5.57-11.77)     |
| 2008 | WI-19       | Portage               | 2          | 146 | 7.35±1.57 | 0.24             | (0.21 - 0.27)     | 0.5287   | 3  | 6.42 (5.14-8.03)      |
| 2008 | WI-2        | Langlade              | 1          | 75  | 1.95±1.3  | 0.13             | (-)               | 10.6312  | 3  | 3.49 (0.89-13.62)     |
| 2008 | WI-20       | Portage               | 2          | 40  | 2.85±0.97 | 0.03             | (0.0092 - 0.038)  | 3.4337   | 3  | 0.7 (0.42-1.16)       |
| 2008 | WI-21       | Adams                 | 1          | 150 | 1.66±0.5  | 0.15             | (0.039 - 0.32)    | 28.2281  | 8  | 4.07 (2.11-7.85)      |
| 2008 | WI-22       | Langlade              | 2          | 105 | 1.09±1.01 | 0.01             | (-)               | 47.9491  | 5  | 0.4 (0.02-8.68)       |
| 2008 | WI-23       | Portage               | 2          | 48  | 1.81±0.71 | 0.08             | (0.046 - 0.24)    | 4.7577   | 3  | 2.14 (1.25-3.67)      |
| 2007 | WI-27       | Langlade              | 2          | 48  | 2.96±1.29 | 0.02             | (0.00033 - 0.024) | 0.5336   | 2  | 0.42 (0.21-0.85)      |
| 2008 | WI-3        | Waushara              | 1          | 75  | 1.01±0.59 | 0.02             | (-)               | 6.5453   | 3  | 0.67 (0.11-4.17)      |
| 2008 | WI-4        | Waushara              | 1          | 76  | 1.44±0.63 | 1.48             | (0.8 - 1241)      | 3.515    | 3  | 39.94 (13.74-116.05)  |
| 2008 | WI-4        | Waushara              | 2          | 74  | 1.43±1.05 | 0.08             | (-)               | 10.9939  | 3  | 2.22 (0.52-9.43)      |
| 2008 | WI-5        | Adams                 | 2          | 146 | 0.87±0.6  | 0.79             | (-)               | 6.4028   | 3  | 21.32 (7.25-62.75)    |
| 2008 | WI-6        | Adams                 | 1          | 75  | 0.83±0.52 | 0.14             | (-)               | 3.3113   | 3  | 3.67 (0.34-39)        |
| 2008 | WI-7        | Adams                 | 1          | 75  | 2.46±0.8  | 0.24             | (0.049 - 0.37)    | 4.0762   | 3  | 6.44 (3.26-12.73)     |
| 2008 | WI-8        | Waushara              | 1          | 78  | 1.26±0.89 | 0.81             | (-)               | 6.3736   | 3  | 21.91 (9.76-49.19)    |
| 2008 | WI-9        | Adams                 | 1          | 74  | 2.41±0.6  | 0.43             | (0.23 - 0.59)     | 0.1641   | 3  | 11.45 (7.28-17.98)    |
| 2009 | WI-1        | Columbia              | 1          | 75  | 3.29±1.36 | 0.01             | (0.01 - 0.02)     | 3.68     | 3  | - -                   |
| 2009 | WI-11       | Waushara              | 1          | 75  | 0.72±0.93 | 0.02             | (-)               | 8.8      | 3  | 0.65 (0.02-17.73)     |
| 2009 | WI-24       | Adams                 | 1          | 75  | 2.46±0.81 | 0.08             | (-)               | 8.09     | 3  | 2.24 (1.29-3.9)       |
| 2009 | WI-24       | Adams                 | 2          | 48  | 1.27±0.65 | 0.09             | (0 - 0.19)        | 6.24     | 3  | 2.54 (0.96-6.69)      |
| 2009 | WI-25       | Adams                 | 2          | 76  | 3.12±0.96 | 0.07             | (0.03 - 0.10)     | 1.12     | 3  | 1.91 (1.19 - 3.05)    |
| 2009 | WI-26       | Adams                 | 1          | 75  | 1.72±0.59 | 0.03             | (0.01 - 0.05)     | 1.23     | 3  | 0.88 (0.54-1.46)      |
