2002 BELTWIDE COTTON CONFERENCES, ATLANTA, GA – JANUARY 8-12

IRRIGATION MANAGEMENTS INFLUENCE ON ARTHROPOD POPULATIONS

Daniel S. Munk
University of California Cooperative Extension
Fresno, CA
Peter B. Goodell
University of California Cooperative Extension
Parlier, CA

Abstract

Irrigation management influences on key cotton pests have not been extensively studied in cotton production systems. In cotton production regions there is commonly considerable variation in irrigation management approaches as well as varietal variation. This study evaluates the impacts of cotton variety and irrigation management practices on key cotton pest populations in the San Joaquin Valley (SJV). As irrigation management changes toward more frequent water applications, the vigor of all varieties were influenced but to different degrees. Fruiting characteristics can range widely depending on variety and give rise to changes in carbohydrate availability resulting in possible insect attraction differences. This study found that both irrigation management and cotton variety were important factors in the cotton pest, Lygus hesperus.

Introduction

Lygus suppression costs in California's SJV are particularly high because current chemical control measures are limited in their ability to provide complete control over a long duration and additional treatments are often needed. The constant and mobile Lygus populations coming from adjacent fields and beyond provide a readily available source that may begin feeding on young fruit soon after their arrival. Lygus resistance to a wide range of available chemistries including the OP's Carbamate's and more recently Pyrethroids has been documented with best chemical control measures having a 15 to 20 day efficacy following treatment. Additional Lygus treatments are sometimes necessary if continued migration is a problem and the possibility of secondary pest outbreaks following an application of a Lyguscide occurs. Aphid in particular has been documented in some instances to have rapidly increasing populations following applications of Pyrethroids used to treat Lygus.

Alternative Lygus control measures are needed that help reduce crop losses while minimizing the potential for pesticide resistance to develop. As one such approach, the University of California Cooperative Extension has been working to develop regional management strategies in the SJV that work to minimize the buildup and migration of Lygus. These strategies involve the management of multiple crops that are either Lygus hosts as in the case of alfalfa, or support hosts such as weeds within or near non-host fields. Alfalfa management has also been a key to regional management systems and specific non-chemical tools are being used that discourage the movement and migration into neighboring cotton fields. Additional tools that allow the grower to manipulate the overall production system can result in improved regional managment for cotton systems.

Materials and Methods

Trials were conducted during the 2001 production season at the University of California's West Side Research and Extension Center in Five Points, CA on Panoche Clay Loam soils that are well drained and are regarded as having high cotton yield potential. Three cotton varieties with distinct maturity classes and genetic backgrounds were evaluated including the San Joaquin Valley Quality Cotton District standard variety Acala Maxxa produced by CPCSD, publicly available industry standard Pima S7 and the inter-specific Hybrid variety Hazera 195-86.

A Split-Split Plot Design was incorporated into the experiment with three irrigation treatments representing the main plots, Aldicarb treatment evaluated as the subplot, and variety established as a sub-subplot. Plant populations ranged from 28,000 to 35,000 plants per acre. Following the March 30 planting, first flower ranged from June 15 for the Hazera 195, and June 20 for Pima S7 and Acala Maxxa. The field received a pre-irrigation of 11.5 inches on January 17. In-season irrigation treatments were scheduled to optimize production incorporating with three practical water scheduling approaches used on 300-foot furrow irrigation runs.

The first irrigation treatment assumed high water costs and low water availability that would result in some yield reduction due to excessive plant water stress some time during the season. The second irrigation treatment represented a management scenario that assumed water availability was at a level that did not prohibit economic gains from optimum production

practices on an irrigation system that is highly uniform and efficient. The third irrigation treatment represented a management system that assumed low water cost and high availability on an irrigation system that lacked high uniformity of application and low field irrigation efficiency.

Results and Discussion

The wide range of water application amounts falls closely in line with the water quantities applied on more than 90 percents of the cotton producing lands in the SJV. Under drought conditions, it is common to see total applied water at 22 to 25 inches (T1) while lands with good water rights and below average Distribution Uniformity will generally apply between 40 to 44 inches, table 1. More typical of the total water applied most years is the treatment number 2, which had three in-season irrigation events and 30 inches of total applied water. This differential of applied in-season water created differences in how the plant performed.

