Investigation of Hull Rot Causal Agents, and Environmental Conditions Conducive to Disease Development in Kern County

University of California
Agriculture and Natural Resources
Cooperative Extension

Mohammad A. Yaghmour, UCCE Advisor Kern and Kings Counties

Cooperators: Mario Viveros, Blake Sanden, Themis Michailides, and Dosanjh Brothers Farms

Introduction

The bearing acreage in Kern county is estimated at 217,000 acres in 2016 and significantly increased over the years with more acreage being planted or older orchards being replanted.

During visits to two orchards with high incidence of hull rot during the summer of 2016, the most prevalent causal agent with visual inspection was *Rhizopus stolonifer*. However, symptomatic spurs and branches had fruits that were only infected with *Aspergillus niger* and in some fruits, there was a mixed infection of *A. niger* and *R. stolonifer*. Samples from one site were collected and sent to Dr. Michailides' lab. *R. stolonifer* and *A. niger* was observed by dissecting scope and isolated from symptomatic tissue, and only *R. stolonifer* was isolated from surface sterilized tissue of symptomatic peduncles and tissue exhibiting internal streaking suggesting that the tissue was colonized by *R. stolonifer*. *A. niger* was reported to cause hull rot in Kern County in 1990 and 1991. Hull rot is considered one of the important diseases that can cause significant losses in almond orchards if it is not well managed.

Objectives

The objective The objective of this project is to investigate the causal agents of hull rot and associated fungi in Kern County and understanding orchard factors and environmental condition playing role in disease development. Is *A. niger* an important factor in disease development in Kern County? What are plant and environmental factors that affect disease development.
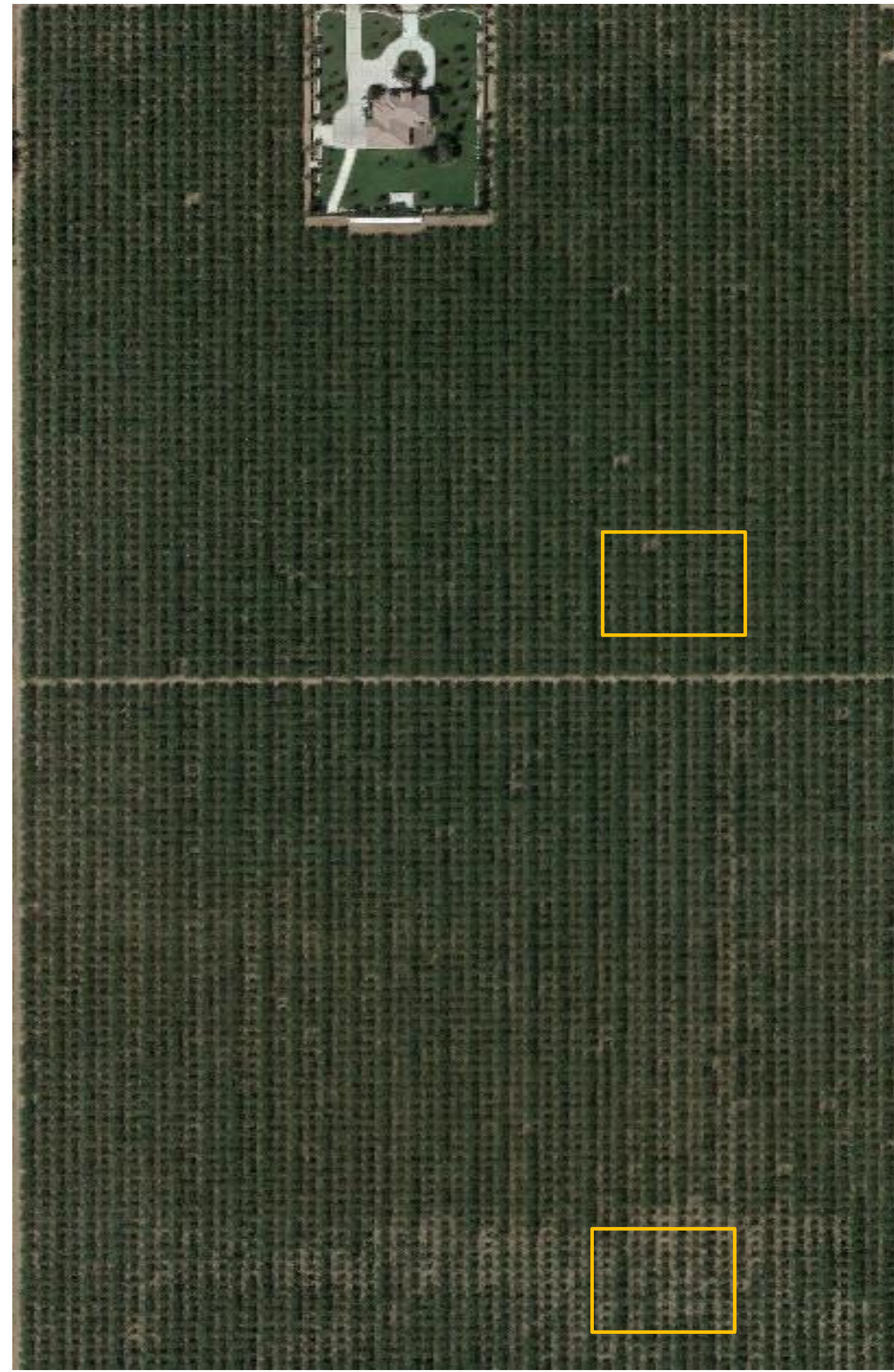
Natural Incidence of Hull Rot

