Impact of Planting Date on Aphid Infestations and Contamination in Head Lettuce

John C. Palumbo

Abstract

The influence of planting dates on aphid population growth in head lettuce was measured over a 5 year period to identify planting windows during the season when lettuce is at risk from aphid infestations. Small, untreated 0.2 acre plantings of head lettuce were established beginning in October with final harvest occurring in April. Plant samples were conducted weekly to estimate the numbers of aphid per plant. Based on these studies, planting date and temperature likely has a strong influence on seasonal abundance and damage caused by aphids. Green peach aphid was the least abundant aphid during the 5 year period, and foxglove aphids appear to be increasing in abundance over the past 3 years. All aphid species have the potential to economically contaminate lettuce, particularly in the November and December planting windows.

Introduction

As key pests of desert lettuce, aphids represent one of the most important insect problems currently facing the industry. Aphids, consisting predominantly of green peach aphid, *Myzus persicae* (GPA), and potato aphids, *Macrosiphum euphorbiae* (PA), are common pests of iceberg lettuce, *Lactuca sativa*, in the western United States. These polyphagous aphid species causes economic damage to lettuce through direct injury, virus transmission, and contamination of heads. Because most Western iceberg lettuce is packed in the field at harvest, it must be relatively free of contamination by aphids and other pests. Another aphid species, *Acyrthosiphom lactucae (AL)*, has been known to infest desert lettuce, but little is know about its population dynamics and damage potential. Over the past several years, aphid populations in commercial fields in the Yuma area have occurred at manageable levels. These declines in aphid populations can largely be attributed to the use of Admire 2F (imidacloprid) soil treatments which provide season-long protection against aphids. However, an important development in the past several years has been the introduction of two new aphid species, the currant-lettuce aphid, *Nasonovia ribisnigri* (LA) and the foxglove aphid, *Aulacorthum solani* (FG) infesting commercial lettuce fields in the Yuma area. Both of these aphid species have the ability to cause economic damage to lettuce, but we are uncertain of their risk during the season. These changes in aphid abundance and potential for establishment of new aphid species found in the Yuma area prompted us to initiate a multiple-year study to examine the population dynamics of these aphid species on winter and spring head lettuce crops in the Yuma Valley of Arizona. Our objective was to measure aphid population growth and contamination in head lettuce in several successive plantings in an attempt to identify planting windows during the season when lettuce is at risk from aphid infestations.

Materials and Methods

To examine the population dynamics and damage potential of aphid species across five planting dates, experimental field plots were established in head lettuce at the University of Arizona, Yuma Agricultural Center. Beginning in mid-October 1999, 0.2 acre plots of head lettuce were planted on 2-3 week intervals. Table 1 provides the planting date and lettuce variety for each planting in each year of the study. On each planting date (wet date) lettuce was direct seeded into double row beds on 42 inch centers. Each planting was subdivided into 4 plots consisting of 4 beds, 150 feet long. Plots were arranged in a randomized complete block design with four replications. No insecticide applications were made during the study.

Aphid populations were assessed by estimating the number of aphids/plant by taking whole plant destructive samples. On each sampling date, 10 plants were randomly selected from each plot and placed individually into large 4-gallon tubs. Each plant was sampled by visually examining all plant foliage and counting the number of alate and apterous aphids present. At harvest, infestation levels of apterous aphids were estimated by randomly selecting 10 plants within each replicate, visually counting the number of aphids on frame/wrapper leaves and heads, and separately recording aphid numbers for each location. Weather data observed from the AZMET station at the Yuma Ag Center was used to examine the influence of temperature and rainfall on foxglove abundance and population growth.

Results and Discussion

Seasonal aphid abundance and timing of infestation for each planting date for the 5 growing seasons is shown in figures 1-4. Population growth and head contamination varied among the species and was influenced in part by weather occurring during each planting (Table 1). Green peach aphid has traditionally been the most abundant and economically important aphid species infesting desert lettuce. However, GPA occurred only sporadically during the first four years of this study (Figure 1). Last season though, GPA reached very high population levels in the October plantings, and crashed with the high temperatures that occurred in March. Economic head contamination by GPA was recorded only in the 30 October planting date (Table 1). Based on a summary of the past 5 years, the lettuce crops at most risk from GPA were during the late-October and early-November planting windows (Table 2).

