Insect Crop Losses and Insecticide Usage for Spring Melons in Southwestern Arizona for 2007

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Abstract

Impact assessment is central to the evolution and evaluation of our IPM programs. Quantifiable metrics on insecticide use patterns, costs, targets, and frequency, crop losses due to all stressors of yield and quality, and other real world economic data (e.g., crop value) are our most objective tools for assessing change in our systems. We recently initiated a project to measure the impact of insect losses and insecticide uses in cantaloupes and watermelons grown in Yuma, AZ and the Bard–Winterhaven area of Imperial County, CA. The data generated in this report is useful for responding to pesticide information requests generated by EPA, and can provide a basis for regulatory processes such as Section 18 or 24c requests, as well as for evaluating the impact of our extension programs on risk reduction to growers. This information also confirms the value of PCAs to the melon industry by showing the importance of cost-effective management of insect pests in desert production.

Introduction

The development of accurate "real world" data on crop insect losses and insecticide usage is important to the assessment of our IPM programs in Arizona. Quantifiable measurements of insecticide use patterns, costs, target pests, and yield/quality losses due to key insect pests are our most objective tools for assessing change in our systems. These data allow us to build relevant databases for measuring user behaviors and adoption of new IPM technologies. This is information important for several reasons. First, specific data on pesticide use patterns and insect losses can be useful for providing information to EPA and other regulatory agencies in submitting Section 18 and 24c requests, as well as support the tolerance of older active ingredients that are critical to the melon industry. In addition, it can directly demonstrate the value of new pest control technologies and IPM tactics. From an academic perspective, these databases help to re-direct the efforts of the College of Agriculture by providing key stakeholder input to our applied research and extension programs. This "real world" input from the industry documents the relevancy of key pest problems and has become mandatory for competing for federal grant funding. Finally, for pest control advisors (PCAs), it can translate their efforts into economic terms for their clientele and confirms their value to the melon industry by showing the importance of key insect pests and their cost-effective management in desert production. This report documents the development of "real world" data on actual insect loss data for cantaloupes and watermelons, and estimates of the level of insecticidal control needed to prevent key insect pests from reducing yield and quality.

Data Collection

The data was developed through the administration of a three-part survey that was conducted in an interactive process with stakeholder input. Growers, PCAs, Extension personnel and industry professionals attended spring Melon Insect Losses and Impact Assessment Workshops in Yuma in July of 2007 and completed surveys in a guided process. The workshops were conducted in an interactive manner where participants were given a presentation that established the incentives for participation, explained the crop insect loss system, and further walked the participants through the estimation process. The three part survey instrument collected the following information:

Part I: Information was collected on the actual cantaloupe and watermelon acreage represented by the respondent, estimates of actual yields and potential yields for this acreage (Table 1), and overall percent reductions in yields due to several biological, environmental and management factors (Table 2). In addition, costs associated with aerial and ground applications (Table 3) and insect management fees for scouting (Table 4) were estimated.

Part II. Information was collected on crop insect losses through the description of the percentage of acres where key insect pests were present and insecticide sprays were required to prevent yield reductions in cantaloupes and watermelons. Included with those estimates are the frequency and costs of insecticide applications directed towards those insects. Overall, these costs represent a loss to the grower associated with preventing insects from damaging plants and reducing yields. Finally, actual percent yield losses (heads not harvested due to insect damage or injury) for individual insect species or complexes were estimated (Table 5 and 6).

Part III: Data on insecticide use patterns was collected. These data identify the frequency of use of various chemistries (identified by both product name and IRAC mode-of-action classification) and the percentage of treated cantaloupe and watermelon acres for each product (Table 9).

Results and Discussion

Part I: The Spring Melon Insect Losses Workshop in Yuma was attended by 24 growers, PCAs, Extension personnel and other stakeholders in 2007. A total of 9 completed surveys collected at the Yuma meeting in 2006 represented 65% of acreage for spring cantaloupes and 60% of the acreage for watermelons (Table 1). All of the acres reported were for melons grown in Yuma County. Estimates of yields (both actual and potential) varied between melon types, where estimates for yield losses averaged about 20% for both crops. These values were higher than the estimates for specific factors responsible for yield losses shown in Table 2.

