

Irrigation Affects Severity of Root Rot Caused By *Phytophthora plurivora* and *P. cinnamomi* on Rhododendron



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SUMMARY

Pathogens in the genus *Phytophthora* cause root rot and plant death, and result in direct economic losses to the nursery industry. Recently, we found *Phytophthora plurivora* prevalent on rhododendron in nurseries in the Pacific Northwest, USA, but there is little information available comparing its pathogenicity in different environments to *P. cinnamomi*, a more well-studied rhododendron pathogen. Substrate moisture in container production can influence plant vigor as well as pathogen inoculum build-up and infection. We evaluated how irrigation frequency and volume affected the ability of *P. plurivora* and *P. cinnamomi* to cause disease on *Rhododendron catawbiense* cultivars. Our results indicate that:

- (1) At high population levels, *P. plurivora* causes similar losses in rhododendron as *P. cinnamomi*, and low population levels of *Phytophthora* decrease plant health;
- (2) Plants grown in pathogen-free media adapt to a broader range of irrigation regimes than plants grown in *Phytophthora*-infested media; and
- (3) Irrigation management alters the incidence and severity of *Phytophthora* root rot on rhododendron.

Results are being used to help develop integrated disease management practices used to reduce crop loss from root rot and improve nursery plant health.

METHODS

In two trials, plants of *Rhododendron catawbiense* 'Boursault' (2015) and 'Roseum Elegans' (2016) were grown for 26 weeks in non-infested (controls) or infested peat-based media with 1 propagule per gram (ppg) or 100 ppg of *P. plurivora* (*P. plu.*) or *P. cinnamomi* (*P. cin.*). A single isolate of each pathogen was used to produce inoculum on vermiculite amended with V8-juice. All containers were flooded for 48 h, 2 weeks after planting (WAP). Plants were drip irrigated daily during the growing season to maintain substrate moisture (SM) at >75% container capacity (CC) (1.0X), irrigated daily with one-half volume of the 1.0X treatment (0.5X), or irrigated only after SM was <50% CC (BB) (FIG. 1A).

Plant health [leaf color, stomatal conductance (g_s)], disease symptoms (wilting, death), substrate variables [moisture, temperature (T_{sub}), and electrical conductivity (EC)], air temperature (T_{air}), relative humidity, and PAR were collected; and plant quality (root rot, biomass, nutrient uptake) determined at 26 WAP.