PA and AL aphids have varied in abundance among planting dates over the past 5 years (Figure 2). Similarly they varied in abundance from year to year, peaking in the spring of 2003. Head contamination by PA and AL was only observed in 2001 and 2003 (Table 1). Last season, PA and AL infestations were extremely light showing up in the late Oct planting at sub-threshold densities. Similarly, head contamination by these species was not economic in 2004. Overall these species appear to be most abundant in the late-November and December plantings (Table 3). LA was first observed in the Yuma area and in our studies in 1999. Since then they have been sporadically abundant during each year (Figure 3). However, LA infestations were quite damaging to heads in the spring 2003 plantings, and almost exclusively in the December plantings (Table 1). Because this aphid species tends to prefer higher temperatures, the lettuce plantings that are seeded in December and harvested in March appear to be at most risk from LA (Table 4).

FG aphids first appeared in our lettuce trials 3 years ago and have continued to increase their abundance in each successive season (Figure 4). Their numbers were quite high during the 2003 season and appeared to be increasing to even higher numbers in 2004, but declined in the later plantings due to the high temperatures we experienced in March. Based on the limited 3 years of data, this species has the potential to cause economic contamination of heads in November and December plantings (Table 1) and consequently, appears to have the potential to be at risk to lettuce crops planted during November and December (Table 5).

In conclusion, the data generated from this study clearly demonstrates that a multiple complex of economic aphid species occurs in desert lettuce. This complex is capable of causing economic damage through contamination to lettuce heads in direct seeded plantings from late October through December. Because aphid abundance and timing of infestations varies from species to species, proper identification will be important for management. This is due in part because aphid susceptibility to different classes of insecticides varies between species. In addition, it is further recommended that growers should begin applying soil systemic insecticides such as Admire (imidacloprid) for aphid control beginning in late October and continuing until planting is over in December.

Acknowledgments

The information provided in this report would not have been possible without the funding and support provided by the *Arizona Iceberg Lettuce Research Council*. Thanks also to Louis Didier, *Select Seed Co*., for providing the seed used in all of these studies. I gratefully acknowledge the excellent assistance from the personnel at the Yuma Agricultural Center including Clay Mullis, Andreas Amaya, Luis Ledesma, Leonardo Chavez, Javier Ruiz and Gerardo Villegas.

Figure 1. Green peach aphid populations in head lettuce in 5 plantings each year from 1999-2004.