Estimates for specific factors responsible for seasonal yield reduction varied as well (Table 2). Overall, weather constituted the factor that PCAs and growers felt was most responsible for yield reductions. This makes sense since spring melons are planted under cool temperatures and higher amounts of rainfall. Disease pressure can also be heavy during the spring (i.e. powdery mildew). However, disease losses were reportedly much lower in 2007 for both crops compared to the previous year. Losses for all insects averaged about 1.2%. Yield reductions due to birds was >2 % in cantaloupes which are direct seeded compared to watermelons (0.2%) which are largely transplanted. However, PCAs have reported that crop losses due to bird damage have been getting worse each year. Percent reduction in yield by other factors included: poor crop and irrigation practices, poor fruit quality, weak melon markets / harvest losses, sunburn, and poor pollination. Collectively, these factors were reported to be responsible from 6.1% of the annual crop losses in spring cantaloupes but only 2.2% in watermelons.

Estimates for aerial and ground insecticide applications on spring melons varied between years and crops (Table 3). In general, more than 2/3 of all acres were treated by both air and ground on an average of > 3 times per acre. Average costs for insecticides applied by ground were about 30% higher than applied by air. Not surprisingly, respondents estimated that 100% of their acres where scouted, monitored and sampled for insect activity (Table 4). The number of field visits per week averaged more than 3 field visits per week and were more frequent in watermelons. Estimates for the cost of scouting were about the same for both crops. These insect management costs suggest that Arizona melon growers find significant value in the expertise and service provided by their PCAs.

Part II: Insect Crop Losses
Spring Cantaloupes: Insects important at stand establishment such as seedling pests (ground beetles, earwigs, and crickets) and seed corn maggots were treated on greater than 50 % of the acreage in 2007 (Table 5). The average cost to control these pests was around $ 15.00 / acre. Seedling pests and seed corn maggot accounted for about 0.3% yield loss. Flea beetles and leafminers were only minor pests in 2007 and no yield losses were reported for either pest.

The lepidopterous larval complex consisting of beet armyworm and cabbage looper accounted for significant control costs in spring cantaloupes. Beet armyworm was treated on almost 50% of the acres (~2 sprays/ acre), but yield losses were negligible (<0.1%). In contrast, cabbage looper was a much more significant pest and was responsible for more yield losses in 2007 than any other pest. The larvae can cause significant quality losses to cantaloupes by feeding on the netting of maturing fruit rendering them unmarketable. Yield losses attributed to this damage was estimated at 2.8%. PCAs reported that an average of ~ 2 applications were made on 97% of the acreage at costs of about $37/acre.

Whiteflies (sweetpotato whitefly, *Bemisia tabaci* – B biotype) were reported to be present on nearly 100% of the spring acreage and required additional foliar sprays on 82% of the spring acres in 2007. Yield losses to whitefly which were higher this year relative to the previous 2 seasons. Control costs with foliar sprays averaged > $40 / acre. Admire and other soil applied neonicotinoids were applied to 100% of the spring acreage (Tables 7). Aphids are considered occasional pests of cantaloupes primarily due to transmission of virus and colonization is rare. Since the wide-spread use of Admire, incidence of aphid-transmitted virus has been almost none existent. However, growers did not report spraying for aphids in spring cantaloupes in 2007.

Thrips and spider mites are rarely found to damage spring cantaloupes and this is evident over the past two years by reported lack of control and yield loss. Similarly trash bugs, particularly false chinch bug can cause problems on melons, but caused no problems for PCAs in 2007. Although darkling beetles can cause problems on spring cantaloupes at harvest by feeding on mature fruit, no control or yield losses were reported. The incidence of Cucurbit Yellows Stunt Disorder Virus was reported on 20% of the spring cantaloupes but low yield losses were attributed to this new whitefly-transmitted virus.

Watermelons: Insects important at stand establishment are generally thought to be less important on watermelons because the bulk of the production is of transplanted seedless varieties. The estimates for control costs and yield losses from 2007 for these pests suggest this as well (Table 6). Similarly, flea beetle and leafminer were not reported as a problem.

Lepidopterous larve are annual pests of watermelons because of aesthetic damage resulting from feeding on immature and mature melons. Beet armyworm is generally thought to be more important, but PCAs reported that cabbage looper actually required more control. Whiteflies caused estimated yield losses of 0.2% and receiving foliar sprays on 73% of the reported acres. About 70% of the acreage was treated with imidacloprid. This might in part explain the higher number of foliar applications in watermelons when compared with cantaloupes.