Plant monitoring conducted just two weeks after first bloom showed some of the vigor differences experienced between varieties and between irrigation treatments, table 2. Plants that were irrigated earlier in the season (T3) were found to be taller than those irrigated with a drought management strategy in mind (T1), but with only minor variation from those irrigated using standard UC Cooperative Extension irrigation guidelines. Differences were also observed in fruiting branch number between irrigation treatments and were particularly noticeable on the most indeterminate variety, Hazera 195. Variety similarities and differences were observed between varieties, with Acala Maxxa and Pima S7 having similar plant heights but more node development for the Pima type.

Late season plant mapping provided additional information to understanding crop fruiting habits and canopy architecture. Final plant map observations describes the late season T3 plants to be 7 to 12 inches taller than the plants using a drought irrigation management strategy. Variety differences were significant in terms of the distribution of fruit with third position fruit becoming more significant, increasing in the order: Acala Maxxa < Hazera 195 < Pima S7. Both plant vigor and/or carbohydrate resource allocation may play an important role in cotton's attractiveness to insect pests.

Lygus hesperus, a key primary pest in the SJV was found to have greater numbers in well irrigated cotton, figure 1. These differences were significant and occurred in a stepwise manner with T2 having an intermediate level of cumulative Lygus numbers throughout the season. Independent evaluations of nymphs and adults found nyphal stages particularly suppressed by drought while adult populations increased only in the highest irrigation treatment, figures 2 and 3.

The cotton variety was also found to influence the occurrence of Lygus and be dependent upon the stage of development. Hazera 195 was particularly attractive to Lygus nymphs while adults were found to have significantly lower cumulative occurrence, figures 4 and 5. Temik applied prior to the first irrigation event was found to have some lasting control in these trials and lower cumulative Lygus counts were seen season-wide, figure 6.

These trials indicate that there is reason to believe that irrigation management can be used as a component tool in the context of cotton IPM practices and should be considered in studies that involve field scale changes in plant water status or in cotton variety. When gin turnout variation is considered, relatively small lint yield variation was experienced; however, rather consistent and important differences in seed cotton yields were observed between irrigation treatments and varieties, figure 7.

Table 1. Inches of water applied for the three treatments in 2001.

Treatment (In-Season Irrigs.)	Total Applied In-Season	Total Applied with 1/17 Pre-Irrig.
T1 (2)	10.6	22.1 Ac./in.
T2 (3)	18.8 Ac./in.	30.3 Ac./in.
T3 (5)	29.9 Ac./in.	41.4 Ac./in.

Table 2. In-Season plant vigor on July 11th 2001.

	Maxxa		Pima S7		Hazera	
Irrigated	Height	Fruiting Branches	Height	Fruiting Branches	Height	Fruiting Branches
6/29	25.2	13.3	25.5	14.5	28.8	14.2
6/14	34.6	14.1	34.5	15.1	38.0	16.4
5/30, 6/29	33.9	14.8	34.7	16.6	40.4	17.3

Table 3. End of season plant characteristics on October 12th 2001.

	Maxxa			Pima S7			Hazera		
Number of In-Season Irrigs.	2	3	5	2	3	5	2	3	5
Plant Height (inches)	37.8	39.8	46.4	38.1	42.6	51.7	47.6	45.7	54.3
Fruiting Branches	19.2	18.9	21.0	19.2	19.5	21.9	22.1	19.6	22.1
% Bolls in Position 1	54.8	52.5	46.5	35.9	34.4	39.9	48.2	42.5	39.6
% Bolls in Position 2	34.1	30.4	31.0	35.0	31.3	34.2	37.1	36.4	35.6
% Bolls in Position 3+	8.9	5.4	15.7	27.2	31.2	24.6	12.0	15.4	22.1

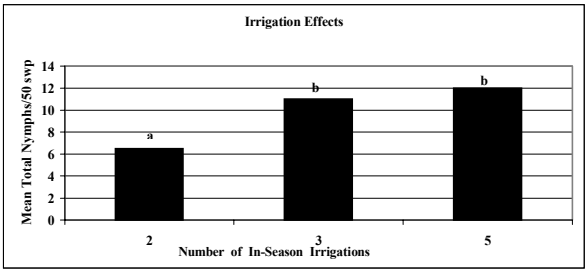

Figure 1. Irrigation effects on season-long Lygus density.

