

RUTGERS COOPERATIVE EXTENSION

NEW JERSEY AGRICULTURAL EXPERIMENT STATION

AGRICULTURAL PESTICIDE USE IN NEW JERSEY

An Assessment of the Pesticides Applied on IPM Grown Field Crops During 1991

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Executive Summary:

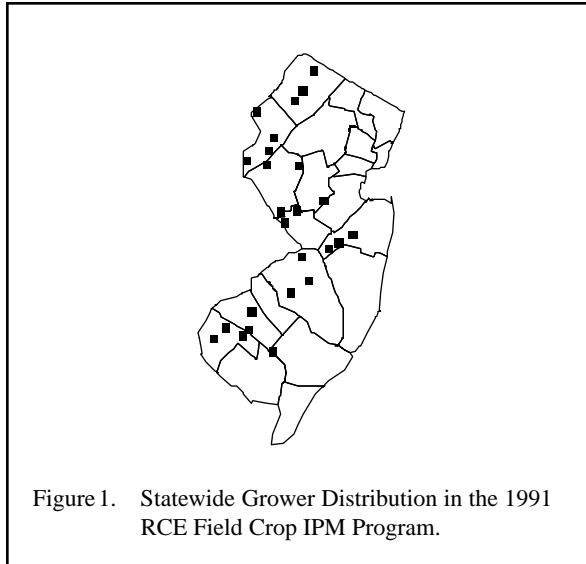
Field crops are of major importance in New Jersey. The importance of field crops as viable commodities is evidenced by their number one ranking in terms of acreage, and number two ranking in cash receipts. Corresponding to its high acreage, is the potential for the use of large amounts of pesticides. This potential high usage, however, should be diminished through the use of IPM programs in various field crops. This study proposed to collect pesticide use, acreage, and yield data for corn, alfalfa and soybeans produced using IPM during the 1991 growing season. To accomplish this, the on-going Rutgers Cooperative Extension (RCE) Field Crop IPM Program was utilized. This program is ideal for this type of data collection because participating growers account for a major portion of the corn, soybeans and alfalfa acreage grown in the state under IPM conditions. Logistically, they are distributed throughout the state and are representative of most growing conditions and use practices within the state.

Data collected from these farms included total acreage planted, pests encountered, and pesticides used to control pests (timing, number of applications, method of application, rates, acreage treated, etc.).

During 1991, 41 growers participated in the RCE Field Crop IPM Program encompassing 1,645, 2,514 and 147 acres of alfalfa, field corn and soybeans, respectively. Twenty eight varieties of alfalfa, 42 varieties of field corn, and 3 varieties of soybeans were grown. The average grower acreage grown for alfalfa was 38.5 acres of alfalfa and 58.1 acres of field corn. The majority of the soybean acreage (116 acres) reported was grown by one grower.

The most numerous insect pests found were potato leafhopper adults and nymphs, alfalfa weevil adults and lepidopteran larvae in alfalfa. For field corn the highest densities were seen for armyworms, Northern corn rootworm and Western corn rootworm. No significant pest injury was observed in soybeans during the season. Of the major pests observed, only potato leafhopper adults and nymphs reached levels above economic threshold levels. On the basis of this, these insects should have been the only pests treated. Examination of application records revealed this to be the case for alfalfa, however applications were made to field corn for rootworm and cutworm control. This suggests that while overall farm densities did not warrant control measures, individual fields may have. Most of the acreage in the program was also treated with a herbicide at some time during the season.

Overall, 6,206 lbs a.i. of pesticide were applied during 1991. The bulk of this consisted of herbicides. In alfalfa, however, insecticides actually accounted for more use of material than herbicides. Carbofuran use for leafhopper control was the predominant material used followed by dimethoate and chlorpyrifos. The major herbicides used were hexazinone and EPTC. In field corn, approximately 10 times the amount of herbicide was applied than insecticides. An atrazine and metolachlor combination made up the bulk of this usage, followed by cyanazine, dicamba, metolachlor and atrazine. For insecticides, in order of usage, carbofuran, terbufos chlorpyrifos and permethrin were applied for rootworm control. Permethrin was used by one grower for cutworm control. Herbicides were the only materials applied to soybeans during 1991. The material most applied was alachlor followed by linuron as either a liquid or wettable powder.



Pest Information

The pest information collected from all farms varied considerably throughout the season. The overall insect mean densities for all farms is presented in Figure 2. Throughout the season six major pests were evident on all farms. For alfalfa, these included alfalfa weevil adults, potato leafhopper adults, potato leafhopper nymphs, general lepidopteran larvae (green clover worm, pyralid larvae, and alfalfa caterpillar), and corn earworm. In field corn, armyworms, and both northern and western corn rootworms were the major pest species observed. No significant damage in terms of total percent defoliation was found in soybeans.

On the basis of these densities, pesticide treatments were only necessary for one insect species, potato leafhopper. This insect reached threshold densities (Table 3) twice during the season overall and would have required treatments only at those times.

This trend is similar if each individual farm is examined (Figs 3-13). Potato leafhopper adults or nymphs reached threshold densities on 25 of the 41 farms sampled. Of these 25 farms, 16 called for a single application of an insecticide, 4 required 2 applications, 4 needed 3 applications, and 1 should have received 5 applications.

Although present, no other insects were sampled for in alfalfa, field corn or soybeans reached economic densities on any farm. For farms growing alfalfa, alfalfa weevil adults were present on 36 farms. Farm 10 had the highest levels at 0.65 adults per stem early in the season, while all other farms never reached levels above 0.5 adults per stem. Lepidopteran larvae were observed on 10 farms and never reached levels greater than 0.5 larvae per sweep. Corn earworm larvae alone were found on 14 farms at levels well below threshold densities of 7 larvae per sweep. In field corn, armyworm larvae were collected on 3 farms at levels below 1% infested plants. Seventeen farms had populations of Western and Northern corn rootworms. Sixteen of these in each case had both species while 1 farm had one or the other species. In all cases, populations of either species never obtained densities above 0.3 individuals per plant.

Table 1. Total Acreage Grown and Treated by Crop in the 1991 Field Crop IPM Program.