| 2009 | WI-27       | Langlade              | 1          | 75  | 3.14±0.66 | 0.12             | (0.09 - 0.15)     | 0.37     | 3  | 3.1 (2.28-4.22)       |
| 2009 | WI-28       | Marquette             | 1          | 75  | 5.17±0.99 | 0.06             | (0.05 - 0.07)     | 0.86     | 3  | 1.57 (1.21-2.02)      |
| 2009 | WI-29       | Adams                 | 1          | 75  | 4.21±1.51 | 0.8              | (-)               | 9.68     | 3  | 21.63 (14.66-31.92)   |
| 2009 | WI-30       | Adams                 | 2          | 76  | 2.1±0.63  | 0.06             | (0.02 - 0.08)     | 3.2      | 3  | 1.55 (0.92-2.61)      |
| 2009 | WI-31       | Adams                 | 1          | 75  | 1.01±0.53 | 0.15             | (-)               | 2.37     | 3  | 4 (1.93-8.29)         |
| 2009 | WI-32       | Langlade              | 2          | 73  | 3.61±1.26 | 0.09             | (-)               | 8.57     | 3  | 2.54 (1.66-3.89)      |

|      |       |           |   |     |              |      |                 |       |   |       |                 |
|------|-------|-----------|---|-----|--------------|------|-----------------|-------|---|-------|-----------------|
| 2009 | WI-33 | Adams     | 1 | 75  | 1.83±0.6     | 0.15 | (0.10 - 0.48)   | 0.85  | 3 | 3.93  | (2.22-6.96)     |
| 2009 | WI-38 | Langlade  | 1 | 75  | 3.84±1.14    | 0.06 | (0.02 - 0.34)   | 6.72  | 3 | 1.49  | (1.04-2.14)     |
| 2010 | WI-1  | Columbia  | 2 | 135 | 4.38±0.75    | 0.04 | (0.03 - 0.05)   | 3.34  | 7 | -     | -               |
| 2010 | WI-11 | Waushara  | 1 | 135 | 1.33±0.34    | 0.97 | (0.40 - 3.30)   | 17.51 | 7 | 25.98 | (12.59-53.59)   |
| 2010 | WI-11 | Waushara  | 2 | 145 | 3.85±0.65    | 0.43 | (0.34 - 0.51)   | 2.12  | 3 | 11.64 | (8.92-15.2)     |
| 2010 | WI-24 | Adams     | 2 | 135 | 0.77±0.38    | 0.15 | (-)             | 3.04  | 3 | 3.92  | (1.48-10.41)    |
| 2010 | WI-31 | Adams     | 2 | 135 | 0.51±0.17    | 0.24 | (0.06 - 0.76)   | 6.8   | 7 | 6.48  | (2.32-18.06)    |
| 2010 | WI-32 | Langlade  | 2 | 179 | 1.55±0.44    | 0.18 | (0.02 - 0.41)   | 12.21 | 4 | 4.92  | (2.66-9.09)     |
| 2010 | WI-33 | Adams     | 2 | 135 | 1.25±0.22    | 0.08 | (0.05 - 0.12)   | 11.77 | 7 | 2.17  | (1.32-3.56)     |
| 2010 | WI-34 | Adams     | 2 | 150 | 0.58±0.17    | 2.94 | (1.21 - 28.80)  | 3.22  | 8 | 79.16 | (23.87-262.57)  |
| 2010 | WI-35 | Adams     | 2 | 148 | 2.07±0.42    | 1.14 | (0.89 - 1.66)   | 2.45  | 3 | 30.76 | (18.09-52.29)   |
| 2010 | WI-36 | Langlade  | 2 | 148 | 1.15±0.33    | 0.24 | (0.14 - 0.99)   | 4.81  | 3 | 6.45  | (3.08 - 13.52)  |
| 2010 | WI-37 | Langlade  | 2 | 107 | 1.46±1.00    | 0.1  | (-)             | 7.49  | 2 | 2.67  | (1.21-5.88)     |
| 2010 | WI-6  | Adams     | 1 | 196 | 1.64±0.22    | 0.22 | (0.17 - 0.31)   | 7.1   | 5 | 0.22  | (0.16-0.3)      |
| 2010 | WI-6  | Adams     | 2 | 150 | 2.58±0.44    | 0.77 | (0.63 - 0.95)   | 0.29  | 3 | 0.77  | (0.63-0.94)     |
| 2011 | WI-1  | Columbia  | 1 | 600 | 3.13±0.33)   | 0.03 | (0.028 - 0.034) | 14.11 | 6 | -     | -               |
| 2011 | WI-11 | Waushara  | 1 | 525 | 1.47±0.11)   | 0.48 | (0.40 - 0.59)   | 6.2   | 5 | 17.23 | (16.8-17.66)    |
| 2011 | WI-13 | Adams     | 1 | 425 | 1.63±0.14)   | 0.72 | (0.59 - 0.87)   | 5.63  | 4 | 25.53 | (24.55-26.5)    |