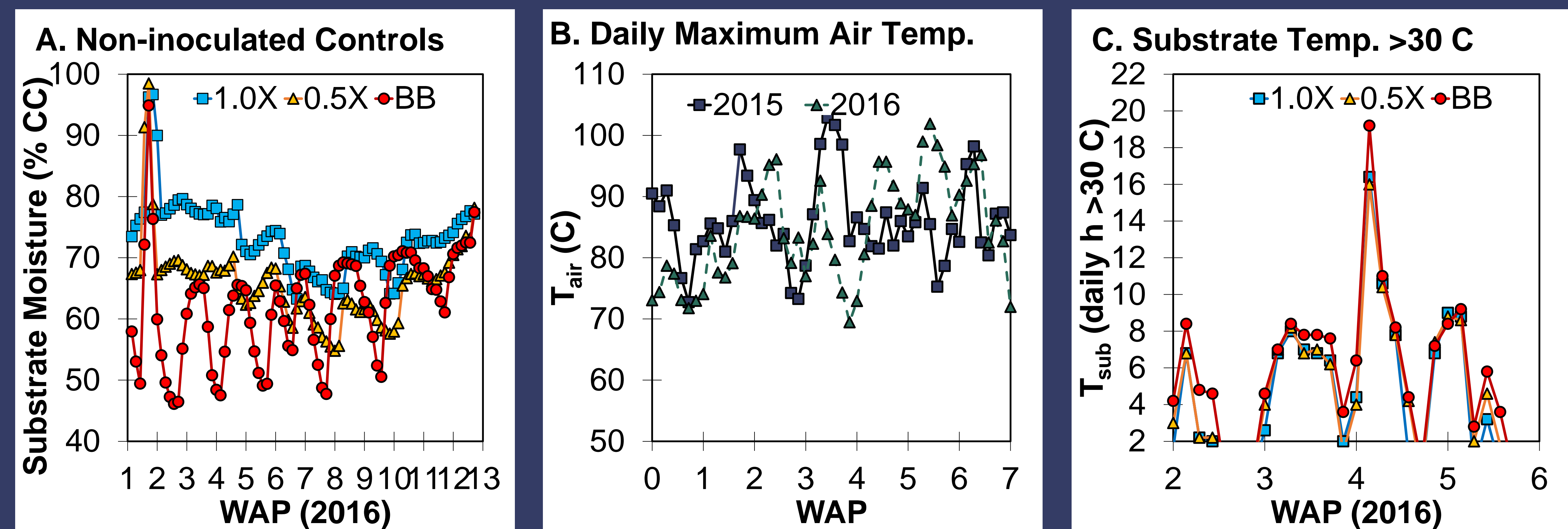


FIG. 1. Substrate moisture, maximum daily air temperature, and substrate temperature >30 C.

RESULTS

P. cinnamomi and *P. plurivora* cause similar losses.

- Disease symptoms (chlorosis, wilting) occurred ~2 weeks earlier on plants inoculated with *P. cin.* than with *P. plu.*; however both pathogens caused similar mortality at 100 ppg (50-80%) (FIG. 2).
- Disease progression was slower in 'Roseum Elegans' (2016) than in 'Boursault' (2015) at 100 ppg, but mortality was similar 9 WAP (FIG. 2A).

Environmental influence on both pathogen and host influence disease.

- In 2015, mortality differences between irrigation regimes occurred 2-3 WAP (FIG. 2B) when lower SM in 0.5X and BB coincided with high T_{air} immediately after inoculation (FIG. 1B). High temperatures with low SM may decrease pathogen growth, resulting in less disease.
- In 2016, mortality differences between irrigation regimes occurred ~5 WAP (FIG. 2C) in conjunction with high T_{sub} (FIG. 1C) and SM >60% CC in 0.5X and BB. High T_{sub} may increase plant stress and susceptibility, and high SM increases zoospore production, resulting in more disease.

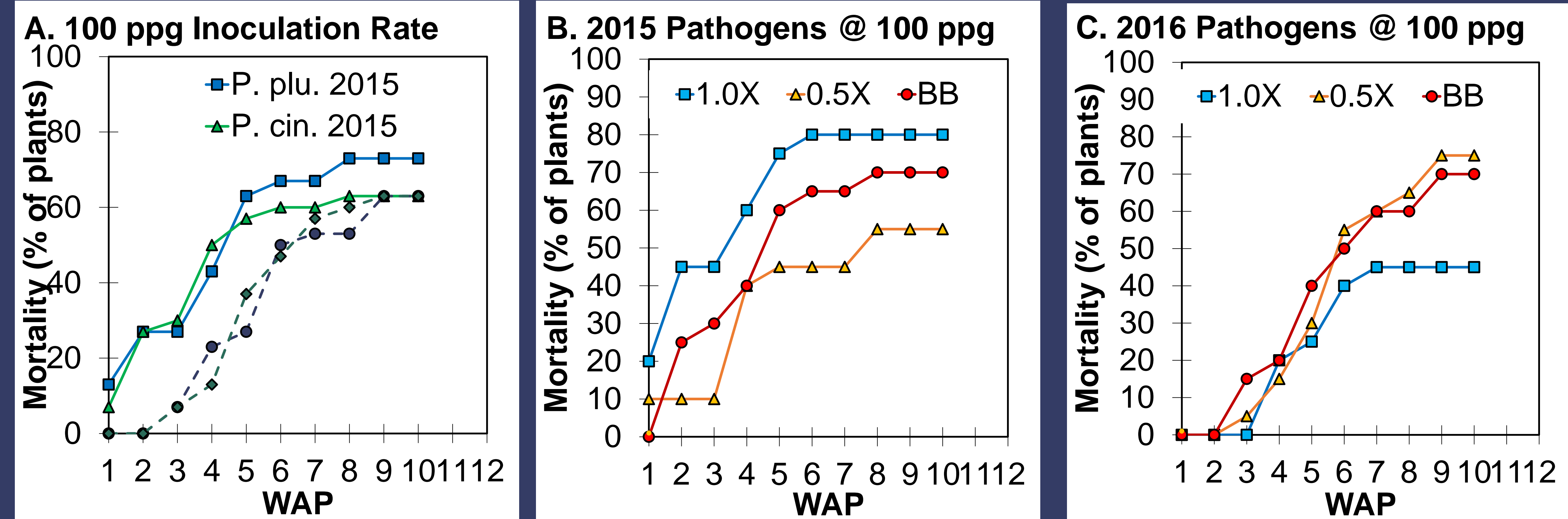


FIG. 2. Influence of irrigation treatments and pathogen inoculation at 100 ppg on plant mortality.