Variety	Acres		Variety	Acres	
	Grown	Treated		Grown	Treated
Alfalfa					
-----	311.0	287.5	Doblers 57X	76.2	76.2
Agway	81.5	81.5	Doblers 57XP	39.0	39.0
Agway Centurion	34.0	34.0	Doblers 57XT	13.5	13.5
All Star	21.0	21.0	Doblers 63XP & 69XP	6.0	6.0
All Star Stanford	21.0	21.0	Doblers 66S6	11.2	11.2
Centurion	204.4	180.5	Doblers 66XP	72.0	72.0
Cimmaron	8.5	8.5	Doblers 66XP & 69XP	31.8	31.8
Commandor	4.0	4.0	Doblers 69	12.0	12.0
DeKalb	40.0	40.0	Doblers 75	4.0	4.0
DeKalb 122	42.0	42.0	Doblers 75 & 84	22.0	22.0
Doblers	20.0	3.0	Doblers 75X	75.0	75.0
Doblers President	34.0	34.0	Doblers 75X	237.2	224.2
Doblers Star Master	26.0	26.0	Doblers 84XP	40.0	40.0
Excalibur	116.0	116.0	Funk	178.5	178.5
Funks 2852	82.0	72.0	Funk 4626	115.0	115.0
Funks 2852 4A Centurion	82.0	72.0	Jaque's 7900	137.0	137.0
Hoffman 2852	40.0	40.0	Lynx 2711	15.0	15.0
Jake's Chief	31.5	31.5	Lynx 2810	20.0	20.0
Ken Grow Procut	81.0	81.0	Pioneer	396.6	396.6
Maxum	21.9	0.0	Pioneer 3140	15.0	15.0
Medistan	90.0	78.2	Pioneer 3241	20.2	20.2
Mohawk	64.0	60.0	Pioneer 3295	6.0	6.0
Pinnacle	28.3	28.3	Pioneer 3343	275.8	273.8
Pioneer	9.0	9.0	Pioneer 3379	106.6	106.6
Pioneer 3241	42.5	42.5	Pioneer 3429	45.2	45.2
Pioneer 532	40.5	40.5	Pioneer 3429 & 3540	7.2	7.2
Pioneer 5331	33.0	33.0	Pioneer 3527	60.0	60.0
WL 320	36.0	36.0	Pioneer 3527 & Agway 658	40.0	40.0
-----			Pioneer 3529	27.0	27.0
Total	1645.1	1523.0	Pioneer 3540	19.8	19.8
			Pioneer 3592	46.0	46.0
Corn			Pioneer 4231	33.0	33.0
Agway 510	17.0	17.0	Pioneer 4382	27.0	18.0
Agway 658	18.0	18.0	-----		
Agway 7088	35.0	35.0	Total	2513.8	2481.3
Agway 817 & Funk 4543	78.0	69.5			
Dekalb 582	79.0	79.0	Soybeans		
Dekalb 636	8.0	8.0	-----	100.6	100.6
Dekalb 636 & Agway 658	6.0	6.0	Commandor	25.0	25.0
Dobler 63XP	27.0	27.0	Williams	21.0	21.0
Doblers	15.0	15.0	-----		
-----			Total	146.6	146.6