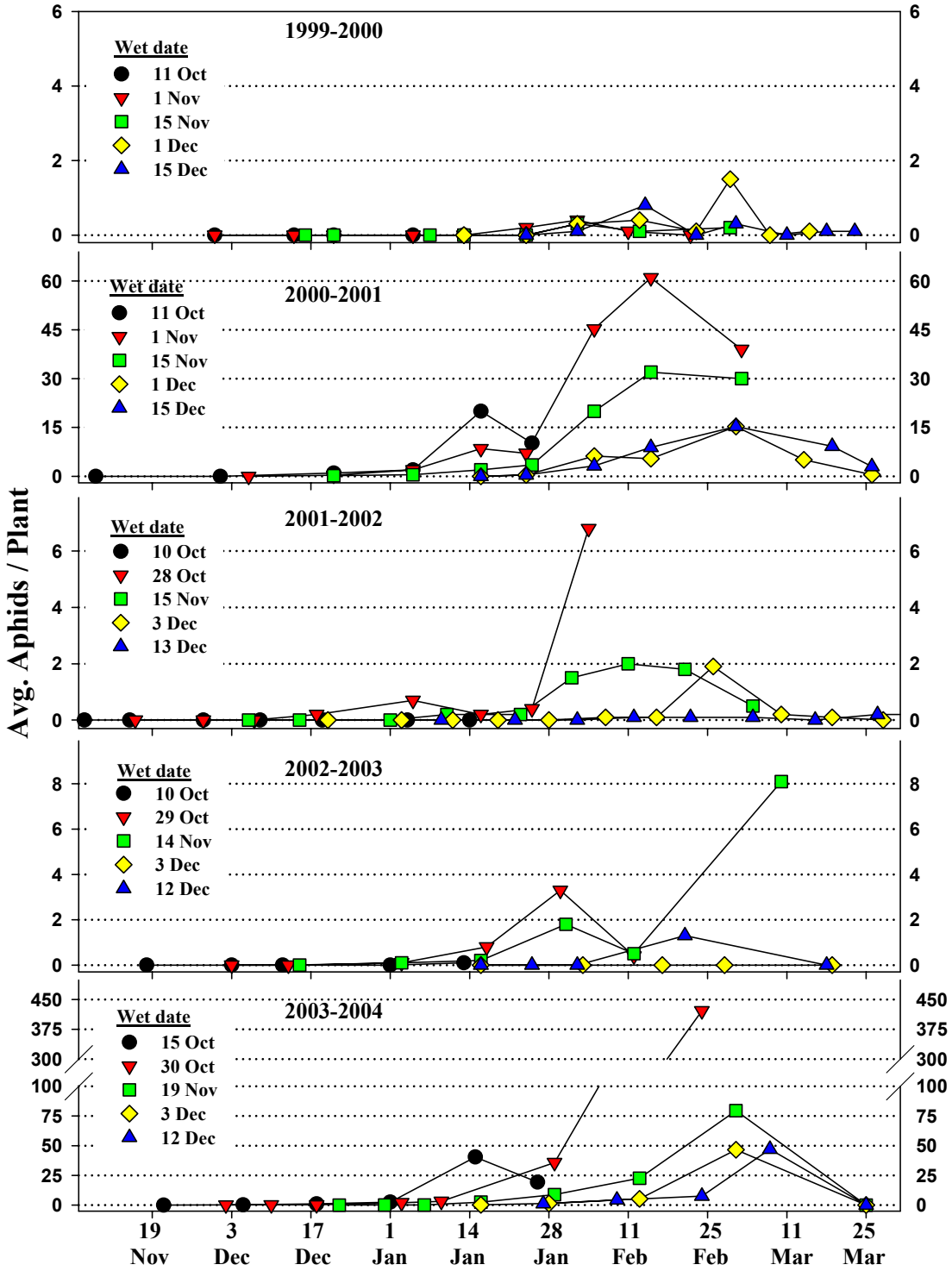

Figure 2. Potato aphid/*Acyrthosiphon lactucae* populations in head lettuce each year in 5 plantings from 1999-2004.

