

## **Influence of Potato Vine Kill Timing and Skin-set duration on Black Dot (*Colletotrichum coccodes*) and Potato Quality- 2 year Summary**

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### **Introduction**

Black dot fungal structures (sclerotia) on harvested tubers are a consistent problem for fresh market potato producers throughout California. Tubers infected with black dot have a rash like appearance that is especially evident on red and yellow skin potatoes making them unmarketable. Black dot infection on below ground stems and stolons occurs within weeks of sprouting. Fungicides are effective at suppressing black dot during the growing season, but fungicides have failed to reduce severity of black dot sclerotia on daughter tubers. Cultural management and harvest timing can influence black dot on daughter tubers. Studies showed that increasing the duration between haulm (stem) senescence and harvest increases severity of black dot; high soil moisture increases black dot, and plant stress can increase severity of black dot. These findings served as a guide for setting up the experiment. The primary study objective was to document the effect of vine kill timing and skin set duration on potato yield, potato quality, and black dot on specialty potatoes under California conditions.

### **Site Information**

- **Soil type-** mucky silty clay loam-6% OM
- **Irrigation** – solid-set sprinklers
- **Potato Spacing-** 36 inch rows with 10 inch seed spacing
- **Design-** Split Block with 4 blocks (reps)

### **Study Methods**

The study was conducted in fields at the Intermountain REC with a long history of natural black dot infection. The study was set up in a split-plot design with four replications. Dark Red Norland, an early maturing red skinned variety was grown in 2021 and Anouk, a medium maturing yellow skin and yellow flesh variety was grown in a different field in 2022. Potatoes were grown under normal conventional management conditions. Vines were killed at three timings: 95% green (77 & 84 days after planting DAP in 2021 and 2022 respectively), 50% green (92 & 98DAP in 2021 and 2022 respectively), and 10% green (106 & 112 DAP in 2021 and 2022 respectively).



**Figure 1. Drone photo of different vine kill timing plots shortly after the 50% vine kill timing.**

Vines were killed using Reglone and rolling (Figure 1). Soil moisture was kept around 60% ASM from vine kill to harvest to minimize bruising. For each vine kill timing, potatoes were harvested 2 weeks after vine kill or 4 weeks after vine kill. Data included tuber yield, tuber size, tuber skinning, tuber bruise, and the incidence and severity of black dot on daughter tubers. Tuber yield and size was determined by running all potatoes from each plot across an automated grade-line. Black dot incidence and severity was determined by evaluating percent coverage of black dot infection on 20 tubers from each plot. Skinning severity was evaluated by tumbling 20 tubers from each plot in a cement mixer without paddles for 1 minute at harvest (figure 2.)



**Figure 2. Cement mixer setup for evaluating tuber skinning.**

### **Results**

Potato yields differed significantly between treatments with the later vine kill timing having the highest yield both years (Tables 1 & 2). The early 95% green vine kill timing had the lowest yield and tuber size both years. The 50% green vine kill timing had lower total yield compared to the 10% vine kill timing in 2021, but average tuber size, tubers per plant, and the % of large tubers were similar between timings (Tables 1 & 2).

Vine kill timing and skin set duration had a significant affect on black dot coverage (Tables 3 & 4). The general trend was for black dot coverage to increase the longer we waited to kill vines and the longer tubers sat in the ground between vine kill and harvest. The 95% green vine kill timing harvested 2 weeks after vine kill had the least amount of black dot both years. A major concern with killing vines early and shortening the time between vine kill and harvest is poor skin set. The 95% green vine kill timing harvested 2 weeks after vine kill had an unacceptable skinning both years (Tables 3 & 4). Tuber skinning was low for the 50% and 10% vine kill timings harvested 4 weeks after vine kill. Tuber shape uniformity and tuber quality were similar across treatments except for the 95% green treatment having slightly less growth cracks in 2021 and slightly better shape uniformity in 2022 compared to the 10% timing (Tables 3-4).

In summary, harvesting both varieties earlier in the season while vines were 95% or 50% green and shorting the skin set duration reduced the severity of black dot tuber blemish. In the case of the yellow potato variety, black dot coverage was reduced below 10% when potato vines were killed at 50% green or earlier. Tuber skinning was unacceptable for the 95% green vine kill timing if the skin set duration was 2 weeks, but skinning was low for most vine kill timings with a 4-week skin set period. Growers will need to weigh maximizing tuber size versus minimizing black dot tuber blemish, but two years of data suggest killing vines at 50% green and waiting 4 weeks to harvest can reduce black dot while maintaining yield and skin set qualities compared to waiting to kill vines at 10% green.

