

Assessment of variety resistance to four postharvest diseases of potato in Michigan, 2025

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Cultivars with postharvest disease resistance can provide economical and effective management. However, robust phenotyping of variety responses is needed. In this study, chipping potato commercial lines and germplasm were assessed for resistance to four major postharvest diseases: *Fusarium* dry rot, bacterial soft rot, pink rot, and *Pythium* leak.

Materials and Methods

1) Postharvest disease variety screening. During 2024-25, harvested and stored tubers from nine chipping lines comprising commercial varieties and research germplasm were obtained from the MSU Potato Outreach Program box bin trial conducted at the MSU Montcalm Research Center (Montcalm County). All materials were tested at three replicate timepoints (5 tubers/timepoint/disease).

Asymptomatic tubers were rinsed with tap water and air-dried overnight at ambient conditions. For all pathogens, 10 µl of inoculum was injected to a 1 cm depth at the apical and basal ends of each tuber using a Hamilton® syringe (710 series, 100-µl volume). Tubers were inoculated with suspensions of the following: 2×10^4 *Fusarium sambucinum* conidia/ml in water; 2×10^4 *Phytophthora erythroseptica* zoospores/ml in 10% soil extract; 5×10^4 *Pythium ultimum* sporangia/ml in potato dextrose broth; or 8×10^8 *Pectobacterium carotovorum* cfu/ml in LB broth. One additional *Fusarium* species, *F. graminearum* identified during surveys of Michigan storage piles, was also used in dry rot screening. Tests for dry rot and pink rot were incubated in paper bags under ambient conditions for 28 or 6 days, respectively. *Pythium* leak and soft rot tests were incubated in plastic bags with moist paper towels at room temperature for 6 days. After incubation, tubers were sliced longitudinally through inoculation sites and internal symptom width and depth were measured using digital calipers. Data was analyzed using an analysis of variance (ANOVA) conducted with the generalized linear mixed model (GLIMMIX) procedure in SAS v. 9.4, and means were compared using Fisher's protected LSD ($\alpha=0.05$).

2) Residual effects of dimethylnaphthalene. We assessed the residual effects of a 20 ppm dimethylnaphthalene (DMN) (1,4Sight®) post-bin loading treatment on dry rot, pink rot, *Pythium* leak, and soft rot development in Mackinaw tubers. Mackinaw tubers were harvested from a MSU Potato Outreach Program field location (Main Farms) on 20 Sep 2024, stored in MPIC storage facilities, and treated with and without 0.03 fl oz/cwt (20 ppm) of 1,4-dimethylnaphthalene (DMN) (1,4Sight®) on 24 Sep 2024. Treated and non-treated tuber samples were collected from both top and bottom these bins and inoculated for disease testing in three minimum replicate timepoints. Tubers were inoculated with each disease and assessed as described above.

3) Pathogenicity of *Plectosphaerella* in tubers. We investigated the potential pathogenicity of a *Fusarium*-like fungal organism commonly observed from tubers with dry rot symptoms in 2024 samples. This organism was morphologically and molecularly characterized as *Plectosphaerella*

cucumerina, which has been previously found to cause stunting, root, and crown rot in pepper and tomato (Raimondo and Carlucci 2018). Eight *Plectosphaerella* isolates (LJ8 to 1B5B-1) as well as isolates of *Fusarium* sp. (Fus25), *F. oxysporum* (Oxy25), and *F. graminearum* (Gra25) from dry rot symptomatic tubers in 2025 were selected and tested for pathogenicity and virulence on Lamoka tuber slices. These were compared with known virulent *Fusarium sambucinum* (Samb) and *F. graminearum* (Gra) isolates and a potato dextrose (PDA) negative control.

Overall Summary

1) Postharvest disease variety screening. Postharvest resistance to four diseases was screened in chipping (Figure 1 and 3) potato entries using Michigan pathogen isolates. No clear relationship was observed between resistance responses to different diseases; however, as observed in 2025, Bliss and NY177 possessed at least moderate resistance to three or four diseases.

From 2025 testing, Bliss exhibited greater resistance to pink rot, Pythium leak and dry rot, Snowden also had greater resistance to dry rot and soft rot, but tended to be more susceptible to pink rot and Pythium leak, and Mackinaw exhibited susceptibility to soft rot, dry rot, and Pythium leak this year. MSBB058-1 exhibited moderate resistance to dry rot and pink rot.

