**CALIFORNIA LEAFY GREENS RESEARCH PROGRAM**

Report, April 1, 2023 to March 31, 2024

**Project Title:** Comprehensive assessment of INSV and soilborne pathogen outbreaks of lettuce in Salinas Valley

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## Abstract

The California lettuce industry is threatened by *Impatiens Necrotic Spot Virus* (INSV) and soilborne pathogens causing diseases such as Pythium wilt, Fusarium wilt, Verticillium wilt, Sclerotinia lettuce drop, Botrytis crown rot, and black root rot. To understand the association between INSV and diseases caused by soilborne pathogens, a survey was conducted in the Salinas Valley. INSV co-occurred with different soilborne pathogens in all INSV-positive fields (a total of 12). Notably, INSV and Pythium wilt occurred together most often. In the total of 51 symptomatic fields, Fusarium wilt and Verticillium wilt were the most prevalent plant diseases, being detected in 27% and 25% of fields, respectively. In addition to the survey, we provided disease diagnostic reports to the collaborative growers and PCAs to assist with management decisions.

## Objectives

Objective 1. Monitor the occurrence of six major diseases caused by soilborne pathogens and their association with INSV in Salinas Valley.

Objective 2. Monitor the occurrence of six major diseases caused by soilborne pathogens and their interaction with INSV in Salinas Valley.

Objective 3. Assist the industry with rapid detection and response to INSV.

## Procedures

**Objective 1. Monitor the occurrence of six major diseases caused by soilborne pathogens and their association with INSV in Salinas Valley.** About 50 commercial lettuce fields were selected based on reports of plant loss from growers, shippers, PCAs, and the CA Leafy Green Research Board. We collected the GPS coordinates, crop and disease history, lettuce variety (if available), wet date, symptoms, estimated disease incidence, irrigation practices, production type (organic or conventional), and soil type. Lab diagnostics for INSV and soilborne

pathogens were conducted using Agdia immunostrips and traditional plating techniques on semi-selective media, respectively, to detect the presence of pathogens. If INSV was not detected in a symptomatic sample, tomato spotted wilt virus (TSWV) was tested using Agdia immunostrips. For traditional plating, plant tissues were surface disinfected and triple-washed in sterilized deionized water. Symptomatic tap root tissues (~0.5 $cm^2$ in size) and secondary or tertiary root tissues (~2cm in length) were removed from each plant and plated on the semi-selective media. The media included Sorensen's NP-10 (Sorensen et al. 1991), modified Komada's media (Scott et al. 2010), PARP- CMA (pimaricin + ampicillin + rifampicin + pentachloronitrobenzene [PCNB] agar (Erwin and Ribeiro, 1996), acidified corn meal agar (ACMA) and acidified potato dextrose agar (APDA). Samples with black root rot symptoms were collected, mounted in water on a microscope slide, and observed under a compound microscope. Pathogens were identified by morphology.

**Objective 2. Monitor the occurrence of six major diseases caused by soilborne pathogens and their interaction with INSV in Salinas Valley.** A follow-up field visit and sampling were proposed. However, due to time constraints and field crop rotations, we did not make progress on objective 2 of revisiting INSV fields. Nevertheless, some follow-up contact was made with growers and PCAs to monitor INSV distribution.

**Objective 3. Assist the industry with rapid detection and response to INSV.** Once the diagnostic assay was optimized, we provided an INSV and plant disease testing service to the industry. Symptomatic tissues were collected by growers and PCAs and submitted to UCCE Monterey office. Confidentiality of the results was maintained and a complimentary diagnostic report was provided to the submitter.

## Results and Discussion

**Objective 1. Monitor the occurrence of six major diseases caused by soilborne pathogens and their association with INSV in Salinas Valley.** From April 2023 to March 2024, we received 51 reports and diagnostic requests from growers and PCAs on disease outbreaks. Fusarium wilt was the most prevalent pathogen detected, present in 27% of the symptomatic fields (Fig. 1). Other pathogens followed at slightly lower prevalence, with Verticillium wilt and INSV present in 25% and 24% of the symptomatic fields, respectively (Fig. 1). One field was positive for lettuce dieback, which was confirmed by Bill Wintermantel (USDA-ARS) and TriCal Diagnostics. The number of Sclerotinia lettuce drop fields may be underestimated due to the lower need for disease diagnosis in a laboratory setting.