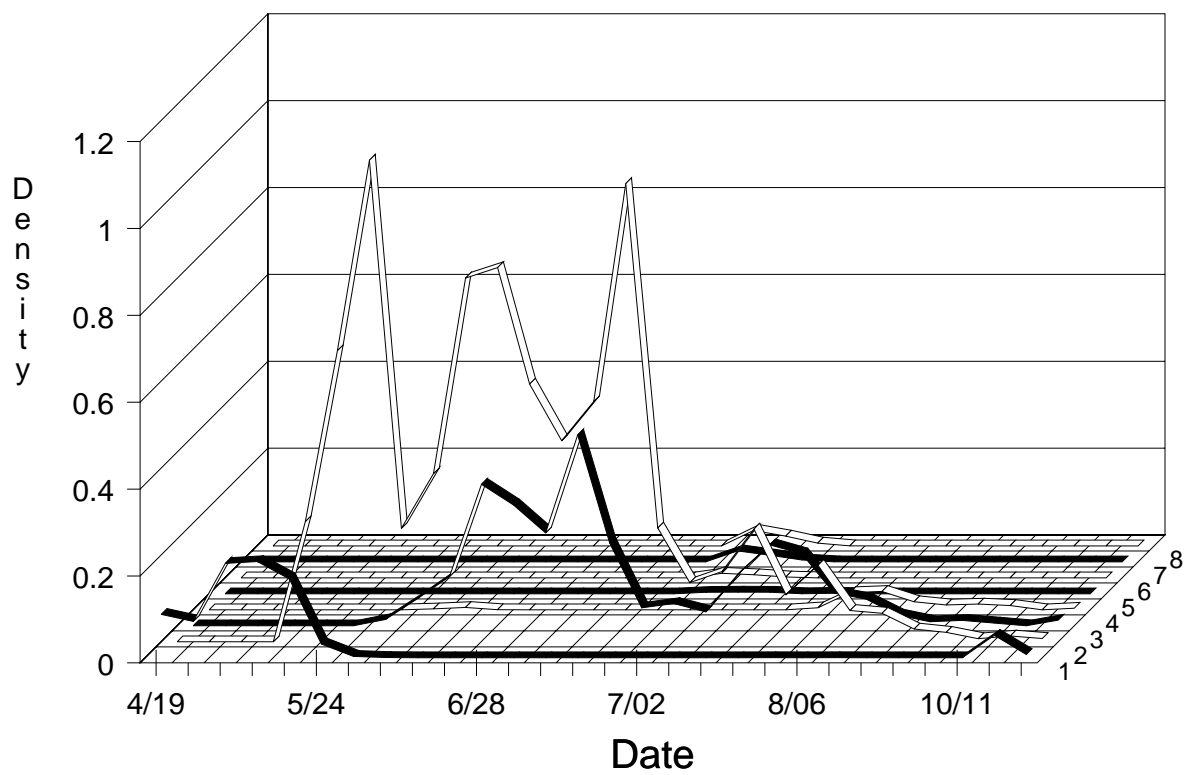


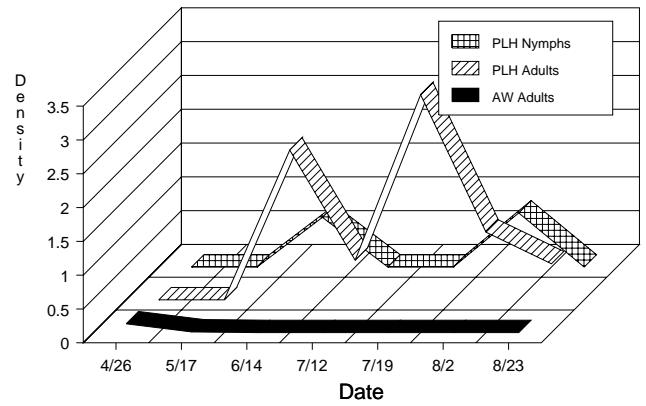
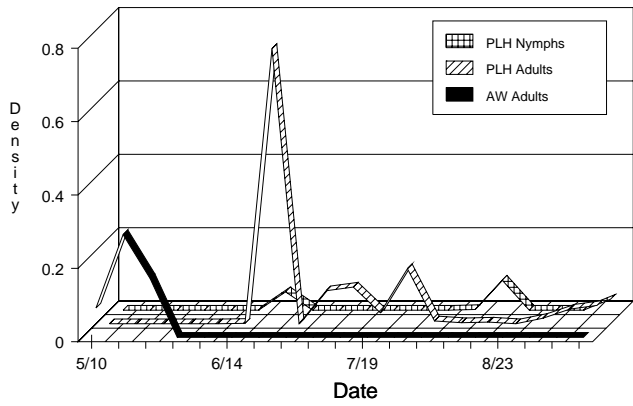
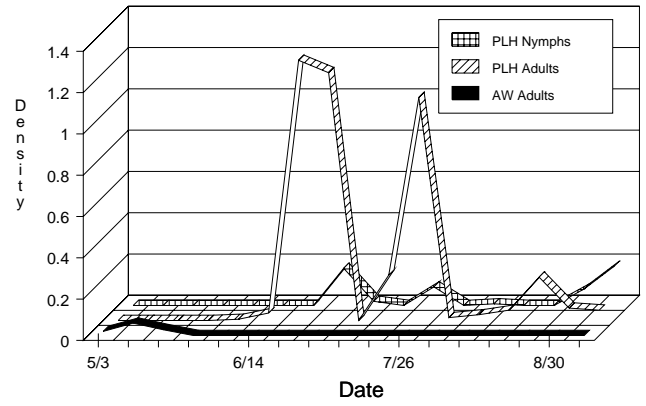
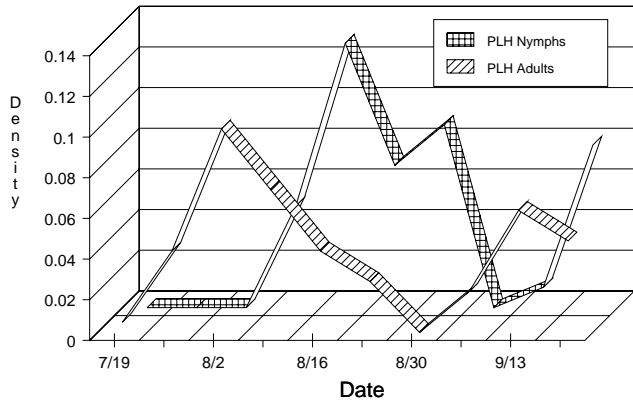
Figure 2. Overall mean densities for the major pests found in alfalfa and field corn during 1991 (alfalfa: 1 - alfalfa weevil adults, 2/3- potato leafhopper adults/nymphs, 4 - total lepidopteran larvae, 6 - corn earworm; field corn: 5 - armyworm, 7- Northern corn rootworm, 8 - Western corn rootworm).

Table 2. Crop Acreage by Grower.

Grower ID	Acres		
	Alfalfa	Corn	Soybean
1	123.0	0.0	0.0
2	28.0	38.0	0.0
3	9.0	462.8	0.0
4	—	—	—
5	—	—	—
6	30.0	0.0	30.0
7	0.0	352.0	0.0
8	86.0	0.0	0.0
9	—	—	—
10	82.0	0.0	0.0
11	0.0	68.0	0.0
12	12.0	0.0	0.0
13	—	—	—
14	9.0	16.0	0.0
15	45.5	0.0	0.0
16	183.3	0.0	0.0
17	162.1	180.0	0.0
18	117.5	126.5	0.0
19	33.0	0.0	0.0
20	—	—	—
21	—	—	—
22	72.0	174.0	0.0
23	105.0	42.0	0.0
24	—	—	—
25	—	—	—
26	—	—	—
27	43.0	15.0	0.0
28	92.5	0.0	0.0
29	38.9	93.1	0.0
30	—	—	—
31	64.0	78.0	0.0
32	105.0	194.0	0.0
33	55.3	289.1	0.0
34	1.5	0.0	0.0
35	0.0	137.0	0.0
36	—	—	—
37	8.0	0.0	0.0
38	—	—	—
39	—	—	—
40	3.0	15.8	116.6
41	69.5	101.0	0.0

Table 3. Economic thresholds for the pests sampled in alfalfa, field corn and soybeans during 1991.

Species	Threshold
alfalfa	
alfalfa weevil	1 larvae per stem
potato leafhopper	1 per sweep at 10" of stand height
green clover worm	7 per sweep
corn earworm	7 per sweep
pyralid larvae	7 per sweep
alfalfa caterpillar	7 per sweep
field corn	
cutworm	3 to 5% damage
armyworm	35% infested plants
Northern corn rootworm	1 per plant
Western corn rootworm	1 per plant
soybean	
Japanese beetle, grasshoppers	prebloom - 40% damage
spider mites and Mexican bean beetle	bloom - 25% damage
bean beetle	post bloom - 40% damage



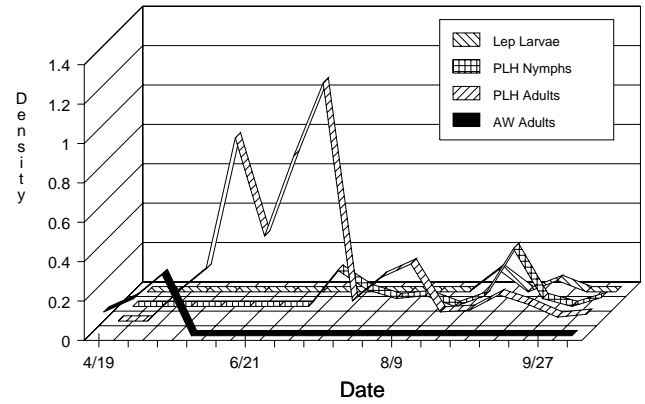
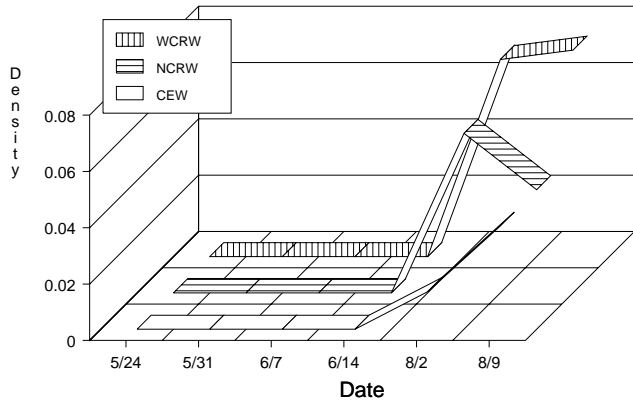
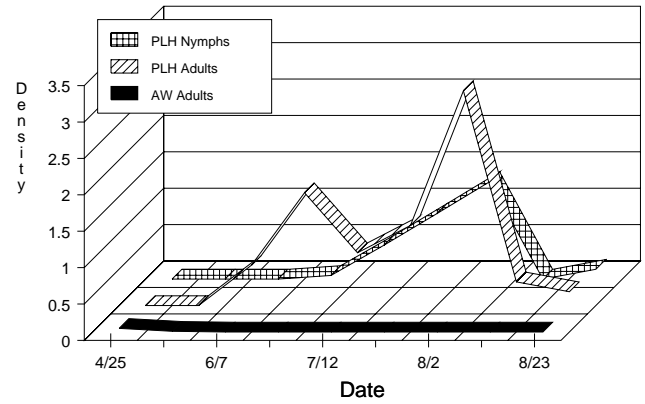
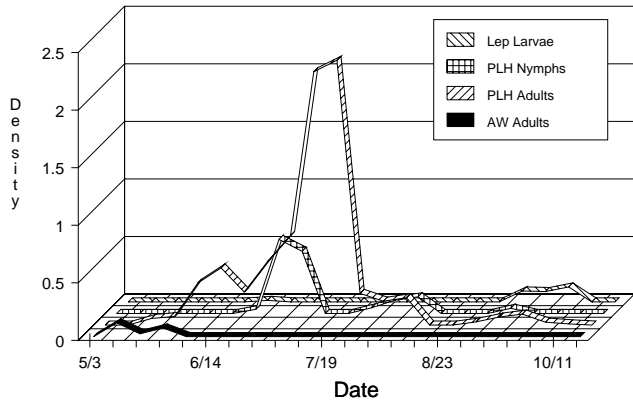
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Figure 3. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farms 1 (A) to 4 (D) (alfalfa: AW Adults - alfalfa weevil adults, PLH Adults/Nymphs - potato leafhopper adults/nymphs).