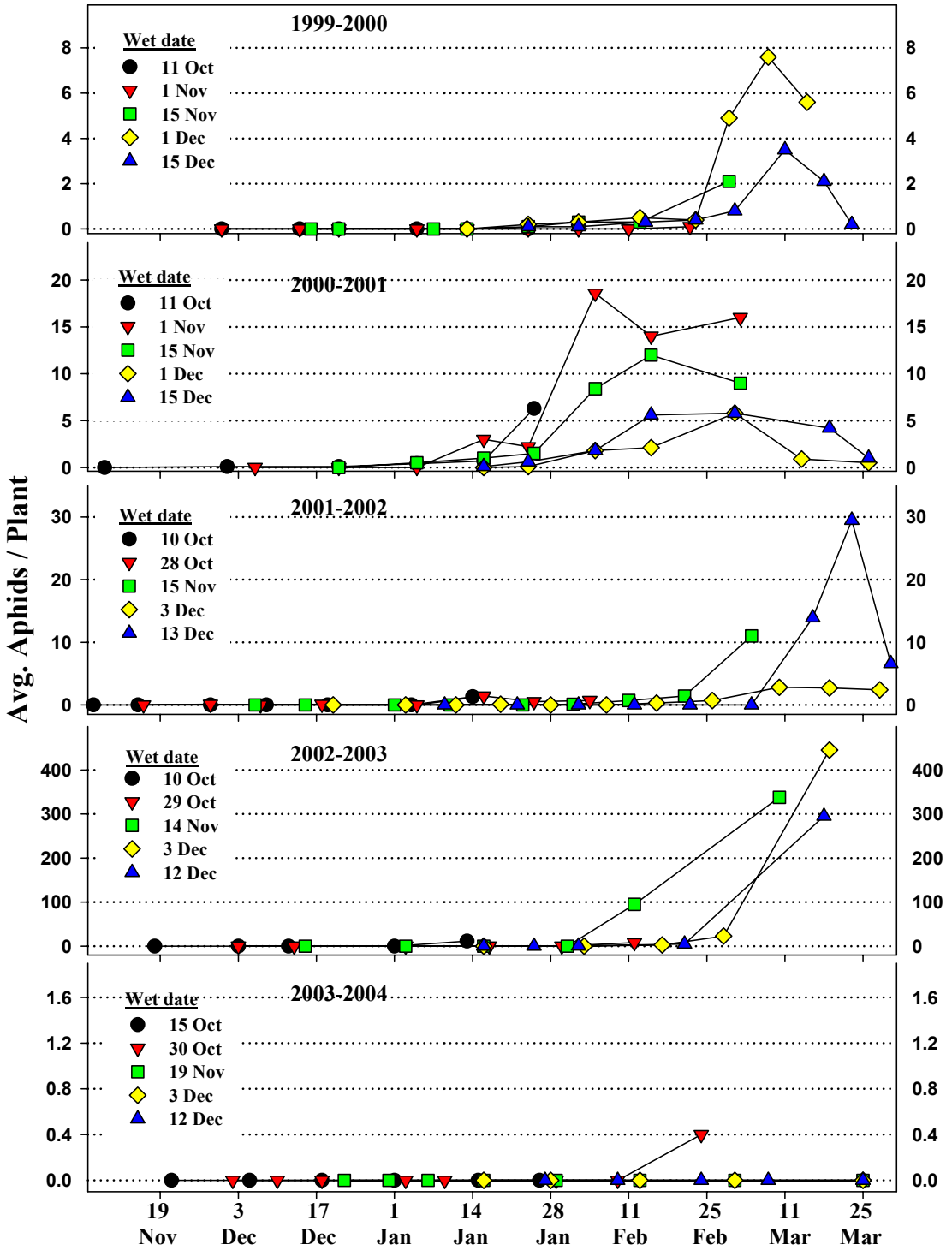

Figure 3. Lettuce aphid populations in head lettuce in 5 plantings each year from 1999-2004.