Among the 51 reports, 25% of the symptomatic fields were identified as uncommon lettuce diseases, or abiotic factors including frost damage, ammonium toxicity, and so on. Suspected Phytophthora stem rot was identified in one field. The *Phytophthora* sp. isolate was sent to CDFA for species identification and further analysis. Furthermore, there were 16 total instances of pathogen co-occurrence (Fig. 1). INSV co-occurred with Pythium wilt, Verticillium wilt, Fusarium wilt, Sclerotinia lettuce drop, and corky root. Notably, INSV and Pythium wilt

occurred together most often. Co-occurrence of Fusarium wilt and black root rot were observed in 4 fields.

INSV, Verticillium wilt, and Fusarium wilt were distributed within the entire Salinas Valley region (Fig. 2) and their seasonal occurrence was observed (Fig 3). 67% of INSV reports were located in the Gonzales area and the disease was observed from July to November. 46% of Verticillium wilt reports were located in Blanco, Castroville area and the disease was observed from May to October. Verticillium wilt was problematic in the Watsonville area where the disease was first discovered in 1995 (Subbarao, 2011), but we did not receive any reports from that area. 50% of Fusarium wilt reports were located in the southern part of the region (Greenfield and King City) and another 36% of Fusarium wilt reports were located in the northern part of the region (Salinas and Spreckels). It was consistent with a recent report that Fusarium wilt was expanding in the northern Central Coast (Putman, 2022), although Fusarium wilt on lettuce has historically been most problematic in warmer areas including King City and south in coastal California (Gordon, 2016).

**Objective 2. Monitor the occurrence of six major diseases caused by soilborne pathogens and their interaction with INSV in Salinas Valley.** A follow-up field visit and sampling were proposed. However, due to time constraints and field crop rotations, we did not make progress on objective 2 of revisiting INSV fields. Nevertheless, some follow-up contact was made with growers and PCAs to monitor INSV distribution.

**Objective 3. Assist the industry with rapid detection and response to INSV.** We handled and identified not only INSV, but also diseases caused by soilborne pathogens and various other foliar diseases, including anthracnose, downy mildew, bacterial leaf spot, and so on. Diagnostic findings were communicated with growers and PCAs who submitted the samples. Occasional plants showing other virus symptoms (eg. lettuce dieback) were forwarded to Bill Wintermantel and TriCal Diagnostics for testing.