While dry rot responses to *F. graminearum* and *F. sambucinum* generally followed similar trends, several varieties may have seemed more or less resistant depending on the species used, such as Bliss and MSDD247-07 (Figure 2). For example, using only the *F. sambucinum* standard isolate, Bliss dry rot susceptibility caused by *F. graminearum* may have been missed.

2) Residual effects of dimethylnaphthalene. We also assessed the effects of a 20 ppm DMN treatment on dry rot, pink rot, Pythium leak, and soft rot using Mackinaw, however there were not significant differences for most diseases (Figure 4). A slight reduction in Pythium leak symptoms was observed in treated bottom of the bin tubers ($P < 0.01$).

3) Pathogenicity of *Plectosphaerella* in tubers. From this preliminary assay, all *Plectosphaerella* isolates were comparable to the mock-inoculated media control and considered likely not pathogenic (Figure 5). While *Fusarium* isolates Oxy25 and Gra25 were also not significantly different from the PDA media control, minimal symptoms were formed on tuber slices though 80% less than than the virulent *F. sambucinum* and *F. graminearum* positive controls (Figure 5A). The whole tuber assay showed similar results as the slice assay, but *Plectosphaerella* isolates did cause significant though very minor infection (Figure 5B); repetitions of this assay will be conducted in the future. From these preliminary assays with Lamoka tubers, *Plectosphaerella* isolates were considered to exhibit low virulence.

Acknowledgements

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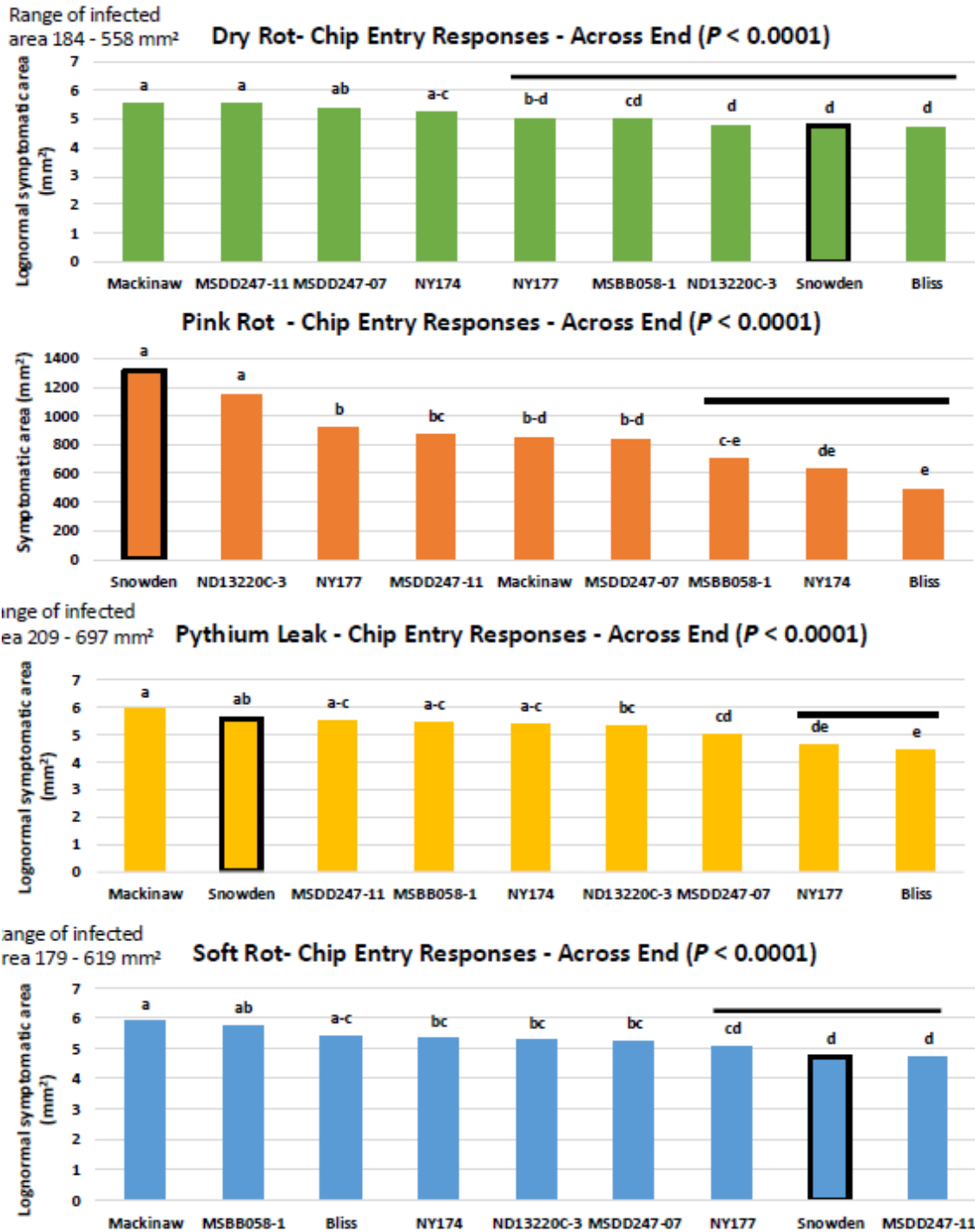