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**Table 1. Potato stand, yield, and size for vine kill and skin set treatments at IREC in 2021.**

| Trt # | Treatment  | Potato Stand %     | Tubers/plant # | Avg tuber size oz | Total yield CWT/A | Tuber size class percentages |          |         |         |       |       | culls |
|-------|--|--------------------|----------------|-------------------|-------------------|------------------------------|----------|---------|---------|-------|-------|-------|
|       |  |                    |                |                   |                   | >14 oz                       | 10-14 oz | 6-10 oz | 4-6 oz  | <4 oz |       |       |
| 1     | 10% green vine kill (106 DAP) & 2 week skin set before harvest | 94% a <sup>1</sup> | 5.84 a         | 7.87 a            | 443 a             | 7% a                         | 15% a    | 36% a   | 19% c   | 19% b | 6% ab |       |
| 2     | 10% green vine kill (106 DAP) & 4 week skin set before harvest | 97% a              | 5.81 a         | 7.63 ab           | 436 a             | 6% a                         | 15% a    | 32% a   | 22% bc  | 19% b | 6% ab |       |
| 3     | 50% green vine kill (92 DAP) & 2 week skin set before harvest  | 98% a              | 5.16 ab        | 7.04 ab           | 363 b             | 3% ab                        | 11% ab   | 35% a   | 24% abc | 21% b | 7% a  |       |
| 4     | 50% green vine kill (92 DAP) & 4 week skin set before harvest  | 92% a              | 5.62 a         | 6.86 b            | 360 b             | 4% ab                        | 9% b     | 33% a   | 24% abc | 23% b | 7% a  |       |
| 5     | 95% green vine kill (77 DAP) & 2 week skin set before harvest  | 96% a              | 4.27 b         | 4.58 c            | 191 c             | 0% b                         | 1% c     | 18% b   | 35% a   | 43% a | 4% b  |       |
| 6     | 95% green vine kill (77 DAP) & 4 week skin set before harvest  | 94% a              | 4.37 b         | 4.31 c            | 181 c             | 0% b                         | 1% c     | 14% b   | 31% ab  | 49% a | 5% ab |       |

<sup>1</sup> Means with the same letter within columns are not statistically different using the Tukey HSD mean comparison test.

**Table 2. Potato stand, yield, and size for vine kill and skin set treatments at IREC in 2022.**

| Trt # | Treatment  | Potato Stand %     | Tubers/plant # | Avg tuber size oz | Total yield CWT/A | Tuber size class percentages |          |         |          |          |           | Undersize | culls |
|-------|--|--------------------|----------------|-------------------|-------------------|------------------------------|----------|---------|----------|----------|-----------|-----------|-------|
|       |  |                    |                |                   |                   | >14 oz                       | 10-14 oz | 6-10 oz | 4-6 oz   | <4 oz    |           |           |       |
| 1     | 10% green vine kill (106 DAP) & 2 week skin set before harvest | 95% a <sup>1</sup> | 15.43 ab       | 2.79 ab           | 444.34 ab         | 0% a                         | 0.2% ab  | 4.8% ab | 13.8% ab | 37.0% a  | 35.0% c   | 2.5% a    |       |
| 2     | 10% green vine kill (106 DAP) & 4 week skin set before harvest | 94% a              | 16.93 ab       | 2.87 a            | 496.78 a          | 0% a                         | 0.3% a   | 6.3% a  | 16.6% a  | 36.7% a  | 41.9% bc  | 3.3% a    |       |
| 3     | 50% green vine kill (92 DAP) & 2 week skin set before harvest  | 96% a              | 17.05 a        | 2.45 bc           | 435.12 ab         | 0% a                         | 0.0% b   | 2.8% bc | 11.0% bc | 36.1% a  | 49.5% ab  | 3.5% a    |       |
| 4     | 50% green vine kill (92 DAP) & 4 week skin set before harvest  | 95% a              | 15.73 ab       | 2.36 c            | 383.80 bc         | 0% a                         | 0.1% ab  | 1.7% cd | 8.7% c   | 32.6% ab | 45.9% abc | 2.0% a    |       |
| 5     | 95% green vine kill (77 DAP) & 2 week skin set before harvest  | 97% a              | 14.92 ab       | 2.09 cd           | 325.72 cd         | 0% a                         | 0.0% b   | 0.5% d  | 4.5% d   | 27.6% bc | 57.0% a   | 1.9% a    |       |
| 6     | 95% green vine kill (77 DAP) & 4 week skin set before harvest  | 91% a              | 14.58 b        | 1.90 d            | 273.30 d          | 0% a                         | 0.0% b   | 0.3% d  | 3.8% d   | 25.0% c  | 52.8% ab  | 1.9% a    |       |

<sup>1</sup> Means with the same letter within columns are not statistically different using the Tukey HSD mean comparison test.