| 2011 | WI-16 | Portage   | 1 | 327 | 2.75±0.51)   | 0.38 | (0.24 - 0.88)   | 10.94 | 3 | 13.45 | (12.55-14.35)   |
| 2011 | WI-31 | Adams     | 1 | 500 | 2.03±0.26)   | 0.73 | (0.51 - 1.047)  | 14.15 | 4 | 25.53 | (23.86-27.98)   |
| 2011 | WI-33 | Adams     | 1 | 524 | 1.81±0.25)   | 0.39 | (0.27 - 0.58)   | 15.78 | 5 | 13.45 | (12.55-14.35)   |
| 2011 | WI-34 | Adams     | 1 | 524 | 1.90±0.26)   | 0.62 | (0.41 - 0.94)   | 17.47 | 5 | 22.22 | (21.01-23.43)   |
| 2011 | WI-36 | Oconto    | 1 | 120 | 0.44±0.82)   | 1.54 | (-)             | 40.07 | 4 | 54.96 | (46.44-63.47)   |
| 2011 | WI-37 | Langlade  | 1 | 120 | 1.26±0.38)   | 0.13 | (0.08 - 0.43)   | 6.91  | 4 | 4.71  | (4.31-5.11)     |
| 2011 | WI-38 | Langlade  | 1 | 120 | 1.86±0.62)   | 1.11 | (-)             | 8.85  | 4 | 39.71 | (24.55-55.75)   |
| 2011 | WI-39 | Langlade  | 1 | 119 | 1.32±0.41)   | 1    | (0.44 - 18.94)  | 3.57  | 4 | 35.69 | (-640.9-712.32) |
| 2011 | WI-44 | Portage   | 1 | 525 | 1.49±0.28)   | 0.72 | (0.39 - 1.47)   | 25.94 | 5 | 26.26 | (24.54-27.98)   |
| 2012 | WI-1  | Columbia  | 1 | 500 | 1.43±0.39)   | 0.05 | (0.025 - 0.31)  | 55.33 | 6 | -     | -               |
| 2012 | WI-40 | Marinette | 1 | 400 | 1.92±0.43)   | 0.55 | (0.29 - 1.60)   | 28.94 | 5 | 19.67 | (17.99-21.36)   |
| 2012 | WI-41 | Langlade  | 2 | 400 | 1.17±0.27)   | 1.27 | (0.6 - 11.4)    | 13.69 | 5 | 45.47 | (37.37-53.56)   |
| 2012 | WI-42 | Oconto    | 1 | 400 | 1.56±0.16)   | 0.35 | (0.28 - 0.44)   | 7.44  | 5 | 12.33 | (11.46-13.21)   |
| 2012 | WI-43 | Marinette | 1 | 400 | 1.81±0.21)   | 0.5  | (0.4 - 0.68)    | 7.29  | 5 | 17.97 | (17.25-18.68)   |
| 2012 | WI-45 | Oneida    | 1 | 400 | 1.88±0.37)   | 0.37 | (0.23 - 0.64)   | 17.47 | 5 | 14.85 | (14.09-15.64)   |
| 2013 | WI-1  | Columbia  | 1 | 350 | 2.568 ± 0.08 | 0.08 | (0.06 - 0.13)   |       |   | -     | -               |
| 2013 | WI-A  | Waushara  | 1 | 350 | 1.709 ± 0.09 | 0.84 | (0.38 - 0.84)   |       |   | 10.5  |                 |
| 2013 | WI-B  | Waushara  | 1 | 350 | 1.616 ± 0.02 | 1.24 | (0.99-1.56)     |       |   | 15.5  |                 |
| 2013 | WI-C  | Waushara  | 1 | 350 | 1.532 ± 0.03 | 1.83 | (1.19-2.98)     |       |   | 22.8  |                 |
| 2013 | WI-D  | Waushara  | 1 | 350 | 1.494 ± 0.04 | 2.22 | (1.35-3.95)     |       |   | 27.75 |                 |
| 2014 | WI-1  | Columbia  | 1 | 500 | 1.46±0.13    | 2.56 | (0.646 - 21.3)  |       |   | -     |                 |
| 2014 | WI-A  | Waushara  | 1 | 500 | 1.26±0.04    | 8.9  | (4.66 - 19.0)   |       |   | 3.47  |                 |
| 2014 | WI-B  | Waushara  | 1 | 500 | 1.18±0.051   | 16.5 | (6.92 - 16.5)   |       |   | 6.44  |                 |
| 2014 | WI-C  | Waushara  | 1 | 500 | 1.15±0.017   | 21.8 | (15.4-31.9)     |       |   | 8.51  |                 |
| 2014 | WI-D  | Waushara  | 1 | 455 | 1.11±0.046   | 29.6 | (12.1 - 87.2)   |       |   | 11.5  |                 |

Model fits that did not converge to generate confidence intervals for LD50 estimates are represented by (-)

<sup>a</sup>R-ratio: Resistance Ratio comparing LD<sub>50</sub> of populations to response of WI-Susceptible population annually.

<sup>b</sup>Reference field population – University of Wisconsin Arlington Agricultural Research Station, Arlington, Wisconsin