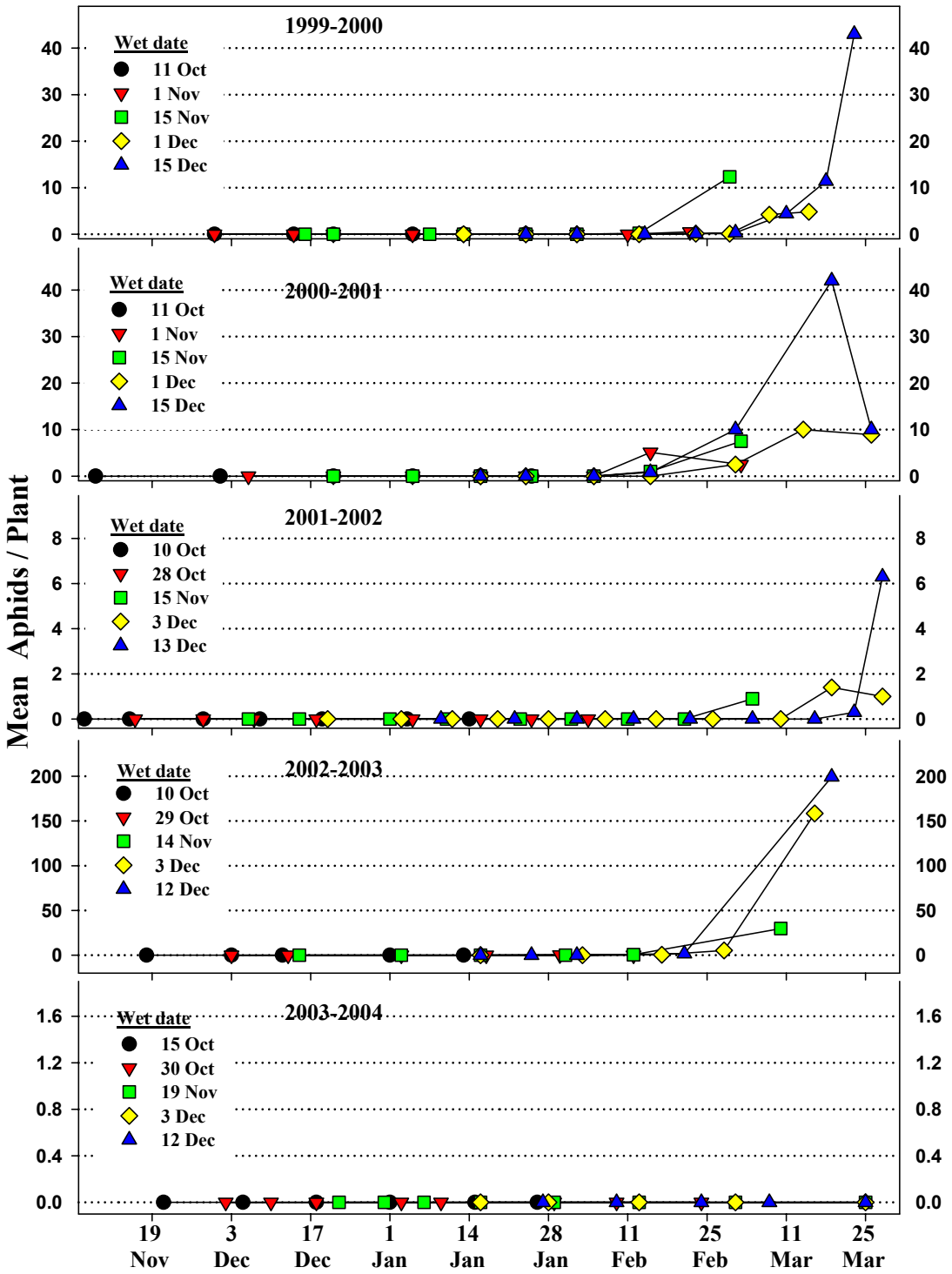

Figure 4. Foxglove aphid populations in head lettuce in 5 plantings each year from 1999-2004.