Figure 1. Responses of nine chipping potato lines to dry rot, pink rot, Pythium leak, and soft rot. Bars with the same letter not significantly different based on Fisher's protected LSD ($\alpha=0.05$). Means are across apical and basal end responses ($P < 0.0001$) for dry rot, pink rot, soft rot, and Pythium leak ($P < 0.001$) in tubers from MSU Potato Outreach Program field locations (Montcalm Research Center) tested in three minimum replicate timepoints.

Dry Rot - Chip Entry Responses - Across End ($P < 0.0001$)

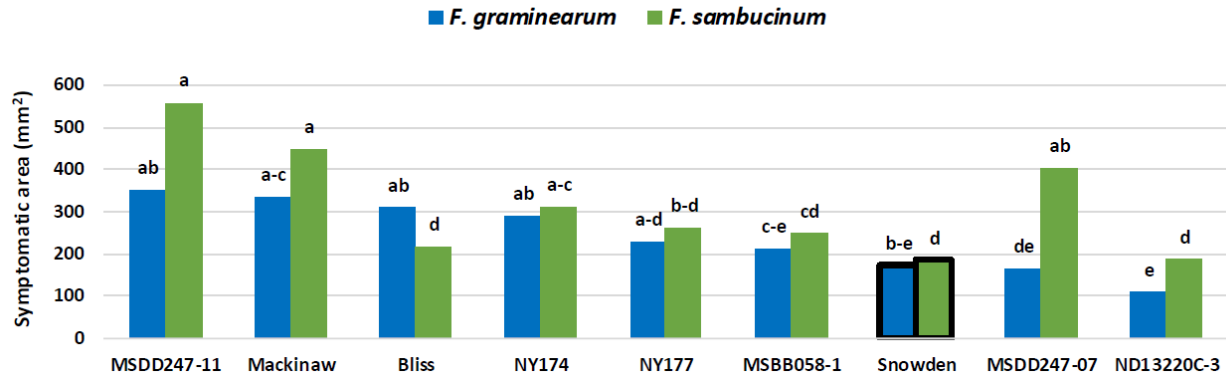


Figure 2. Responses of nine chipping potato lines to dry rot caused by two species of *Fusarium* prevalent in Michigan potato samples. *F. graminearum* (blue), *F. sambucinum* (green). Bars with the same letter not significantly different based on Fisher's protected LSD ($\alpha=0.05$). Significant variable responses were observed across apical and basal ends ($P < 0.0001$).

