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

John Palumbo, Al Fournier, Peter Ellsworth, Erin Taylor and Kevin Rice

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 central Arizona (Maricopa, Pinal and La Paz counties). 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 Phoenix 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 Workshops in Phoenix were attended by 9 growers, PCAs, Extension personnel and other stakeholders and a total of 3 usable surveys were collected (Table 1). Estimates of yields (both actual and potential) varied between melon types, where estimates for yield losses range from 25-30% for both crops. These values are also fairly consistent with the total estimates of specific factors responsible for seasonal yield losses found in Table 2. Overall, weather and disease constituted the factors that PCAs and growers felt were most responsible for yield reduction. 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). Losses for all insects ranged from 0.7-2.0 % and varied between melon crops. This is consistent with the unpredictable nature of insect outbreaks that are often influenced by weather and adjacently grown spring produce crops. Yield reductions due to birds varied similarly. 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 management practices, poor planting operations and weak melon markets. Collectively, these factors were reported to be responsible from 7.0-15% of the annual crop losses in spring melons

Estimates for aerial and ground insecticide applications on spring melons varied between crops (Table 3). In general, more than 50% of all acres were treated by both air and ground on an average of fewer than 2 times per acre. No cantaloupe acres were treated by air in 2007, but > 90% were treated with ground equipment. Watermelons were treated with primarily ground equipment (47.3 %),. 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 averaging more than 2 field visits per week. Estimates for the cost of scouting were 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

<u>*Spring Cantaloupes:*</u> Insects important at stand establishment such as seedling pests (ground beetles, earwigs, and crickets), seed corn maggots, flea beetles and leafminers were present on greater than 50% of the acreage, but did not require insecticide treatments (Table 5). No yield losses were reported for these pests. The lepidopterous larval complex consisting of beet armyworm and cabbage looper accounted for significant control costs in spring cantaloupes. Beet armyworm was treated on less than 10% of the acreage, and was responsible for a slight yield reduction. In contrast, cabbage looper was a much more significant pest, requiring more control and caused higher yield losses. Cabbage looper larvae can cause significant quality losses to cantaloupes by feeding on the netting of maturing fruit rendering them unmarketable.

Whiteflies (sweetpotato whitefly, *Bemisia tabaci* – B biotype) were reported to be present on nearly 100% of the spring acreage in both years, but did not require additional foliar sprays in 2007. This is consistent with comments made by PCA's in central Arizona that numbers were unusually light this year in response to the freezing temperatures that occurred during December and January. Admire and other soil applied neonicotinoids were

applied to only 21 % of the spring acreage in 2007 (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 reported that aphids were not present on spring cantaloupes this spring. Thrips are rarely found to damage spring cantaloupes and this is evident by reported lack of control and yield loss. Spider mites were treated on only 10% of the acreage and caused a reported 0.4% loss. Darkling beetles continue to cause problems on spring cantaloupes at harvest by feeding on mature fruit, and PCA treated 30% of the acres for this pest in 2007.

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 for 2007 for these pests suggest this as well (Table 6). Lepidopterous larve however are annual pests of watermelons because of aesthetic damage resulting from feeding on immature fruit. Beet armyworm is generally thought to be more important, but PCAs reported that cabbage looper actually caused more damage to watermelons. Both species required ~ 2 applications at a cost of ~ $20.00 / acre. Collectively, yield losses to cabbage looper and beet armyworm were higher than any other insect pests. Whiteflies did not cause any yield losses this year, but required treatment on 26% of the acres. Table 8 shows that 44% of the watermelon acreage was treated with imidacloprid in 2007.

Aphids and spider mites are frequent pests in watermelons grown in southwestern Arizona. Although no yield losses were reported for these two pests, a few acres were treated. Aphid pressure appeared to be much lighter in 2007, but spider mites present requiring treatment on less than 10% of the acreage. Darkling beetles were treated on about 10% of the acres and caused a 0.5% crop loss.