➤ The Northern plot had significantly higher natural incidence of hull rot

➤ Fruits associated with hull rot symptoms was collected from affected spurs and evaluated for *A. niger* and *R. stolonifer* infections

➤ When looking at each block within the orchard, the northern plot had higher fruit infected with *A. niger* while the southern plot had higher *R. stolonifer* infections compared to the northern plot

Hull Rot Incidence

Percentage of Fruit Associated with Hull Rot that has *Aspergillus niger* or *Rhizopus stolonifer*
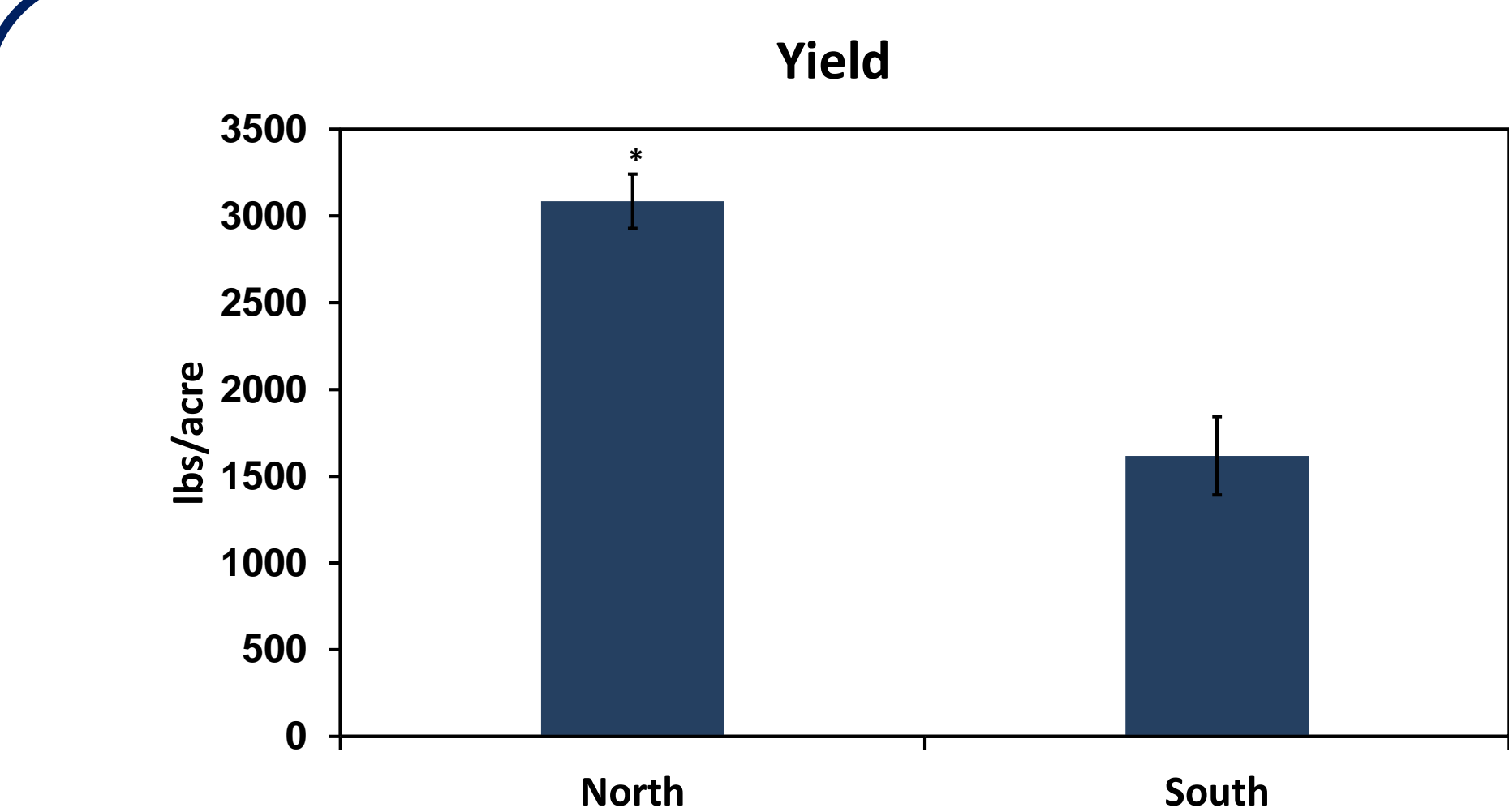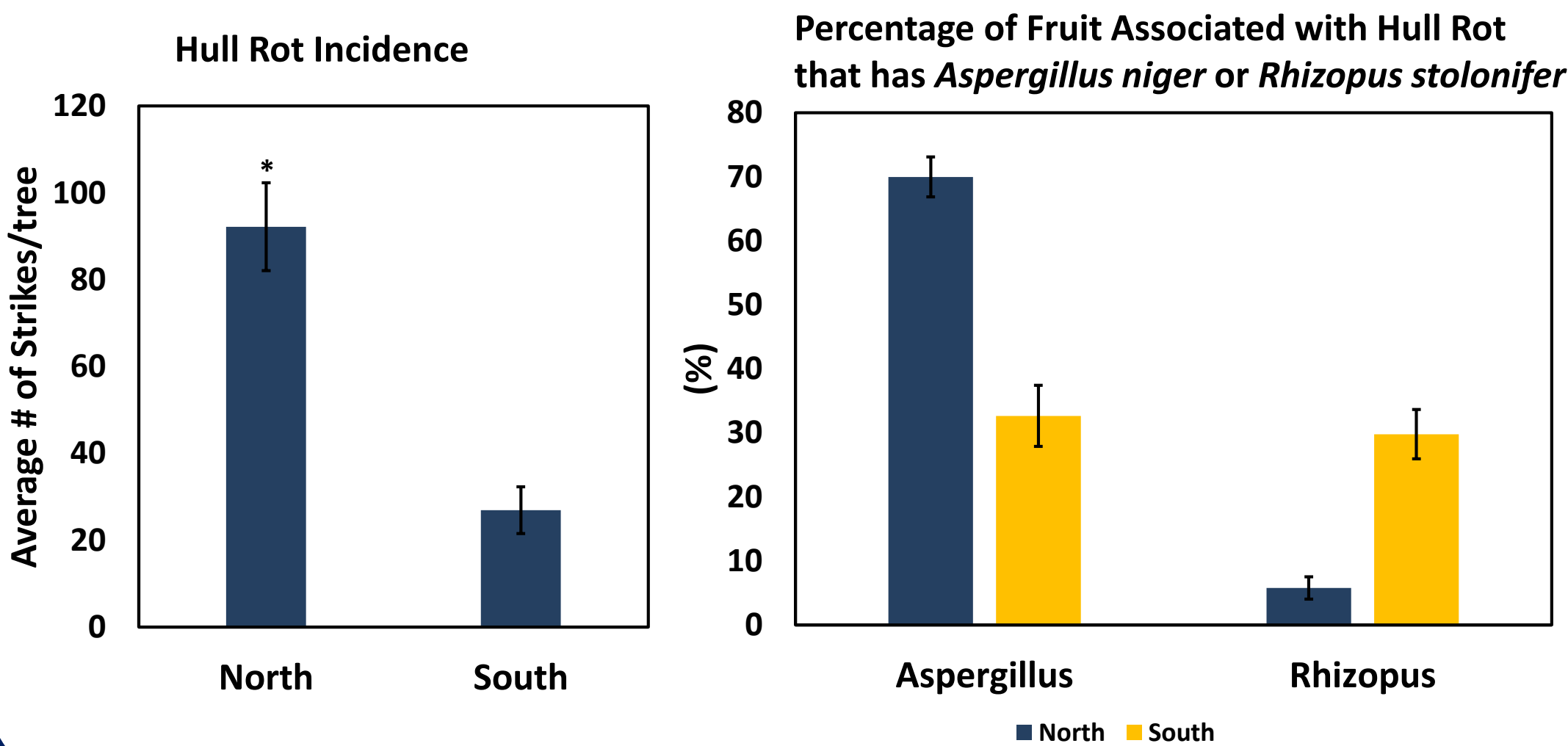
Yield