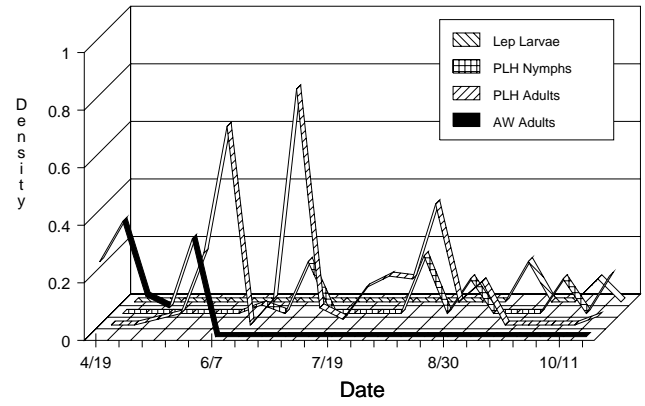
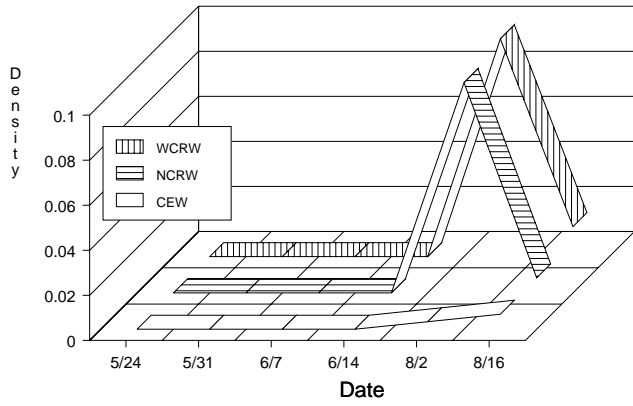
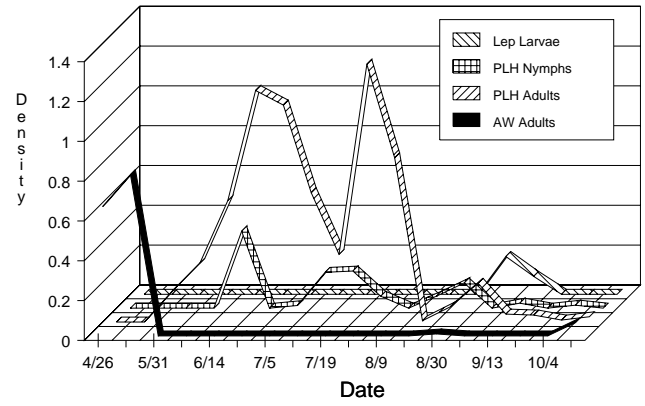
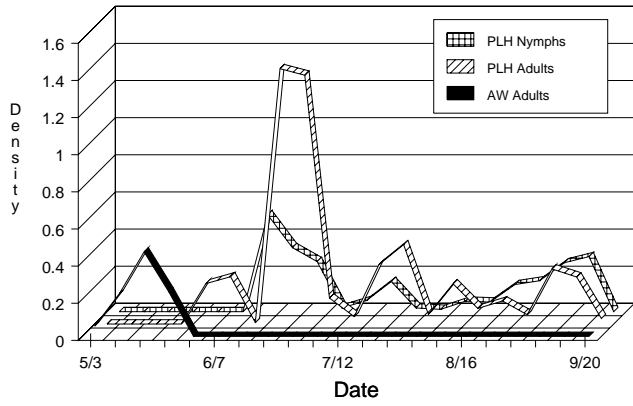
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Figure 4. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farms 5 (A) to 8 (D) (alfalfa: AW Adults - alfalfa weevil adults, Lep Larvae - total lepidopteran larvae, PLH Adults/Nymphs - potato leafhopper adults/nymphs, CEW - corn earworm; field corn: NCRW - Northern corn rootworm, WCRW - Western corn rootworm).



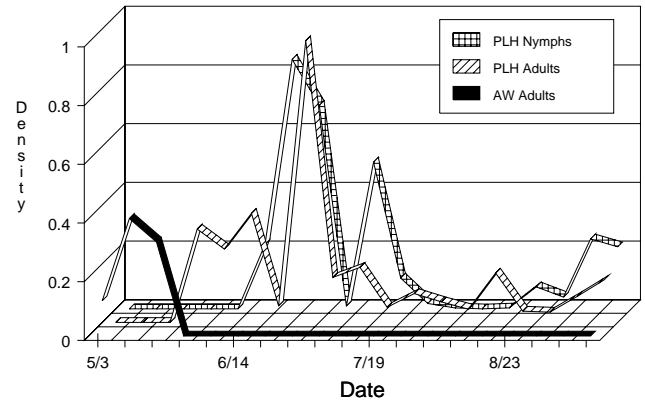
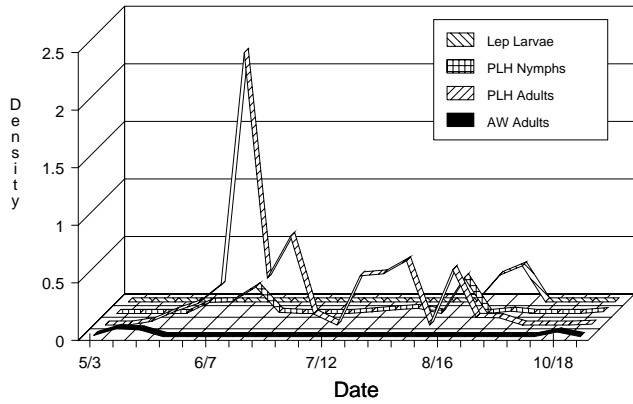
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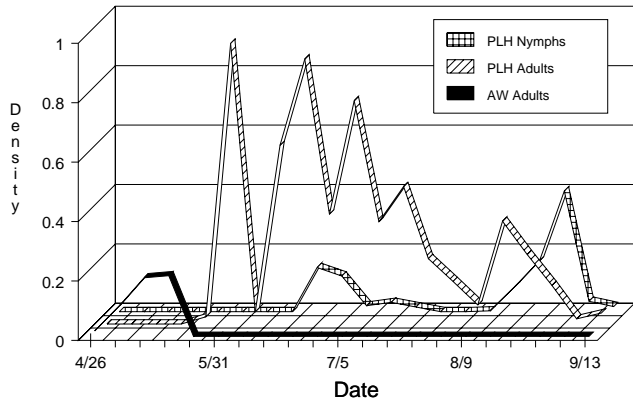
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Figure 5. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farms 9 (A) to 12 (D) (alfalfa: AW Adults - alfalfa weevil adults, Lep Larvae - total lepidopteran larvae, PLH Adults/Nymphs - potato leafhopper adults/nymphs, CEW - corn earworm; field corn: NCRW - Northern corn rootworm, WCRW - Western corn rootworm).