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, only Vydate (oxymyl) and Diazinon were used and only on cantaloupes. Endosulfan (Group 2A) was used on 44% of cantaloupes acres in 2007, presumably for whitefly and cabbage looper control. Surprisingly, endosulfan in watermelon was applied to only about 13% of the reported acreage. Pyrethroids (Group 3) in cantaloupes were used on 61% of the acreage. In watermelons, foliar applications of pyrethroids were used on few acres but applied more frequently. Pyrethroids 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. 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 (ie. 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. Admire use was not reported on cantaloupes, and only used on 21% of the watermelon acres. In contrast, generic imidacloprid was used on about 44% of the cantaloupe acres, but no use was reported on watermelons. No other soil or foliar neonicotinoid use was reported on either cantaloupes or watermelons in 2007

Success (Group 5) was used spraibgly in cantaloupes but was applied to 34% of the watermelon acreage. 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 commonly used for lepidopterous larvae control in melons is Intrepid (18A); however, no melon acres in central Arizona were treated with this product in 2007. Bt was used on a significantly greater number of acres in 2007, particularly in cantaloupes. The other product that had significant use reported was Oberon. It was applied to greater than 50% of the watermelon acreage, which makes sense since it is a selective insecticide with good whitefly and spider mite activity.

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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	3	3
Acreage reported for these estimates	6750	1900
Estimated yield /acre (cartons/tons)	717	29.3
Potential yield / acre (cartons/tons)	950	41.7

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	11	12.3
Chemical injury	0.3	0.3
Weeds	1.3	0.3
Disease	4.3	4.3
All insects	0.7	2.0
Birds	2.0	0.7
Other factors	7.0	15.1
Avg. Total Losses	26.6	34.9
	30.8	

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

Insecticide Applications	Cantaloupes	Watermelons
Aerial application		
% acres treated	0	26.3
No. applications	0	1
Cost ($) / application	0	12.00
Ground application		
% acres treated	91.8	47.3
No. applications	1.5	1.8
Cost ($) / application	17.33	17.50

Table 4. Insect management costs for spring melons in 2007

Insect Management	Cantaloupes	Watermelons
% acres scouted	100	100
No. field visits/week	2.2	2.2
Cost ($) / acre	14.00	14.00

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	51.0	0	0	0	0
Seed corn maggot	68.1	0	0	0	0
Flea beetles	62.8	0	0	0	0
Leafminers	46.1	0	0	0	0
Beet armyworm	10.1	8.9	2	25.00	0.4
Cabbage looper	47.3	44.4	2	25.00	0.9
Whiteflies	95.9	0	0	0	0
Aphids	0	0	0	0	0
Thrips	7.3	0	0	0	0
Spider mites	17.8	8.9	1	20.00	0.4
Trash bugs	11.0	0	0	0	0
Darkling beetle	37.3	30.8	1	10.00	0
CYSD virus	1.2	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	73.7	0	0	0	0
Seed corn maggot	21.1	0	0	0	0
Flea beetles	46.3	0	0	0	0
Leafminers	42.6	0	0	0	0
Beet armyworm	46.3	38.4	1.7	20.00	0.5
Cabbage looper	42.1	28.9	2	19.00	0.7
Whiteflies	89.5	26.3	1	25	0.0
Aphids	0	0	0	0	0
Thrips	47.4	0	0	0	0
Spider mites	14.7	6.8	1	20.00	0.0
Trash bugs	39.5	0	0	0	0
Darkling beetle	52.6	10.5	1.0	12.0	0.5
CYSD virus	0	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	51.5	1	6.50
Soil applied insecticide used (Admire Pro, generic imidacloprid, Venom)	21.1	0	40.00

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	26.3	1	5
Soil applied insecticide used (Admire Pro, generic imidacloprid, Venom)	44.4	1	40.00

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	0	0
1A	Vydate	44.4	1	0	0
1B	Diazinon	24.4	1	0	0
1B	Dimethoate	0	0	0	0
1B	Metasystox -R	0	0	0	0
2A	Endosulfan	44.7	1.3	13.2	1
3	Pyrethroids	61.1	1	31.6	1.3
4A	Admire	0	0	21.1	1
4A	Generic imidacloprid	44.4	1	0	0
4A	Venom-soil	0	0	0	0
4A	Venom -foliar	0	0	0	0
4A	Platinum	0	0	0	0
5	Success	4.7	1	34.2	1.5
6	Agrimek	0	0	0	0
9B	Fulfill	0	0	0	0
11B	Bt (i.e. Dipel/Javelin)	44.4	1	21.1	1.0
16	Courier	0	0	0	0
18A	Intrepid	0	0	0	0
23	Oberon	0	0	52.6	1