Low pathogen populations decreases health.

- No controls died during either trial. Plant mortality at 1 ppg was <10%, but compared to controls, plants inoculated at 1 ppg exhibited lower g_s , nutrient uptake (FIG. 3. A-C), and plant biomass, and more chlorosis and root rot (data not shown).

Irrigation regimes altered plant response to pathogens.

- At 1 ppg, irrigation regime had little influence on water stress in *P. cin.* plants while decreasing SM (0.5X and BB regimes) increased water stress in *P. plu.* plants (FIG. 3B).
- Irrigation regimes had no influence on controls except for nutrient uptake. In both controls and in inoculated plants, nutrient uptake was greatest in the 0.5X regime and lowest in the 1.0X regime (FIG. 3C).
- Greater nutrient uptake in the 0.5X treatment may be a result of greater nutrient availability (less nutrient leaching, data not shown), and, for plants inoculated at 1 ppg, healthier roots (less root rot, data not shown).

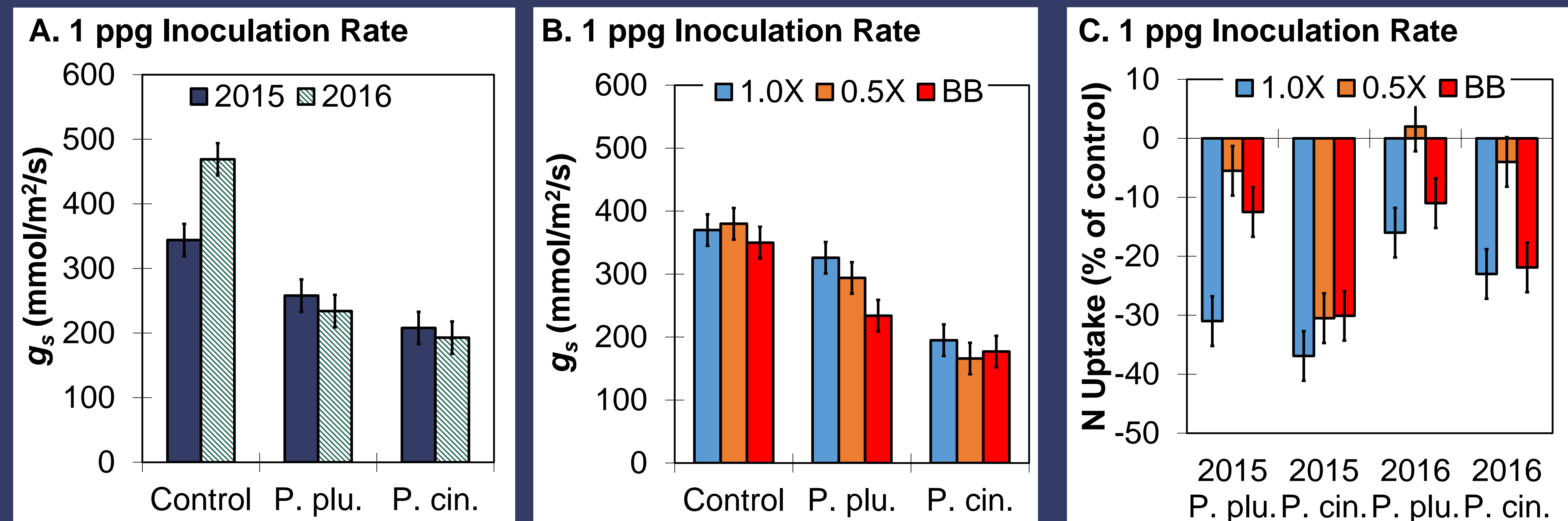


FIG. 3. Influence of irrigation treatments and pathogen inoculation at 1 ppg on plant health.