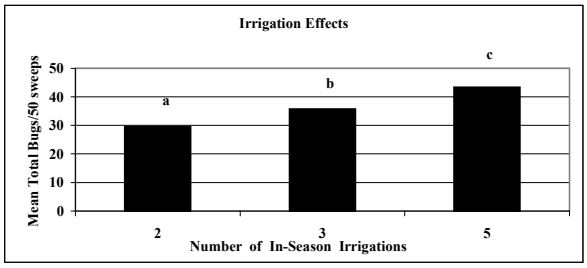

Figure 2. Irrig. Effects on season-long Lygus nymphal density.

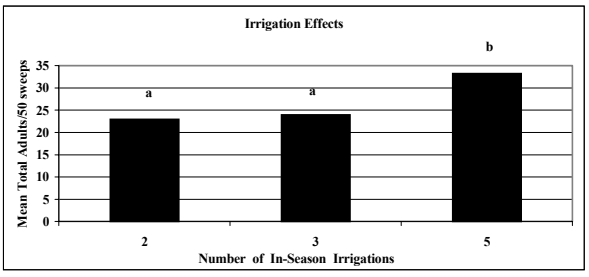

Figure 3. Irrigation Effects on season-long Lygus adult density.

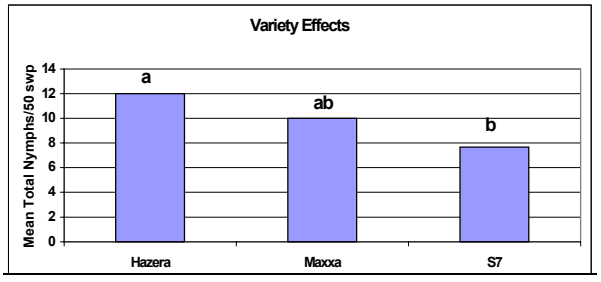

Figure 4. Variety effects on season-long Lygus nymphal density.

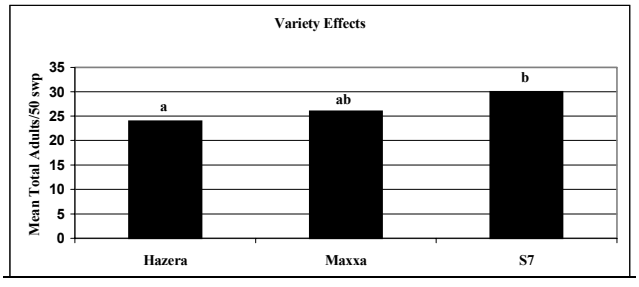

Figure 5. Variety effects on season-long adult Lygus density.

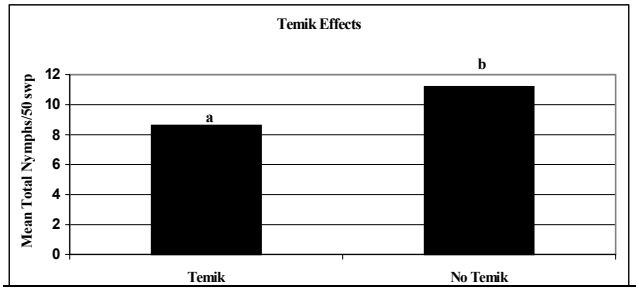

Figure 6. Temik effects on season-long Lygus nymphal density.

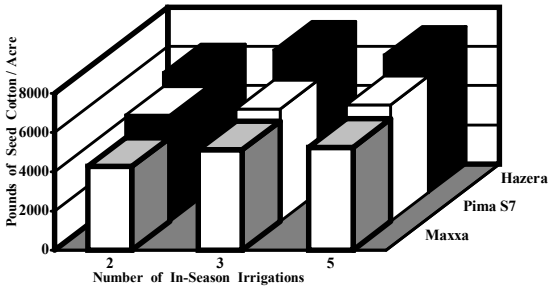

Figure 7. Seed cotton yields from 2001.