Improving Integrated Pest Management of Spider Mites on Almond

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Introduction

Preventing economic damage from twospotted spider mite, *Tetranychus urticae* Koch, and pacific mite, *Tetranychus pacificus* McGregor, is a key component of annual arthropod management strategies in almond. Spider mite management strategy commonly consists of a preventative, or prophylactic, application of abamectin (often applied along with another insecticide targeting navel orangeworm) followed by one or two miticide applications prior to hull split. When applied in late April or early May, abamectin provides relatively long residual activity due to translaminar movement into the leaf surface where it is protected against solar degradation. A major drawback to the management strategy is that abamectin is toxic to the highly effective spider mite predator, sixspotted thrips.

This prophylactic strategy has strong support among pest control advisers and growers as an effective and cost-efficient tool; however, supporting data do not exist. Moreover, this study found that resistance to abamectin has developed in some *T. pacificus* populations; most notably in mid San Joaquin Valley populations.

Objectives

1. Evaluate the effectiveness of a prophylactic, early-season application of abamectin to manage spider mite populations on almond.
2. Via laboratory bioassays, determine if San Joaquin Valley populations of twospotted and pacific mite have developed resistance to abamectin.
   a. Establish base-line LD_{50} for susceptible strains of twospotted and pacific spider mites to abamectin.
   b. Evaluate spider mite populations collected from different locations in the southern and central San Joaquin Valley against susceptible strain.

Acknowledgements

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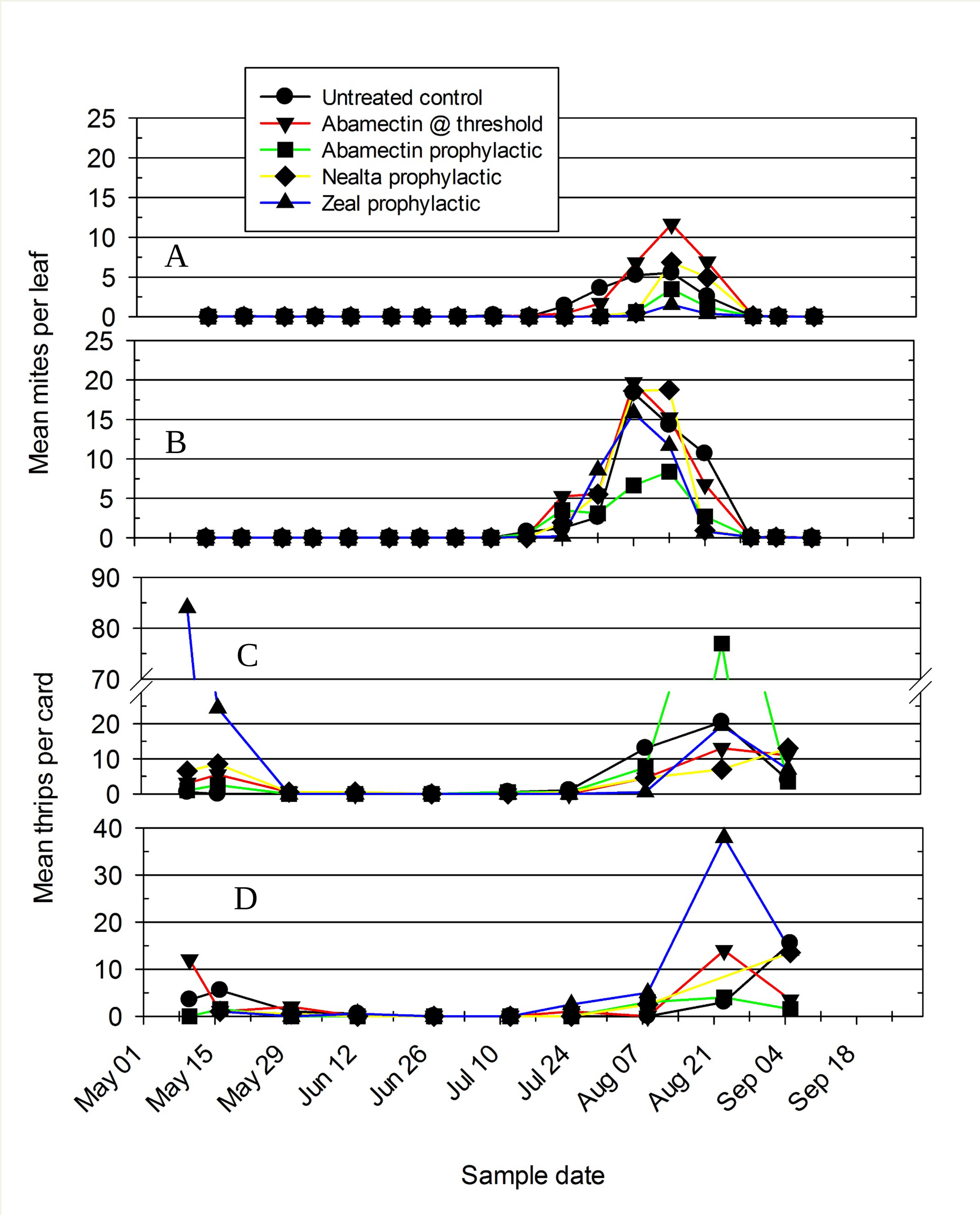