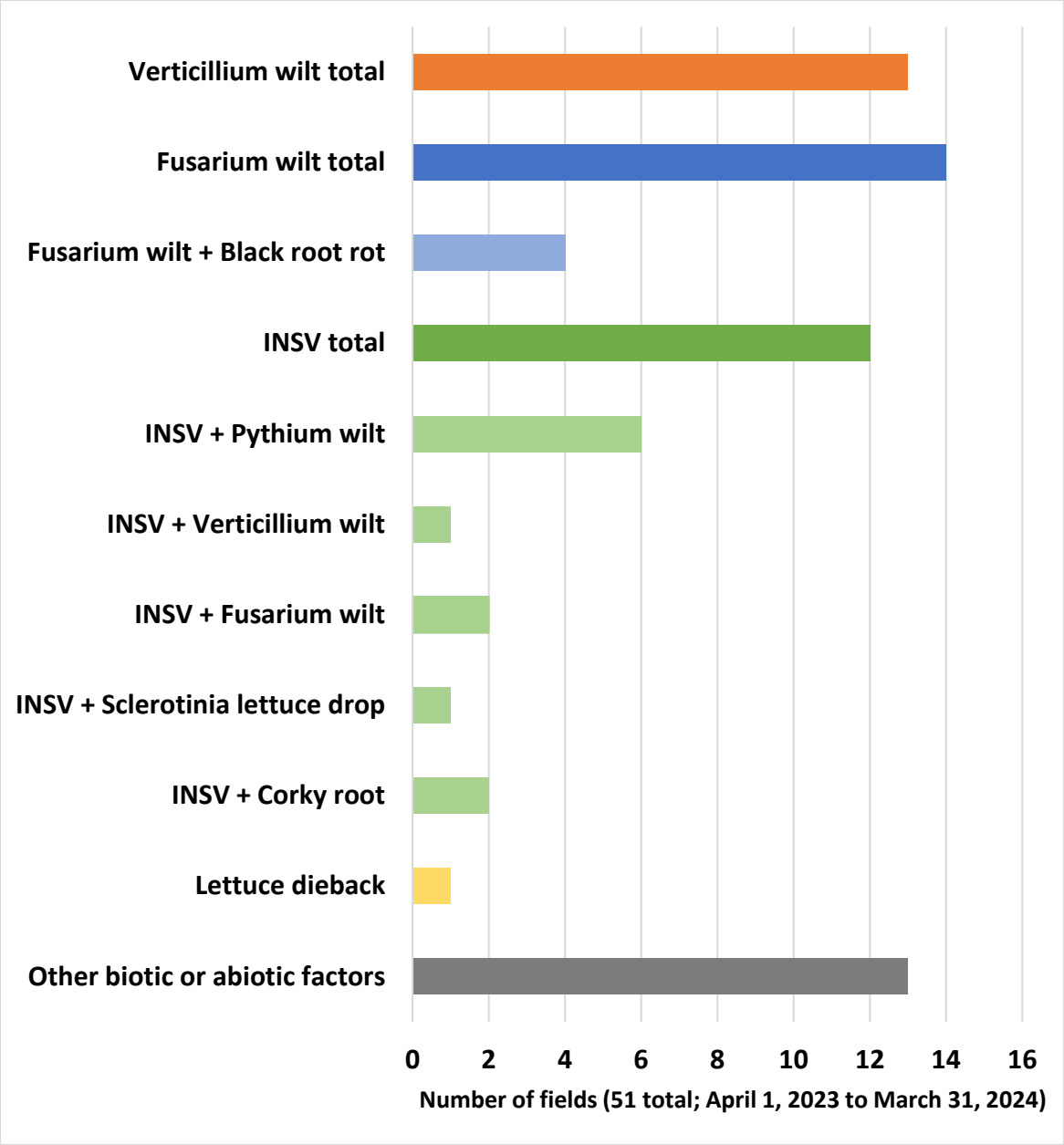


Fig. 1. Summary of disease identification during the survey period. (+ denotes disease co-occurrence)

