Effects of potato psyllid vector density and time of infection on zebra chip disease development after harvest and during storage

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Zebra chip (ZC) disease

- Disease associated with bacterium
  ("Candidatus Liberibacter solanacearum" [Lso])

- Bacterium vectored by the potato psyllid
  (Bactericera cockerelli)
- Potato psyllid abundance low during most of season, peaking only late season

- Texas studies (Rush and Rashed) suggest ZC develops from late infections
  - “Green harvest”
  - fresh/chip varieties
Field plots

- Individually caged potato plants
- cv. Russet Burbank
- Inoculations w/ psyllids from Lso-positive colony
- RCB design
- 8-10 replicates
  - ½ rated at harvest
  - ½ rated after storage
Half of reps rated at harvest

- Held for no more than 2 weeks at 12.8°C, 95% RH

Half of reps rated after storage

- Cured for 2 weeks at 12.8°C, 95% RH
- Decreased 0.3°C per day until = 7.2°C
- Held for total of ca. 90 days
ZC ratings

- Each tuber cut into fry planks
- Raw planks rated, fried, fry color with Photovolt Reflection Meter
ZC ratings

- Visual ZC ratings, confirmed by PCR

- Visual ZC ratings:
  - A: no symptoms
  - B: some discoloration near stem end
  - C: obvious ZC symptoms through tuber
Inoculation treatments (2014-2015 experiment)
| No. psyllids |  | 2014 | 2015 |  | 2014 | 2015 |
|-------------|---|------|------|---|------|------|
| 0 (check)   |  | 0.0  | 0.0  |  | 0.0  | 0.0  |
| 2           |  | 2.6  | 15.3 |  | 17.8 | 25.3 |
| 5           |  | 23.5 | 24.4 |  | 30.8 | 27.1 |
|                  | 2014  | 2015  | 2014  | 2015  |
|------------------|-------|-------|-------|-------|
| **Check**        | 0.0 b | 0.0 b | 0.0 b | 0.0 c |
| 2 days           | 0.0 b | 0.0 b | 0.0 b | 0.0 c |
| 1 week           | 0.0 b | 0.0 b | 0.0 b | 0.0 c |
| 3 weeks          | 1.4 b | 1.3 b | 36.9 a| 24.3 b|
| 7 weeks          | 50.8 a| 78.2 a| 60.3 a| 80.4 a|
Inoculation treatments (2016-2017 experiments)

- 5 weeks before vine kill
- 4 weeks
- 3 weeks
- 2 weeks
- 1 week
- non-inoculated check

4 psyllids per plant
| Inoculation timing | Percentage of raw tubers with severe ZC symptoms |
|--------------------|-----------------------------------------------|
|                    | at harvest                                    |
|                    | after storage                                  |
| —                  | 0.0 b                                         |
| 1 week             | 0.0 b                                         |
| 2 weeks            | 0.0 b                                         |
| 3 weeks            | 7.3 ab                                        |
| 4 weeks            | 25.2 a                                        |
## 2017

| Inoculation timing | Percentage of raw tubers with severe ZC symptoms |
|--------------------|-----------------------------------------------|
|                    | at harvest | after storage |
| —                  | 0.0 b      | 0.0 b         |
| 1 week             | 0.0 b      | 0.0 b         |
| 2 weeks            | 0.0 b      | 11.4 b        |
| 3 weeks            | 4.5 ab     | 25.7 b        |
| 4 weeks            | 8.3 ab     | 30.6 b        |
| 5 weeks            | 38.5 a     | 94.1 a        |
|                | USDA1 | USDA2 | USDA3 | USDA4 |
|----------------|-------|-------|-------|-------|
| Mean fry color reflectance at harvest after storage | 2016  | 2017  | 2016  | 2017  |
| Check         | 45.3 a| 43.5 a| 38.4  | 40.6 a|
| 1 week        | 44.7 a| 38.8 ab| 38.1  | 40.7 a|
| 2 weeks       | 47.5 a| 37.5 ab| 37.5  | 37.8 ab|
| 3 weeks       | 44.5 a| 33.1 bc| 33.1  | 32.9 b|
| 4 weeks       | 36.6 b| 29.8 c | 33.7  | 32.9 b|
| 5 weeks       | —     | —     | 24.5  | 19.1 c|
| time before vine kill | ZC risk at harvest | ZC risk after storage |
|-----------------------|--------------------|-----------------------|
| 1 week                | low                | low                   |
| 2 weeks               | low                | low to moderate        |
| 3 weeks               | low to moderate    | high                  |
| 4+ weeks              | high               | high                  |
Conclusions

• Vector density less important than timing of infection

• ZC incidence at harvest may underestimate risk after storage

• Plants should be protected until at least 2 weeks before vine kill
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