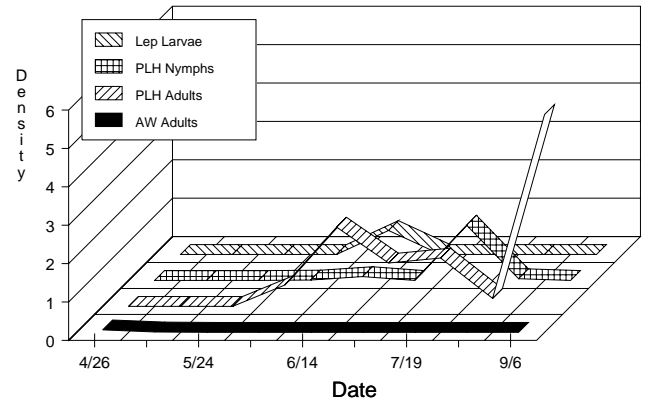


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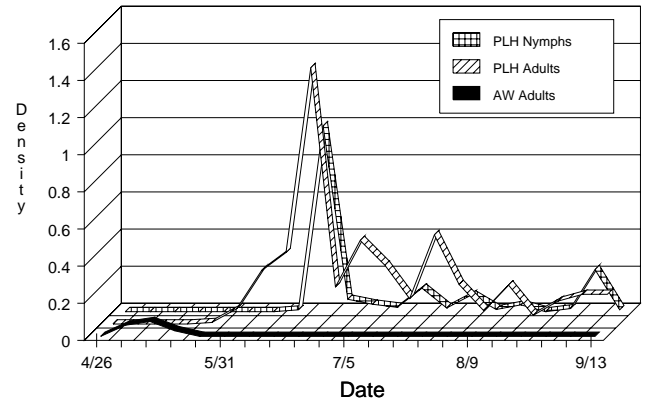
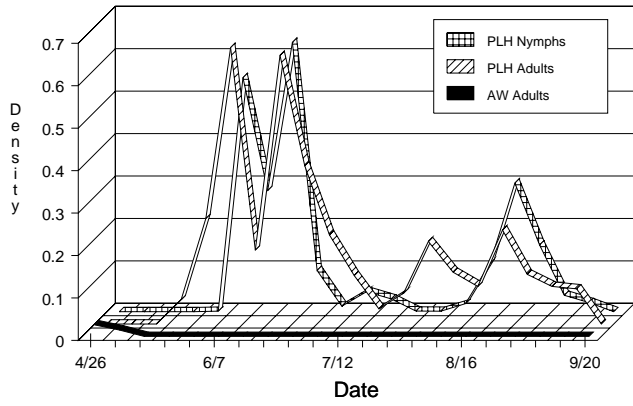


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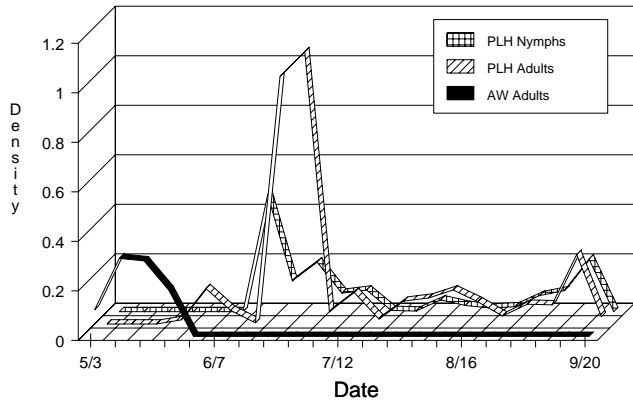
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Figure 6. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farms 13 (A) to 16 (D) (alfalfa: AW Adults - alfalfa weevil adults, Lep Larvae - total lepidopteran larvae, PLH Adults/Nymphs - potato leafhopper adults/nymphs).

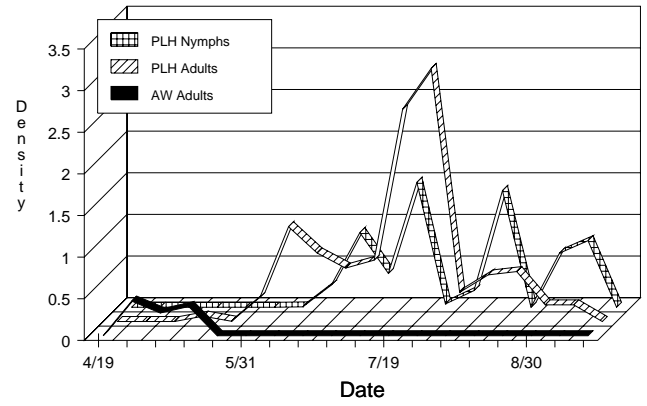


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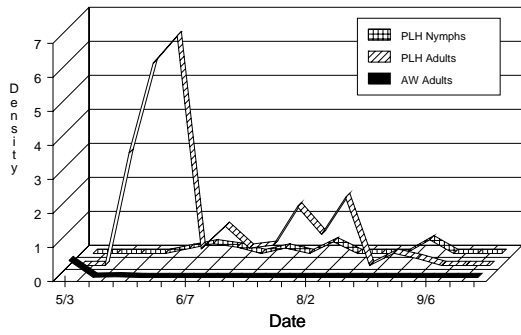


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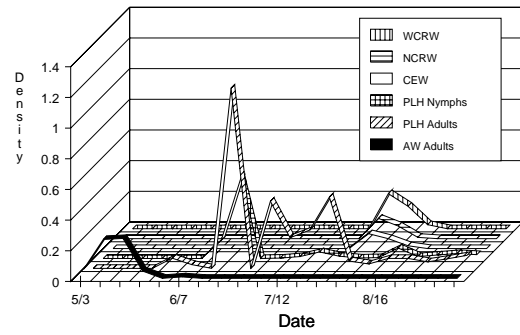


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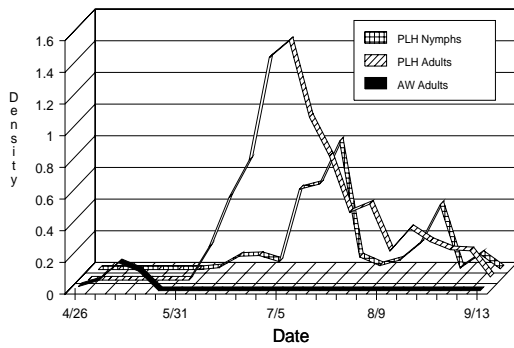
Figure 7. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farms 17 (A) to 20 (D) (alfalfa: AW Adults - alfalfa weevil adults, PLH Adults/Nymphs - potato leafhopper adults/nymphs).