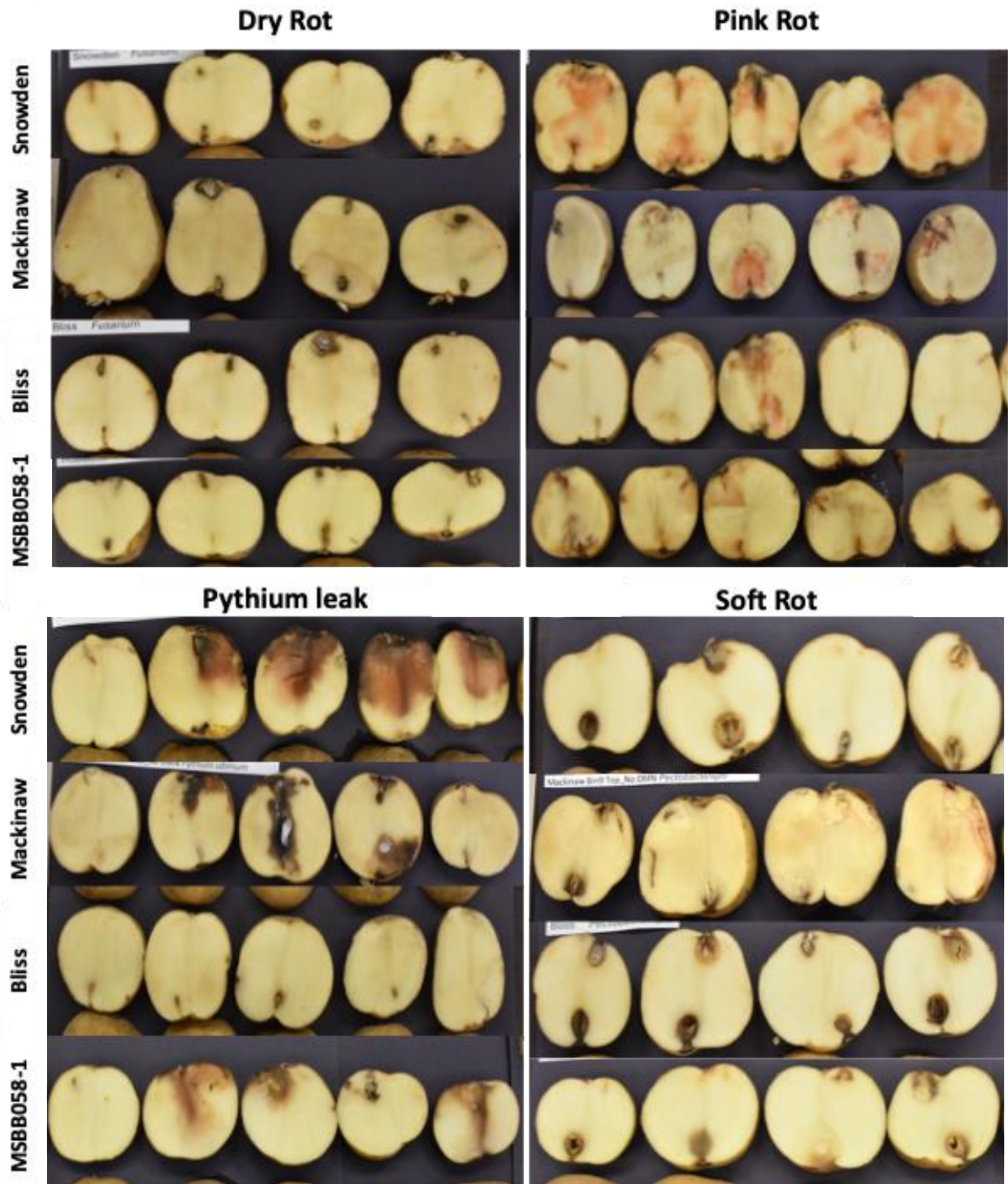


Figure 3. Examples of typical symptoms for each of the four tested postharvest diseases. Bliss had greater resistance to pink rot, Pythium leak and dry rot, Snowden also had greater resistance to dry rot and soft rot, but tended to be more susceptible to pink rot and Pythium leak, and Mackinaw exhibited susceptibility to soft rot, dry rot, and Pythium leak this year. MSBB058-1 exhibited moderate resistance to dry rot and pink rot.