Aphids and spider mites are frequent pests in watermelons grown in southwestern Arizona. Aphid pressure appeared to be much lighter in 2007, but spider mites were especially troublesome, requiring treatment on greater than 50% of the acreage and causing the highest yield losses among all pests (0.4%). Trash bugs were treated on about 16% of the acres.

Part III: Insecticide Usage

The frequency of use and the percentage of treated acres for insecticides applied on spring melons are shown in Table 9. The individual insecticide products are grouped by the IRAC mode-of-action classification (http://www.irac-online.org). This system groups chemistries with a similar mode-of-action with a common number so that users can effectively rotate different chemistries in resistance management programs. We list insecticides by a product name when possible; otherwise the chemical name is listed. Pyrethroids were listed by class because of the numerous products registered in head lettuce.

The carbamate and organophoshphate chemistries are listed within IRAC Group 1 because of their common mode-of-action. Among this group, Diazinon was the only product used in cantaloupe and d Lannate the only product used on watermelons. Very few acres were treated with either product. Endosulfan (Group 2A) was used on >50% of cantaloupes acres in 2007 and about half that much on watermelons, presumably for whitefly and cabbage looper control. Pyrethroids (Group 3) were consistently the most heavily used insecticide in both crops, both in frequency of use and % treated acres. They provide broad spectrum activity against pests such as darkling beetle, flea beetle, and moths that are not controlled with many of the new, selective insecticides. Also, it is commonly applied through sprinkler chemigation for control of pests at stand establishment. Pyrethroids such as bifenthrin or Danitol combined with endosulfan are one of the most efficacious adulticides available for whiteflies.

Group 4A represents the neonicotinoid chemistry which includes Admire, generic imidacloprid (Alias), Platinum and the newly registered Venom. This class of chemistry represents the most efficacious group of insect ides available for management of whiteflies and aphids in melons. Generic imidacloprid was by far the most heavily used neonicotinoid on cantaloupes, but Admire was applied to a greater number of watermelon acres. Total soil applied neonicotinoid use in 2007 was reported on 100% of the cantaloupe acres, but was comparatively lower in watermelons. With the exception of a small usage of Venom in 2007 on watermelons, no other neonicotinoid use was reported.

The second most heavily used compound in watermelons was Success (Group 5). In cantaloupes, use was considerably lower, but higher than last year. Success use in watermelons is primarily targeted against lepidopterous larvae which are one of the primary pests responsible for yield losses in Arizona melons. Another product used for lepidopterous larvae control in melons included Intrepid (18A), which was applied to almost 40% of the cantaloupes acres in 2007. Agrimek (6) is an effective insecticide compound for leafminer and mite control, but was reportedly treated on only watermelons in 2006. The other products that had significant use reported were Courier and Oberon, two selective insecticides with good whitefly activity. They were used on a higher percentage of watermelons acres where Courier use declined significantly in 2007. Oberon use increased from last year on both crops. PCAs reported using Dusting sulfur on a significant number of acres in 2007, primarily for powdery mildew, and spider mite management.

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Table 1. Number of respondents and reported acreage and yields for spring melons in 2007.

Survey use stats	Cantaloupes	Watermelons
No. of PCA respondents	9	6
Acreage reported for these estimates	4196	1522
Estimated yield /acre (cartons)	764	940
Potential yield / acre (cartons)	1017	1140

Table 2. Percent reductions in yields due to several biological, environmental and management factors for spring melons in 2007.

	Yield Reduction (%)	
Factor	**Cantaloupes**	**Watermelons**
Weather	4.8	6.8
Chemical injury	0.1	0
Weeds	0.6	0.5
Disease	2.2	1.4
All insects	1.3	1.2
Birds	2.1	0.2
Other factors	6.1	2.2
Avg. Total Losses	17.2	12.3
	14.8	

Table 3. Frequency and costs for aerial and ground applications on spring melons in 2007.

Insecticide Applications	Cantaloupes	Watermelons
Aerial application		
% acres treated	71.1	33.3
No. applications	1.6	1
Cost ($) / application	11.71	7.2
Ground application		
% acres treated	65.6	100
No. applications	1.7	2.6
Cost ($) / application	16.39	14.58

Table 4. Insect management costs for spring melons in 2007

Insect Management	Cantaloupes	Watermelons
% acres scouted	100	100
No. field visits/week	3.2	3.9
Cost ($) / acre	19.33	19.50

Table 5. Insect losses and control costs on spring cantaloupes in 2007.