**Table 3. Black dot Coverage and Potato Quality for vine kill and skin set treatments at IREC in 2021.**

| Trt # | Treatment  | Tuber black dot coverage % | Tuber skinning rating | Tuber skin appearance rating | Tuber shape uniformity | Knobs   | Growth cracks | Green  | Black spot bruise | Vascular discoloration | Hollow Heart |
|-------|--|----------------------------|-----------------------|------------------------------|------------------------|---------|---------------|--------|-------------------|------------------------|--------------|
|       |  |                            |                       |                              |                        |         |               |        |                   |                        |              |
| 1     | 10% green vine kill (106 DAP) & 2 week skin set before harvest | 28% ab                     | 4.21 a                | 3.42 b                       | 3.3 a                  | 2.7% ab | 8.2% abc      | 0.5% a | 0.0% a            | 0.3% a                 | 0.2% a       |
| 2     | 10% green vine kill (106 DAP) & 4 week skin set before harvest | 30% a                      | 4.25 a                | 3.42 b                       | 3.3 a                  | 2.2% ab | 9.3% a        | 0.7% a | 0.2% a            | 0.5% a                 | 0.2% a       |
| 3     | 50% green vine kill (92 DAP) & 2 week skin set before harvest  | 20% bc                     | 3.58 bc               | 3.67 ab                      | 3.5 a                  | 6.2% a  | 5.8% abc      | 0.3% a | 0.0% a            | 1.0% a                 | 0.0% a       |
| 4     | 50% green vine kill (92 DAP) & 4 week skin set before harvest  | 28% a                      | 4.00 ab               | 3.58 ab                      | 3.5 a                  | 3.3% ab | 8.8% ab       | 0.2% a | 0.2% a            | 0.7% a                 | 0.0% a       |
| 5     | 95% green vine kill (77 DAP) & 2 week skin set before harvest  | 14% c                      | 3.17 c                | 3.83 a                       | 3.8 a                  | 1.5% b  | 4.0% bc       | 0.0% a | 0.0% a            | 0.8% a                 | 0.2% a       |
| 6     | 95% green vine kill (77 DAP) & 4 week skin set before harvest  | 20% bc                     | 4.00 ab               | 3.92 a                       | 3.8 a                  | 3.8% ab | 3.0% c        | 0.0% a | 0.0% a            | 0.7% a                 | 0.2% a       |

<sup>1</sup> Means with the same letter within columns are not statistically different using the Tukey HSD mean comparison test.

**Table 4. Black dot Coverage and Potato Quality for vine kill and skin set treatments at IREC in 2022.**

| Trt # | Treatment  | Tuber black dot coverage | Tuber skinning rating | Tuber skin appearance rating | Tuber shape uniformity | Knobs  | Growth cracks | Green   | Black spot bruise | Vascular discoloration | Hollow Heart |
|-------|--|--------------------------|-----------------------|------------------------------|------------------------|--------|---------------|---------|-------------------|------------------------|--------------|
|       |  | %                        | 1-5 rating; 5 = best  |                              |                        |        |               |         |                   |                        |              |
| 1     | 10% green vine kill (106 DAP) & 2 week skin set before harvest | 13.68 b                  | 4.9 a                 | 4.1 a                        | 3.5 bc                 | 1.8% a | 0.0% a        | 0.9% ab | 0.0% a            | 2.5% a                 | 0.0% a       |
| 2     | 10% green vine kill (106 DAP) & 4 week skin set before harvest | 20.78 a                  | 5.0 a                 | 4.1 a                        | 3.3 c                  | 2.1% a | 0.1% a        | 1.1% ab | 0.0% a            | 2.5% a                 | 0.8% a       |
| 3     | 50% green vine kill (92 DAP) & 2 week skin set before harvest  | 6.73 c                   | 2.8 c                 | 4.3 a                        | 4.3 a                  | 1.9% a | 0.0% a        | 1.1% a  | 0.8% a            | 5.0% a                 | 0.0% a       |
| 4     | 50% green vine kill (92 DAP) & 4 week skin set before harvest  | 9.35 bc                  | 4.9 a                 | 4.3 a                        | 3.8 b                  | 1.4% a | 0.0% a        | 0.7% ab | 0.0% a            | 2.5% a                 | 0.0% a       |
| 5     | 95% green vine kill (77 DAP) & 2 week skin set before harvest  | 0.35 d                   | 2.8 c                 | 4.1 a                        | 4.5 a                  | 1.9% a | 0.0% a        | 0.2% b  | 0.8% a            | 3.3% a                 | 0.0% a       |
| 6     | 95% green vine kill (77 DAP) & 4 week skin set before harvest  | 6.68 cd                  | 4.3 b                 | 4.3 a                        | 4.4 a                  | 1.5% a | 0.0% a        | 0.9% ab | 0.0% a            | 4.2% a                 | 0.0% a       |

<sup>1</sup> Means with the same letter within columns are not statistically different using the Tukey HSD mean comparison test.



**Figure. Post-harvest skinning severity. From left to right: 95% green vinekill 2 wk; 95% green vinekill 4 wk; & 50% green vinekill 4 wk**