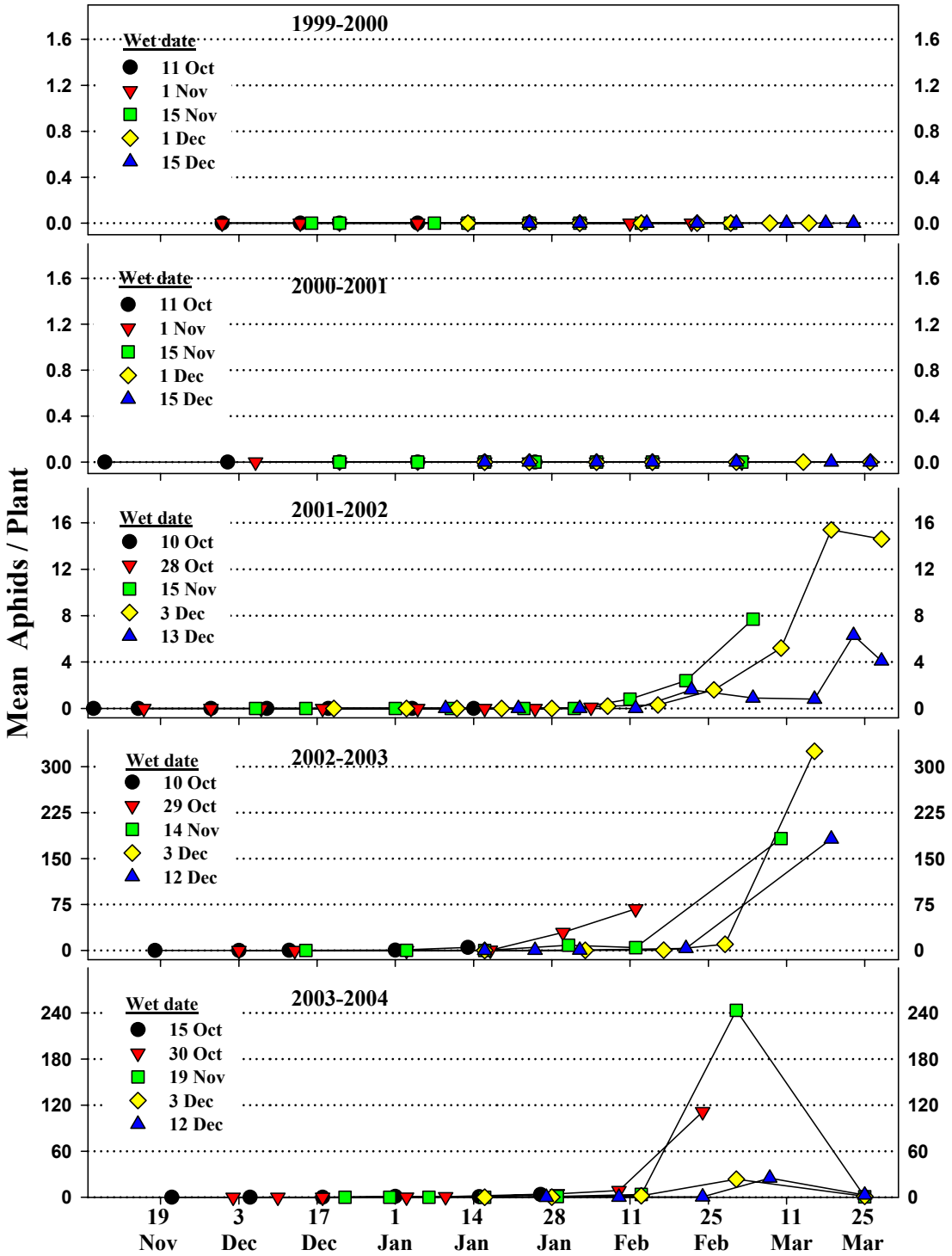

Table. 1 Aphid Contamination levels in lettuce heads and frame leaves at harvest in 5 plantings each growing season from 1999-2004.

								Mean Apterous Aphids / Plant at Harvest					
				Temperature (ºF)			Rain	Green Aphid Complex [a]		Lettuce Aphid		Foxglove Aphid	
Season	Wet date	Harvest	Variety	Max	Min	Avg	(inch.)	Head	Frame	Head	Frame	Head	Frame
1999-2000	11-Oct	24-Jan	*Grizzley*	*81*	48	64	0	0	0	0	0	-	-
	1-Nov	20-Feb	*Wolverine*	*75*	45	58	0.1	0	0	0	0	-	-
	15-Nov	1-Mar	*Del Rio*	*75*	45	59	0.1	1.3	0.6	12.3	0	-	-
	1-Dec	23-Mar	*Jackel*	*73*	44	60	0.3	0.3	0.3	8.2	0.5	-	-
	15-Dec	23-Mar	*Diamond*	*74*	45	60	0.3	0.2	0.1	42.9	0.6	-	-
2000-2001	11-Oct	25-Jan	*Grizzley*	*74*	50	61	1.2	2	14.4	0	0	-	-
	1-Nov	2-Mar	*Wolverine*	*70*	45	57	1.16	15.2	38.5	5.1	0	-	-
	15-Nov	3-Mar	*Del Rio*	*70*	44	56	1.12	8.5	42.6	6.5	0.9	-	-
	1-Dec	26-Mar	*Jackel*	*72*	46	58	2.9	2.6	12.9	9.6	0.4	-	-
	15-Dec	26-Mar	*Diamond*	*73*	47	59	2.9	0.3	3.0	8.2	0.6	-	-
2001-2002	10-Oct	14-Jan	*Wolverine*	*78*	49	63	0.1	0	0	0	0	0	0
	28-Oct	4-Feb	*Grizzley*	*72*	44	58	0	0	2.3	0	0	0.3	0
	15-Nov	5-Mar	*Wolverine*	*74*	44	58	0	0.5	7.1	0	0	0	0.1
	3-Dec	22-Mar	*Diamond*	*72*	41	57	0	3.6	7.9	1.1	0.1	1.4	6.3
	13-Dec	6-Apr	*Diamond*	*73*	42	57	0	1.0	1.5	6.3	0.4	11.7	2.9
2002-2003	10-Oct	14-Jan	*Winterhaven*	*77*	47	59	0.03	0.4	3.5	0	0	0.5	3.4
	29-Oct	12-Feb	*Winterhaven*	*74*	45	59	1.27	1.1	6.9	0	0	2.4	48.1
	14-Nov	9-Mar	*Bubba*	*73*	45	59	1.27	96.6	244.6	44.7	16.4	33.9	150.9
	3-Dec	18-Mar	*Diamond*	*73*	44	58	1.23	105.5	345.6	145.7	21.4	125.9	201.3
	12-Dec	18-Mar	*Diamond*	*74*	45	59	1.23	126.2	170.9	182.2	18.9	81.8	101.0
2003-2004	15-Oct	26-Jan	*Honcho*	*75*	47	61	0.46	3.6	12.7	0	0	0.8	2.9
	30-Oct	24-Feb	*Bubba*	*70*	46	56	0.46	149.7	272.8	0	0	21.0	90.4
	19-Nov	16-Mar	*Coach Suprem*	*70*	43	56	0.36	0	0	0	0	0.7	0
	3-Dec	25-Mar	*Diamond*	*73*	44	58	0.36	0	0	0	0	1.3	0
	12-Dec	25-Mar	*Diamond*	*74*	45	59	0.36	0	0	0	0	2.2	0.4