Pest	Cantaloupes				
	Acres Pest was Present *(%)*	**Acres Pest was Treated** *(%)*	**Foliar Insecticide Applications** *(No./ac)*	**Control costs** *($/ac)*	**Yield losses** *(%)*
Seedling pests	50.1	13.6	1	15.00	0.2
Seed corn maggot	30.7	23.8	1	12.50	0.1
Flea beetles	38.7	1.3	1	15.00	0
Leafminers	64.0	14.3	1.3	18.00	0
Beet armyworm	68.2	47.7	1.9	38.10	0.1
Cabbage looper	97.1	97.1	1.9	36.60	2.8
Whiteflies	100.0	82.6	1.7	40.10	0.8
Aphids	63.2	0	0	0	0
Thrips	85.2	0	0	0	0
Spider mites	2.4	0	0	0	0
Trash bugs	42.5	28.6	0.6	11.90	0
Darkling beetle	20.7	0	0	0	0
CYSD virus	20.9	0	0	0	0

Table 6. Insect losses and control costs on spring watermelons in 2007.

Pest	Watermelons				
	Acres Pest was Present *(%)*	**Acres Pest was Treated** *(%)*	**Foliar Insecticide Applications** *(No./ac)*	**Control costs** *($/ac)*	**Yield losses** *(%)*
Seedling pests	39.9	0	0	0	0
Seed corn maggot	36.8	0	0	0	0
Flea beetles	51.4	0	0	0	0
Leafminers	84.2	8.3	2	40.00	0
Beet armyworm	74.3	74.2	1.3	36.60	0.2
Cabbage looper	100.0	100.0	1.4	34.75	0.2
Whiteflies	100.0	73.7	1.3	37.30	0.2
Aphids	36.9	5.3	1.3	13.0	0.0
Thrips	100.0	36.8	2	18.0	0
Spider mites	55.3	55.3	1.7	25.0	0.4
Trash bugs	16.6	16.6	1	18.0	0
Darkling beetle	0	0	0	0	0
CYSD virus	5.5	0	0	0	0

Table 7. Frequency and costs of chemigation and soil-applied insecticides at stand establishment on spring cantaloupes in 2007.

Treatment	Cantaloupes		
	Acres Treated (%)	Applications (no.)	Cost ($)
Chemigation treatments used at stand establishment	15.8	1	6.50
Soil applied insecticide used (Admire Pro, generic imidacloprid, Venom)	100	1	42.56

Table 8. Frequency and costs of chemigation and soil-applied insecticides at stand establishment on spring watermelons in 2007.

Treatment	Watermelons		
	Acres Treated (%)	Applications (no.)	Cost ($)
Chemigation treatments used at stand establishment	5.3	1	8.00
Soil applied insecticide used (Admire Pro, generic imidacloprid, Venom)	70.3	1	49.60

Table 9. Insecticide usage on spring melons in 2007.

IRAC MOA Group	Product	Cantaloupes		Watermelons	
		Treated acres *(%)*	**No. times applied** *(No./ac)*	**Treated acres** *(%)*	**No. times applied** *(No./ac)*
1A	Lannate	0	0	5.3	1.0
1A	Vydate	0	0	0	0
1B	Diazinon	1.9	1.0	0	0
1B	Dimethoate	0	0	0	0
1B	Metasystox -R	0	0	0	0
2A	Endosulfan	56.1	1.3	21.3	1.0
3	Pyrethroids	82.4	1.7	94.7	1.8
4A	Admire	16.7	1.0	46.6	1.0
4A	Generic imidacloprid	83.3	1.0	23.7	1.0
4A	Venom-soil	0	0	5.8	1.0
4A	Venom -foliar	0	0	0	0
4A	Platinum	0	0	0	0
5	Success	53.9	1.4	89.5	1.3
6	Agrimek	0	0	4.2	1
9B	Fulfill	0	0	4.2	1
9C	Beleaf	0	0	4.2	1
11B	Bt (i.e. Dipel/Javelin)	5.2	2.0	0	0
16	Courier	19.5	1.5	5.3	1.0
18A	Intrepid	53.5	1.0	36.8	1.3
23	Oberon	38.3	1.0	43.7	1.0
Unk	Dusting sulfur	13.1	1.0	34.2	1.5