Fig. 1. Mean mites per leaf at two ~ 21-year-old almond orchards located in Kern Co, site one (A) and site two (B). Mean spider mites calculated from 7 trees (15 leaves/tree) per plot (105 leaves/plot). Treatments were replicated 3x at each site. Mean thrips per yellow sticky card site one (C) and two (D). Means calculated from two cards per rep.

Table 1. Code and location of susceptible (SUS1, and SUS2) and seven almond orchard-collected spider mite populations.

Population	Collection location (2017)	Species
SUS1	University of California, Davis, Zalom laboratory	*T. pacificus*
SUS2	University of California, Davis, Zalom laboratory	*T. urticae*
TULCO1	Tulare, Tulare Co	*T. pacificus*
KERCO1	Corcoran, Kern Co	*T. pacificus*
KERCO2	McFarland, Kern Co	*T. pacificus*
FRSCO1	Navelencia, Fresno Co	*T. pacificus*
FRSCO2	Fresno, Fresno Co	*T. pacificus*
FRSCO3	Raisin City, Fresno Co	*T. pacificus*
FRSCO4	University of California, Westside Field Station	*T. pacificus*

Table 2. Probit analysis results and concentration response of almond orchard-collected populations of *T. pacificus*.

Population	n	Slope (SEM)	X^2	LC_{50} (95% CL), ppm	Resistance ratio
SUS1	445	1.33 (0.17)	59.8	0.39 (0.27 - 0.52)	-
SUS2	593	1.38 (0.15)	90.6	0.38 (0.30 - 0.49	-
FRSCO1	945	1.50 (0.16)	84.1	1.16 (0.98 - 1.14)	2.97
FRSCO2	216		0.15		
FRSCO3	610	0.72 (0.14)	27.9	6.24 (3.63 - 12.77)	16
FRSCO4	375	2.04 (0.44)	20.96	1.96 (1.5 - 3.19)	5.02
KNGCO1	469		2.08		
KERCO1	382		0.59		
TULCO1	376	0.53 (0.21)	6.71	5.11 (1.83 - 2375)	13.1

Procedure

Objective 1.

- Established plots (17 – 19 acres in size) at two almond orchard sites at Wonderful Orchards in Kern Co. Treatments replicated 3x at each of two sites.
- **Treatments** 1) untreated control, 2) abamectin (applied at the University of California treatment threshold of ~ 2 mites/leaf), 3) abamectin (prophylactic), 4) Nealta (prophylactic), and 5) Zeal (prophylactic).
- Assessed spider mite populations weekly from late-Mar to mid-Sept on 7 trees (15 leaves/tree) per plot (105 leaves/plot).

Objective 2.

- Established abamectin-susceptible colonies of *T. urticae* and *T. pacificus* to determine abamectin susceptible baseline.
- Collect *T. urticae* and *T. pacificus* from field populations.
  - Conduct laboratory bioassays to determine if resistance to abamectin has developed.

Results and Discussion

Results from 2017 indicate that a prophylactic application of abamectin did not provide an efficient spider mite management strategy. Not until well into the hull split period, 24 and 31 July, at sites two and one respectively, was the two mites per leaf threshold reached in any of the treatments (Fig. 1, A and B). At site one (lower pressure) in treatments 3, 4, and 5, mean mites per leaf remained below one to 7 Aug. Mean mites in each treatment, except treatment 5, exceeded ~ 3.5 by 14 Aug. Mean counts, decreased precipitously to below one mite per leaf by 30 Aug (Fig. 1, A).

At site two (higher pressure) on 7 Aug, counts exceeded six mites per leaf in treatment 3 and ~16 mites per leaf in treatments 1, 2, 4, and 5. Mite counts remained at or above eight mites per leaf to 14 Aug. However, like site one, mean mites per leaf decreased to below one by 30 Aug (Fig. 1, B).

Mean sixspotted thrips counts varied considerably during the experiment at both sites. In general, mean thrips counts indicated relatively small populations occurred during May, decreasing to near undetectable levels to mid-July, then increasing at the end of July and early Aug (Fig. 1, C and D). The later increase in sixspotted thrips counts relates with the rapid decrease in mean spider mite counts that occurred during late Aug.

Between June and Sept. of 2017, we evaluated Pacific spider mite populations collected from seven orchards in Fresno, Kings, Tulare, and Kern counties (Table 1). Among four sites resistance ratio ranged from ~3 to 16 (Table 2).