[a] Green aphid complex consisting of *Acyrthosiphon lactucae* , potato aphid and green peach aphid

Table 2. Seasonal Avg. Green peach aphids/plant

Season	Wet date					5 Yr Avg
	11-Oct	30-Oct	15-Nov	3-Dec	15-Dec	
1999-2000	0.0	0.1	0.1	0.3	0.2	0.1
2000-2001	5.5	20.4	12.6	4.7	5.7	9.8
2001-2002	0.0	1.0	0.7	0.2	0.1	0.4
2002-2003	0.0	0.8	1.8	0.0	0.3	0.6
2003-2004	15.8	117.0	23.0	10.6	12.0	**35.7**
Avg	4.3	**27.9**	7.6	3.2	3.7	

Table 3. Seasonal Avg. Potato aphids[a]/plant

Season	Wet date					5 Yr Avg
	11-Oct	30-Oct	15-Nov	3-Dec	15-Dec	
1999-2000	0.0	0.1	2.5	3.5	1.0	1.8
2000-2001	1.3	6.7	4.6	1.6	2.7	3.4
2001-2002	0.2	0.4	1.5	0.8	5.6	1.7
2002-2003	2.3	1.4	72.2	94.2	60.1	**46.0**
2003-2004	0.0	0.1	0.0	0.0	0.0	0.0
Avg	0.8	2.2	16.2	**20.0**	13.9	

[a] includes *Acrythosiphum lactucae* populations

Table 4. Seasonal Avg. Lettuce aphids/plant

Season	Wet date					5 Yr Avg
	11-Oct	30-Oct	15-Nov	3-Dec	15-Dec	
1999-2000	0.0	0.1	1.6	1.2	4.4	1.8
2000-2001	0.0	1.0	1.2	3.1	9.1	2.9
2001-2002	0.0	0.0	0.9	0.2	0.7	0.4
2002-2003	0.0	0.1	5.1	32.8	40.2	**15.6**
2003-2004	0.0	0.0	0.0	0.1	0.5	0.1
Avg	0.0	0.3	1.8	7.5	**11.0**	

Table 5. Seasonal Avg. Foxglove aphids[b]/plant

Season	Wet date					5 Yr Avg
	11-Oct	30-Oct	15-Nov	3-Dec	15-Dec	
1999-2000	-	-	-	-	-	
2000-2001	-	-	-	-	-	
2001-2002	0.0	0.1	1.2	14.6	1.5	3.5
2002-2003	1.1	16.3	32.6	67.1	37.2	**30.9**
2003-2004	1.4	25.1	49.8	5.6	5.7	17.5
Avg	0.8	13.8	**27.9**	**29.1**	14.8	

[b] foxglove aphids not reported prior to the 2001-2002 season