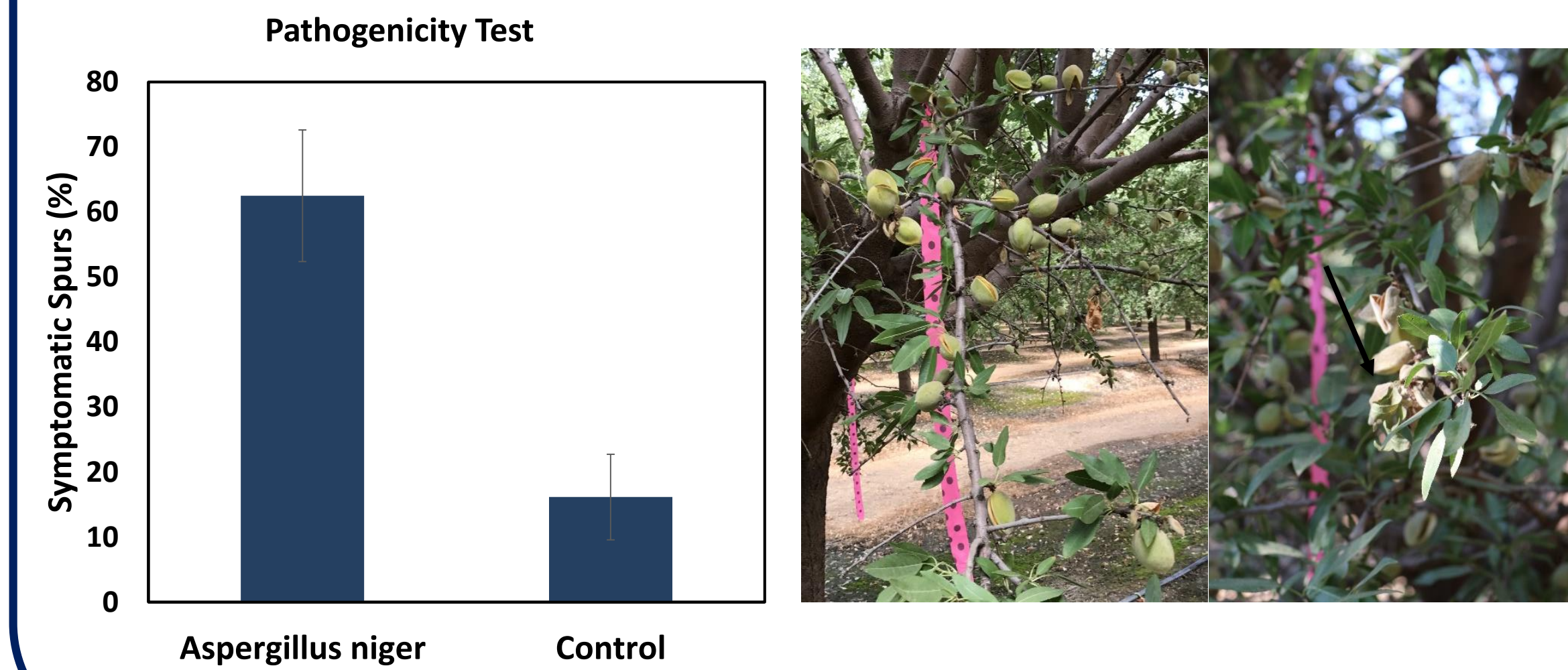Yield of Nonpareil was significantly higher in the northern plot.