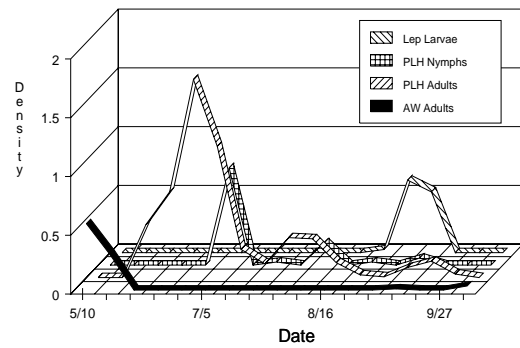
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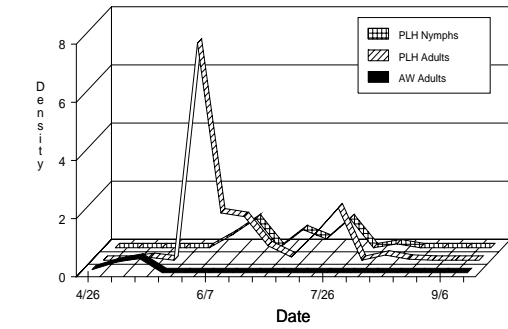


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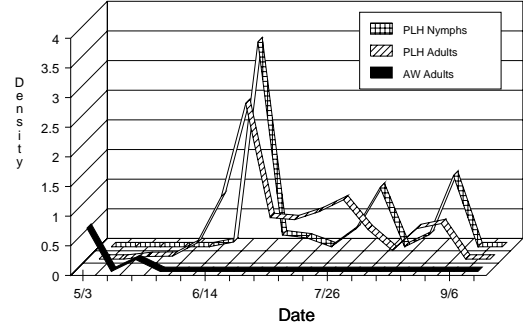


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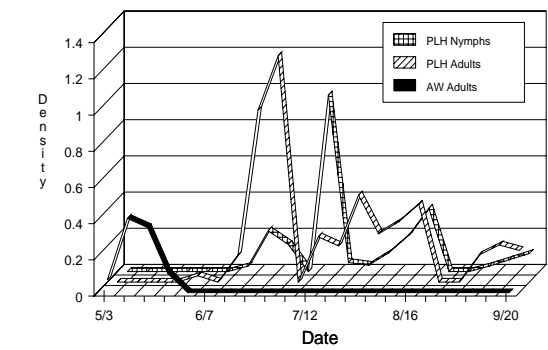
Figure 8. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farms 21 (A) to 24 (D) (alfalfa: AW Adults - alfalfa weevil adults, PLH Adults/Nymphs - potato leafhopper adults/nymphs, Lep Larvae - Lepidopteran Larvae, CEW - corn earworm; field corn: WCRW - Western corn rootworm, NCRW - Northern corn rootworm).



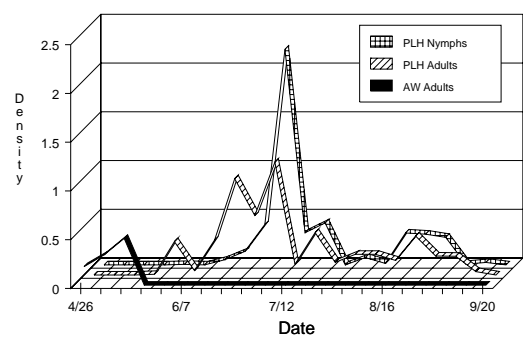
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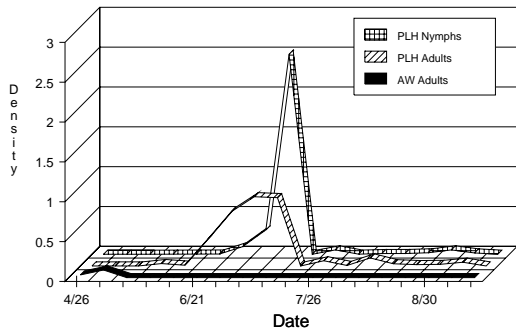


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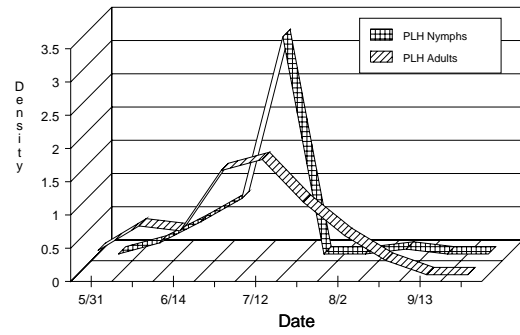


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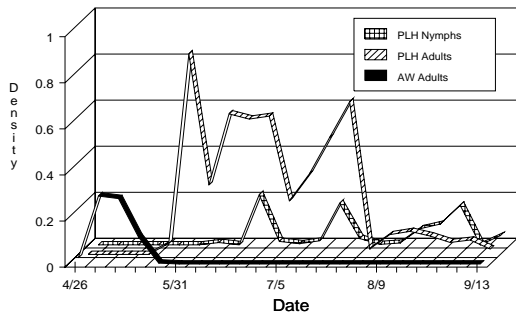
Figure 9. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farms 25 (A) to 28 (D) (alfalfa: AW Adults - alfalfa weevil adults, PLH Adults/Nymphs - potato leafhopper adults/nymphs).



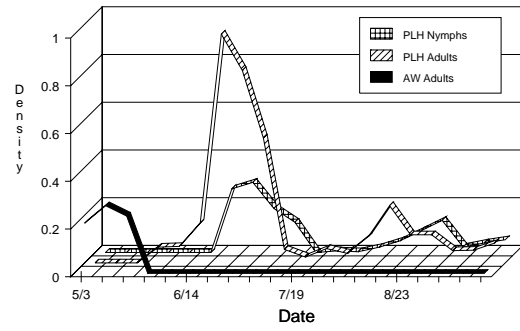
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Figure 10. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farms 29 (A) to 32 (D) (alfalfa: AW Adults - alfalfa weevil adults, Lep Larvae - total lepidoptern larvae, PLH Adults/Nymphs - potato leafhopper adults/nymphs).