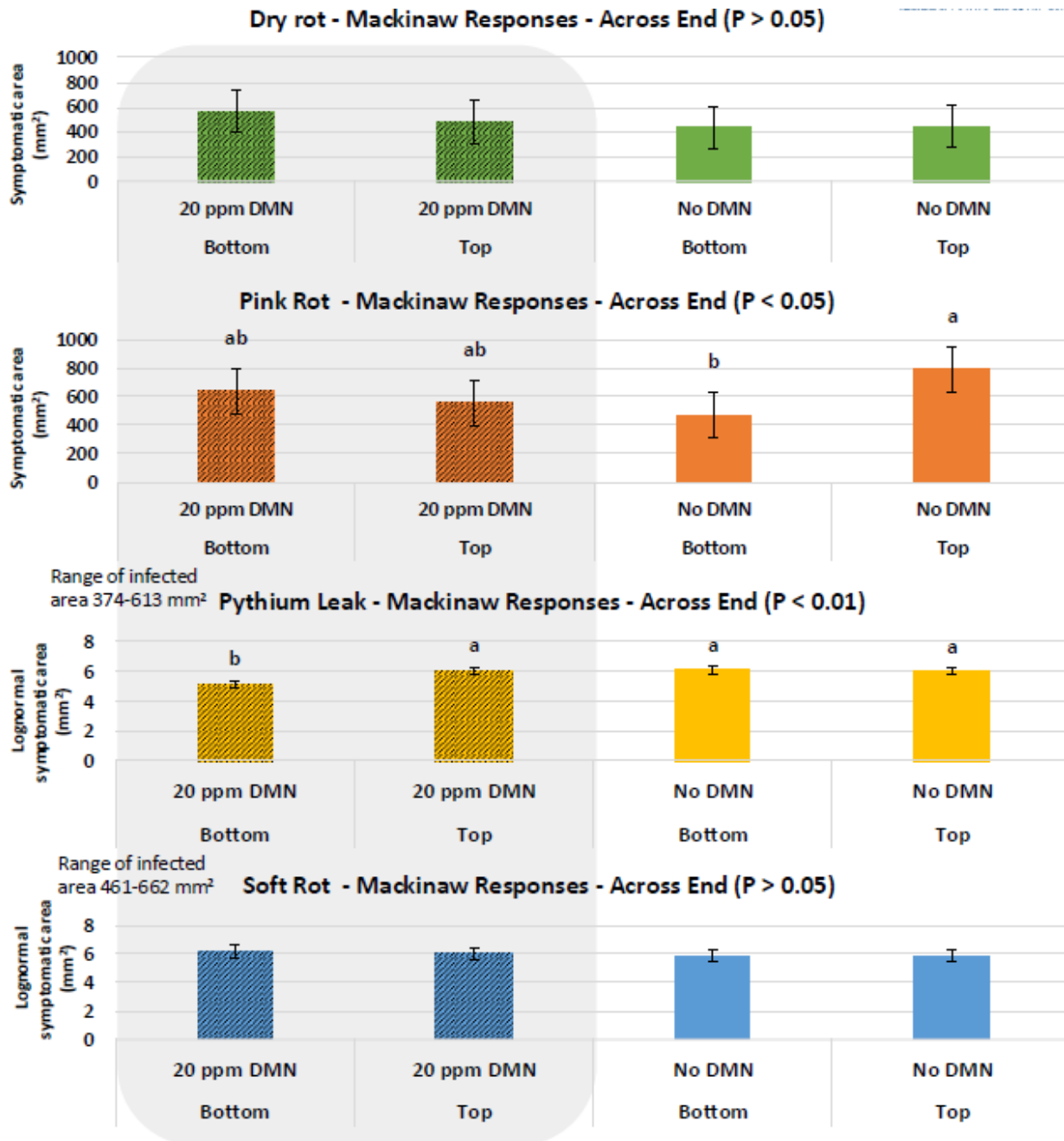


Figure 4. Effect of 20ppm DMN treatment to dry rot, pink rot, Pythium leak, and soft rot. Mackinaw were harvested from a MSU Potato Outreach Program field location (Main Farms) on 20 Sep 2024, stored in MPIC storage facilities, and treated with and without 0.03 fl oz/cwt (20 ppm) of 1,4-dimethylnaphthalene (DMN) (1,4Sight®) on 24 Sep 2024. Treated and non-treated tuber samples were collected from both top and bottom these bins and inoculated for disease testing in three minimum replicate timepoints. Bars with the same letter not significantly different based on Fisher's protected LSD ($\alpha=0.05$). There were no consistent significant differences between treatment for any disease, except a slight reduction in Pythium leak symptoms observed in treated bottom of the bin tubers ($P < 0.01$).