Experimental Site

➤ Planted in 2011 with 50% Nonpareil, 25% Sonora, and 25% Monterey
➤ Planted 22'×20' and irrigated with microsprinklers
➤ Five replicates in each main plot established on the NP row.

Stem Water Potential

Trees in the Northern plot was more stressed compared to the trees in the Southern plot

Nonpareil Leaf Nutrient Analysis

➤ Leaf analysis resulted in normal Nitrogen content

➤ Nitrogen levels was not significantly different between the two major plots

Leaf Analysis

	N %	P %	K %	Zn mg/kg	Mn mg/kg	Na %	B mg/kg	Ca %	Mg %	Fe mg/kg	Cu mg/kg
North	2.3	0.1	3.0	107.7	69.0	0.01	45.3	4.2	0.7	185.0	6.0
South	2.4	0.1	2.7	69.7	115.3	<0.01	52.7	4.7	0.7	149.7	5.0

Pathogenicity Test

➤ Two branches per tree (cv. Nonpareil) were spray-inoculated with *A. niger* (1×10^5 spore suspension)-total 4 trees inoculated
➤ One branch on a different tree was sprayed with only water as a control
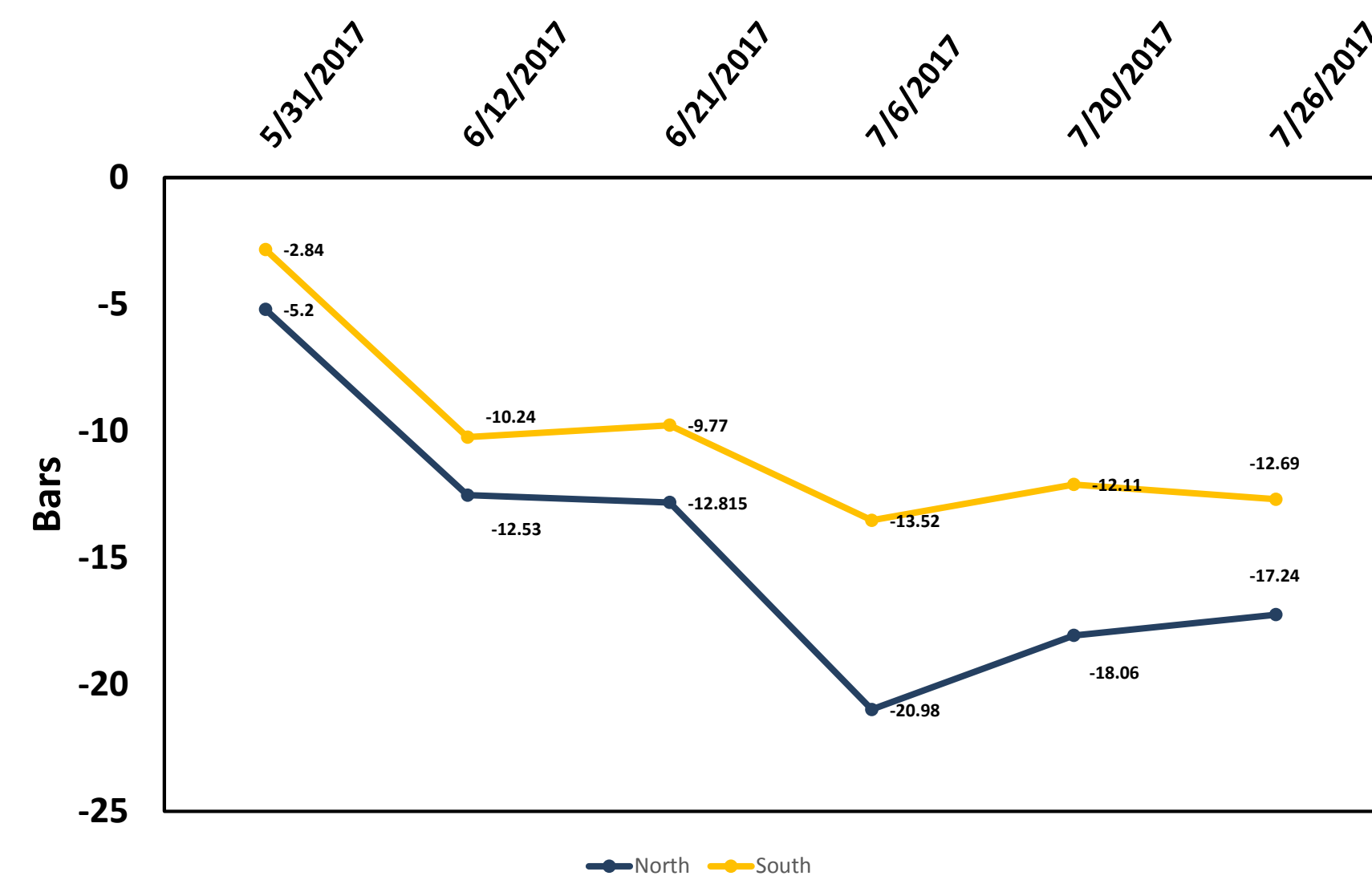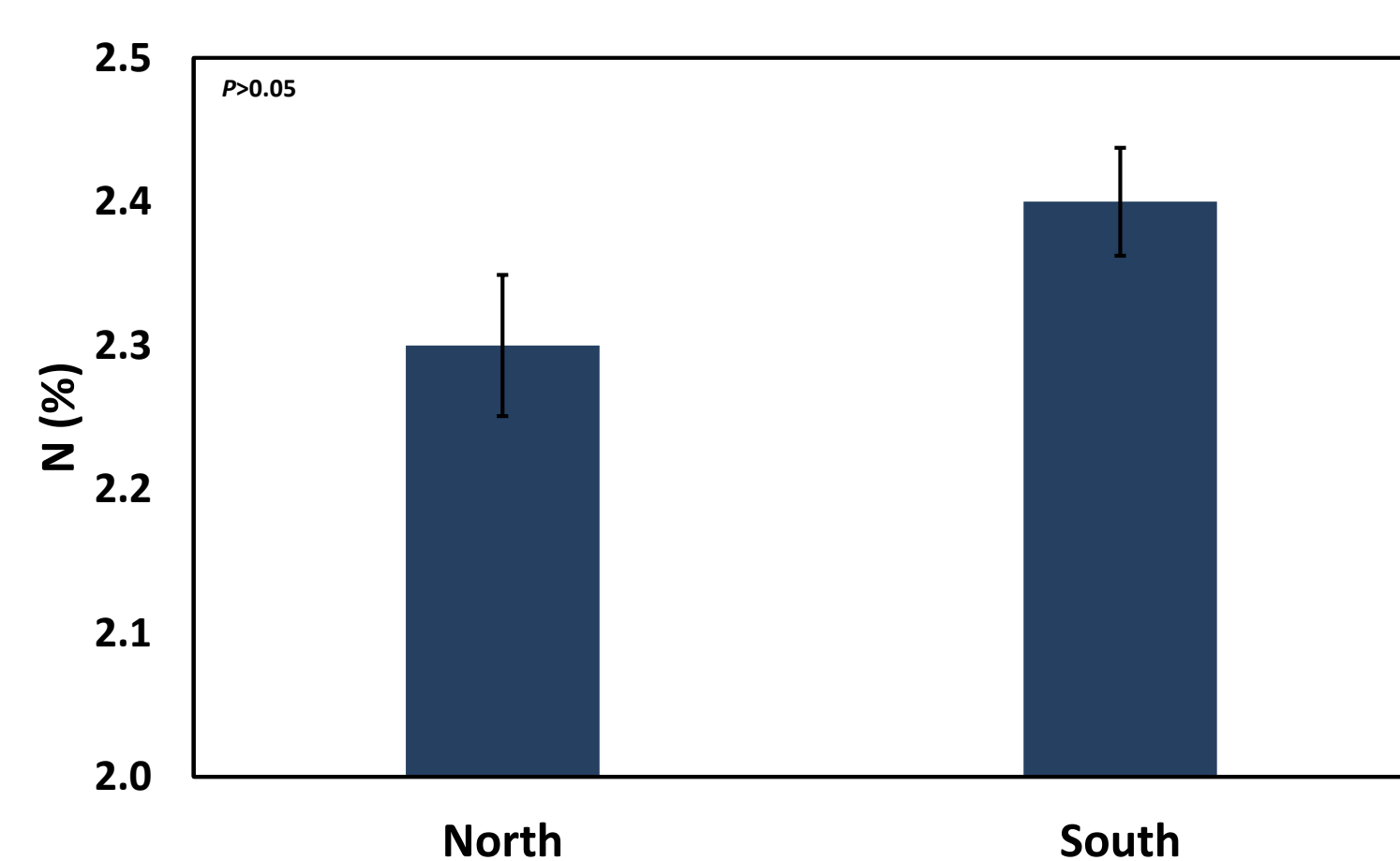

Pathogenicity Test

Symptoms of Hull Rot in Kern County

When the hull is infected and disease progress, leaves near the infected fruit starts to dry and shrivel and may kill fruiting spurs and twigs.

In summer of 2016 and 2017, Hull Rot infections was observed in almond orchards in Kern County (A). *Aspergillus niger* has flat jet black and causes hull rot (B). *Rhizopus stolonifer* was also observed in orchards in Kern County killing spurs and twigs.

Finding and Future work

➤ *Aspergillus niger* has been associated with hull rot in Kern County and was isolated from the cankers from samples sent to Dr. Michailides' lab.
➤ In preliminary pathogenicity tests, *A. niger* reproduced hull rot symptoms in field inoculations.
➤ Association of *A. niger* with hull rot has been also observed in Fresno, and San Joaquin Counties.
➤ It is important to look at the effect of tree water status (stem water potential) in relation to this disease and whether there is any relation with Aspergillus hull rot.

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