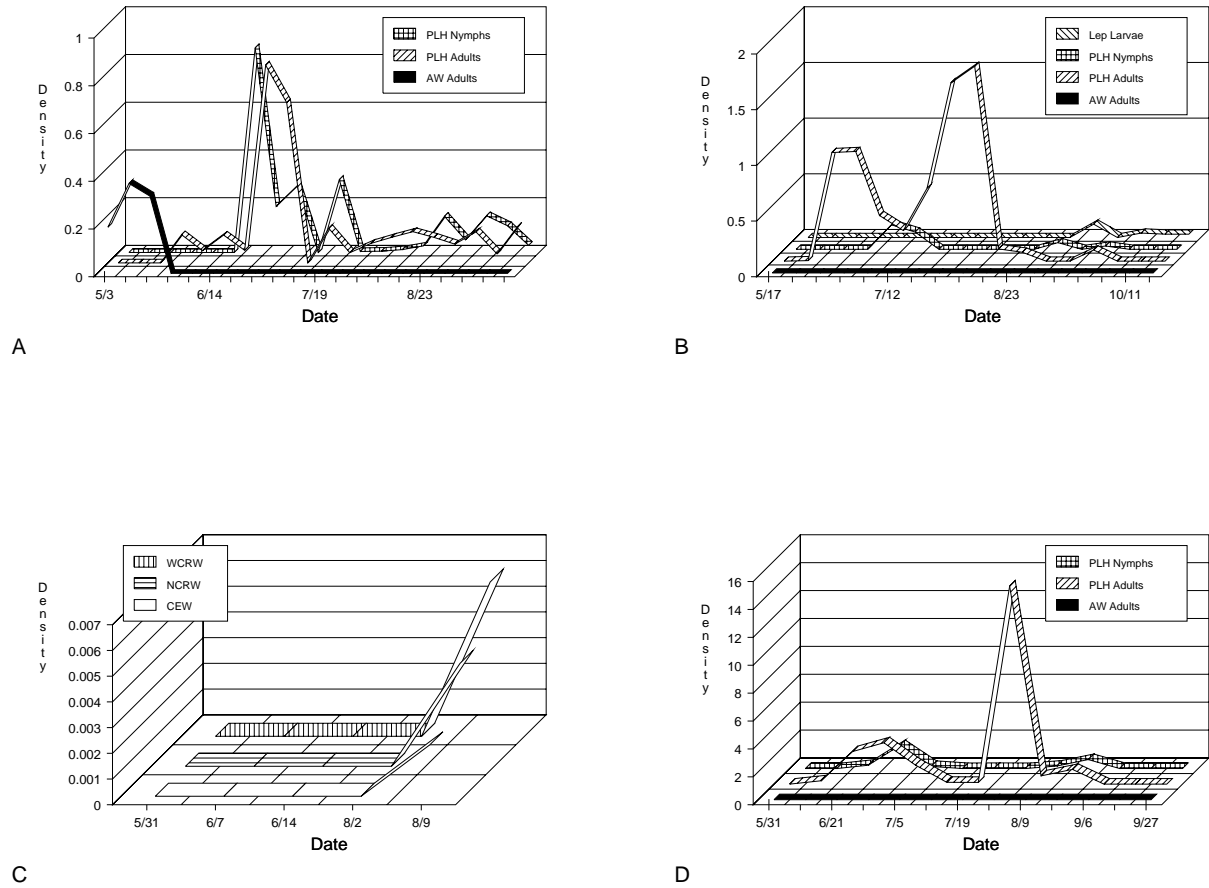
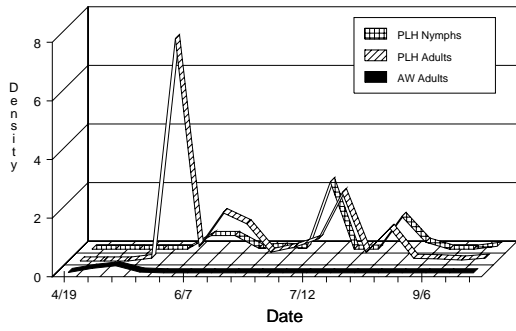
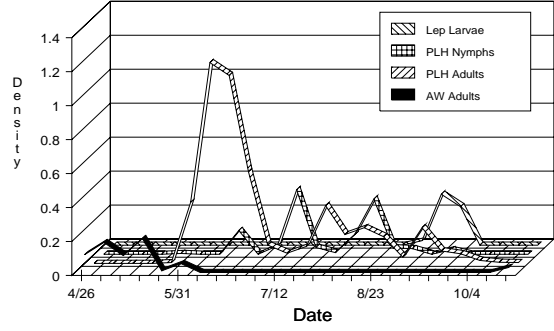


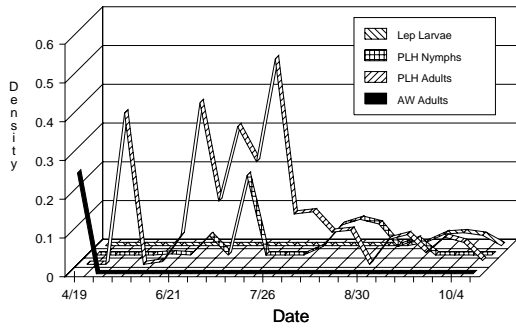
Figure 11. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farms 33 (A) to 36 (D) (alfalfa: AW Adults - alfalfa weevil adults, PLH Adults/Nymphs - potato leafhopper adults/nymphs, Lep Larvae - Lepidopteran Larvae, CEW - corn earworm; field corn: WCRW - Western corn rootworm, NCRW - Northern corn rootworm).



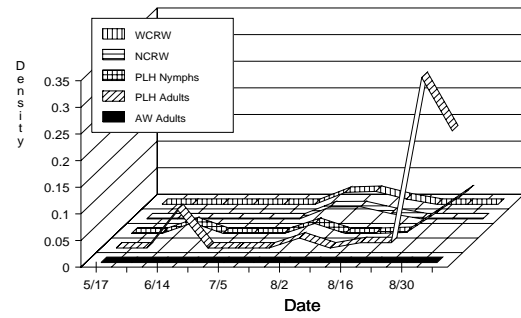
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Figure 12. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farms 37 (A) to 40 (D) (alfalfa: AW Adults - alfalfa weevil adults, Lep Larvae - total lepidopteran larvae, PLH Adults/Nymphs - potato leafhopper adults/nymphs; field corn: NCRW - Northern corn rootworm, WCRW - Western corn rootworm).