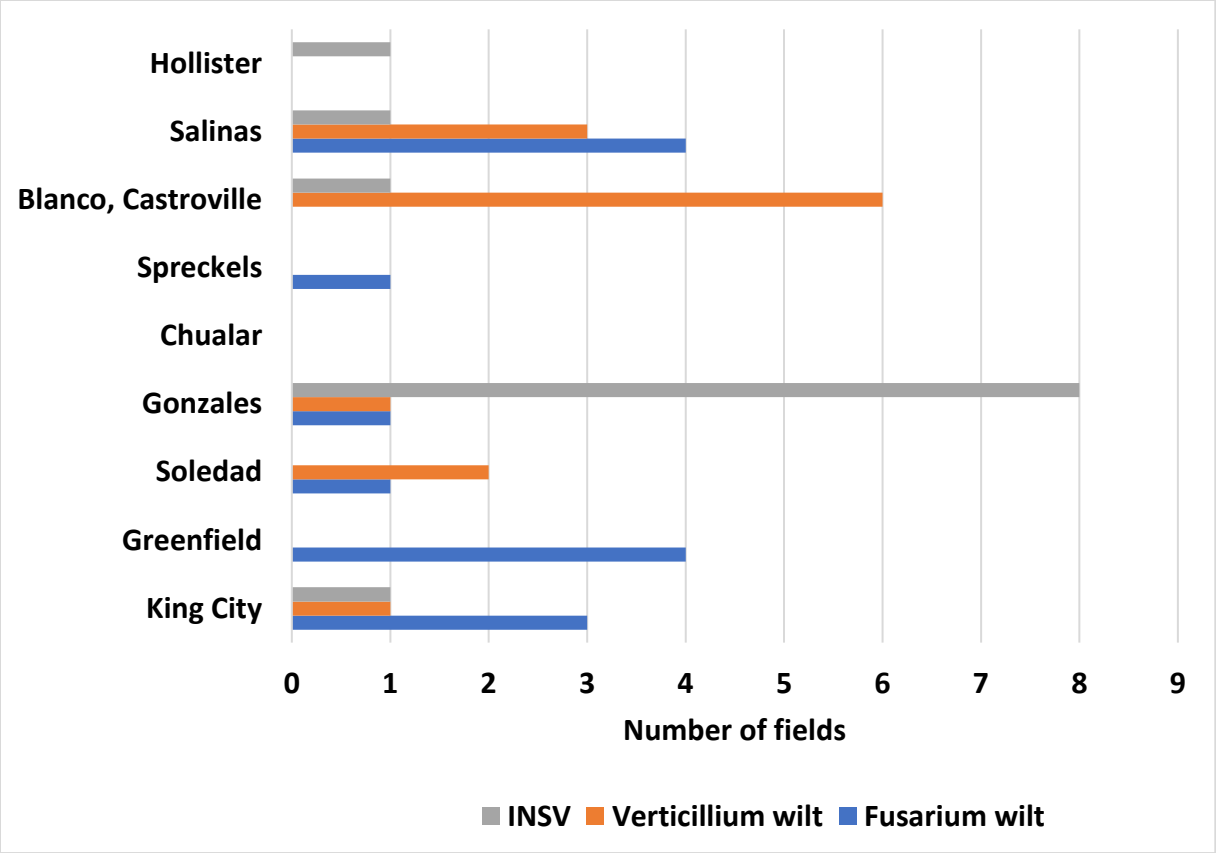


Fig. 2. Disease prevalence in different growing regions of the Salinas Valley

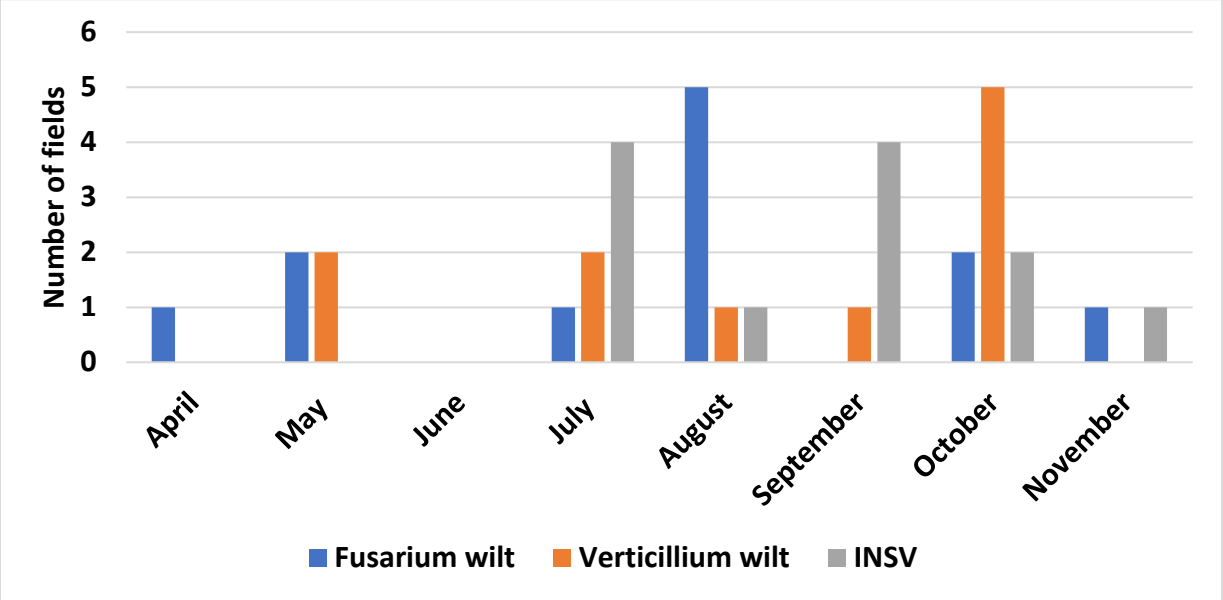


Fig. 3. Seasonal occurrence of the top three diseases in the survey period of April 1, 2023 to March 31, 2024.

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