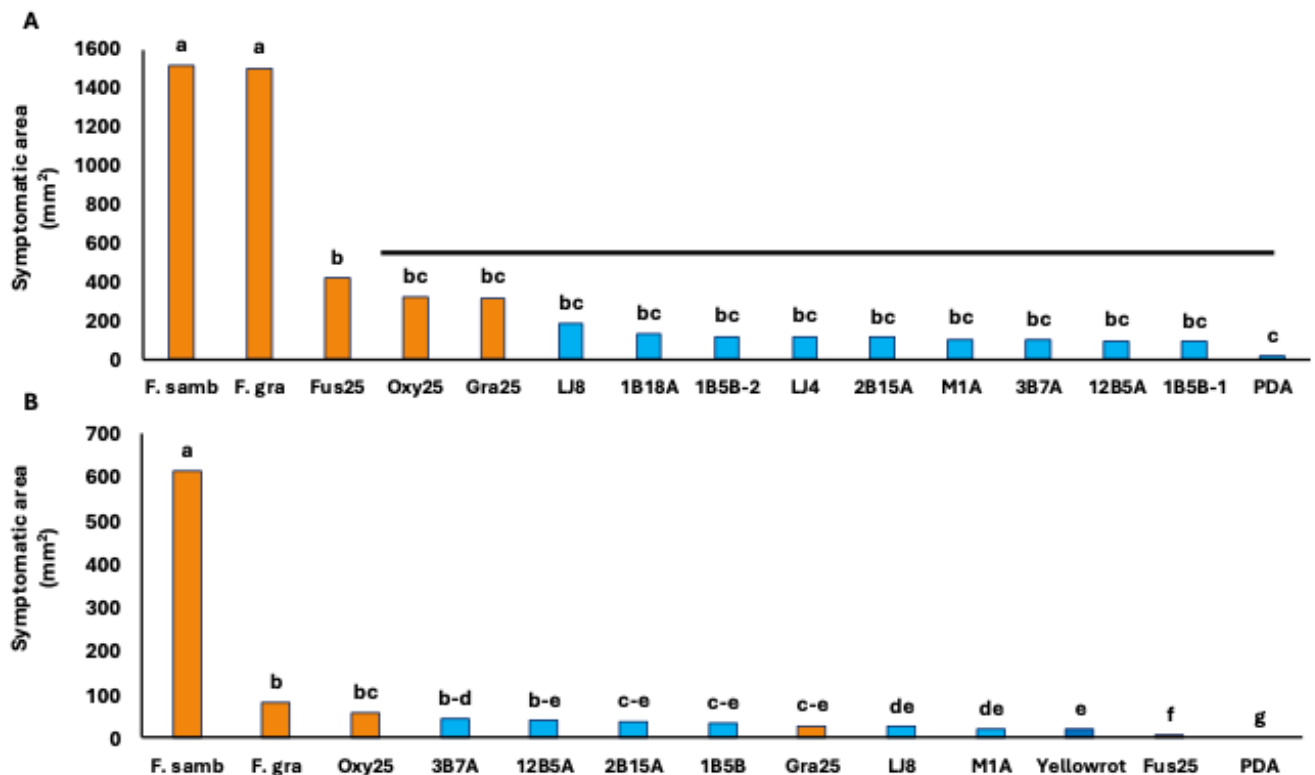


Figure 5. *Fusarium* (blue bars) and *Plectosphaerella* (orange bars) isolate virulence and pathogenicity assay conducted on A) tuber slices measured at four days post-inoculation (DPI4) ($P < 0.0001$) and B) in whole tubers measured at 28 days post-inoculation (DPI28) ($P < 0.0001$). *Plectosphaerella* sp. isolates were observed frequently in submitted dry rot samples in 2024. Eight *Plectosphaerella* isolates (LJ8 to 1B5B-1) as well as isolates of *Fusarium* sp. (Fus25), *F. oxysporum* (Oxy25), and *F. graminearum* (Gra25) from dry rot symptomatic tubers in 2025 were selected and tested for pathogenicity and virulence on Lamoka tuber slices and whole tubers. These were compared with known virulent *Fusarium sambucinum* (F. samb) and *F. graminearum* (F. gra) isolates and a potato dextrose (PDA) negative control. From these preliminary assays with Lamoka tubers, *Plectosphaerella* isolates were considered to exhibit low virulence.