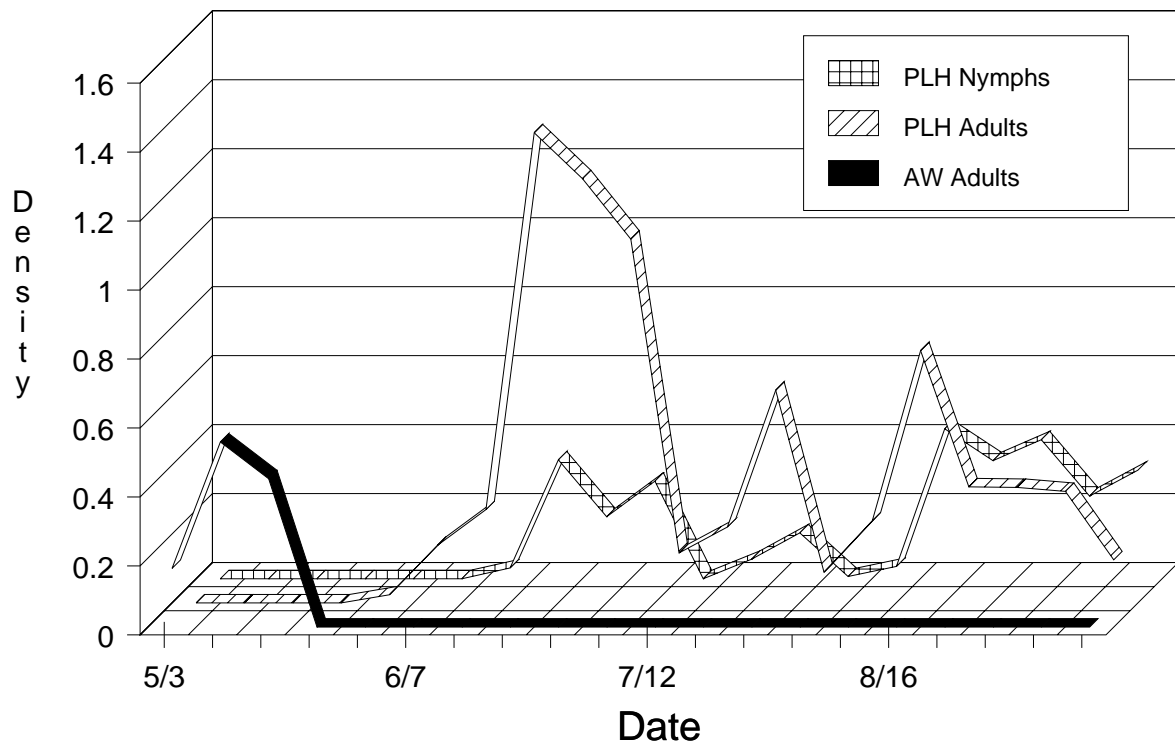


Figure 13. Overall mean densities for the major insect pests found in alfalfa and field corn during 1991 for farm 41 (alfalfa: AW Adults - alfalfa weevil adults, PLH Adults/Nymphs - potato leafhopper adults/nymphs;).

Pesticide Information

During 1991, a total of 4,115 acres of alfalfa, field corn and soybeans or 96% of total acreage received some type of pesticide application (Table 4). All of this acreage was treated using ground application equipment. If this acreage is divided by crop, 1,478 acres of alfalfa, 2,490 acres of field corn and 147 acres of soybeans were treated.

In alfalfa, for the growers reporting data, the bulk of the material applied was either a preemergent (217 acres) or postemergent application (134 acres). Preplant, broadcast and incorporated applications represented 6, 55 and 17 acres, respectively. In field corn, as with alfalfa, the main type of application was either a preemergent (1,683 acres) or postemergent (169 acres). No preplant applications were made. Broadcast applications represented 37 of the total acres treated while incorporated applications were made to 70 acres. All but 10 acres (postemergent) were made as a preemergent application in soybeans.

Based on insect data collected, no treatments for insects other than potato leafhopper should have been made.

In alfalfa, this was the case as evidenced by grower application records. The only acreage treated for insects was done so for the control of potato leafhopper (Table 5). Of the 1,645 acres in the program only 977 acres were treated. For field corn, this was not the case. While the data shows that no treatment was necessary, 148 acres were treated for corn rootworm control and 25 acres for cutworm control. This suggests two scenarios. The first is that for a particular farm, corn rootworm control was instituted at planting regardless of the presence of the pests. A second scenario is that while the mean farm densities for corn rootworm called for no treatment, an individual field within the farm may have.

In both alfalfa and field corn, the only other materials used were herbicides. For alfalfa, 10 acres were treated specifically for chickweed and 48 acres for mustard. Grass and broadleaf weed herbicides were applied to 48 and 389 acres, respectively. In field corn, 2,310 acres were treated for broadleaf and grass weeds with an additional 8 acres being treated for quackgrass specifically.

In soybeans, the only materials used were for weed control. Of the 147 acres in the program, all received some type of herbicide application.

Overall, a total of 6,206 pounds of active ingredient (a.i.) were applied during 1991. Of this, 1,085 lbs a.i. were applied to alfalfa, 4,884 lbs a.i. to field corn, and 236 lbs of a.i. to soybeans (Tables 6-8).

Table 4. Number of treated acres by crop and type of application.

Type of Application	Acres Treated	Total
Alfalfa		
Broadcast	55.30	
Incorporated	16.50	
Postemergence	134.40	
Preemergence	216.50	
Preplant	6.00	
Unknown	1,049.00	1,477.70
Field Corn		
Broadcast	37.00	
Incorporated	69.50	
Postemergence	168.80	
Preemergence	1,682.80	
Preplant	0.00	
Unknown	532.20	2,490.30
Soybeans		
Broadcast	0.00	
Incorporated	0.00	
Postemergence	10.00	
Preemergence	136.60	
Preplant	0.00	
Unknown	0.00	146.60

In alfalfa, applications were made of 467 lbs a.i. of herbicide and 618 lbs a.i. of insecticide to 494 acres and 975 acres, respectively (Table 6). Carbofuran had the highest level of use (283 lbs a.i.) for the insecticides used, followed by dimethoate (204 lbs a.i.), chlorpyrifos (61 lbs a.i.), malathion, carbaryl and permethrin. In terms of total acreage applied, however, dimethoate had the largest usage (407 acres), followed by carbofuran (283 acres), chlorpyrifos (123), permethrin (103 acres), malathion and carbaryl. These materials were used for the control of potato leafhopper adults and nymphs. Of the herbicides used, hexazinone had the highest level of use both in the amount of material applied (251 lbs a.i.) and total acreage treated (251 acres). EPTC ranked second in total amount applied (165 lbs a.i.) followed by paraquat, sethoxydim, 2,4-DB, and metribuzen. In terms of acreage treated, paraquat ranked second (77 acres) to hexazinone followed by EPTC (64 acres), sethoxydim and metribuzen. EPTC, hexazinone, paraquat and metribuzen were applied as both broadleaf weed and grass control materials while 2,4-DB was used for broadleaf weed control and sethoxydim was applied for grass control.

In field corn, herbicide usage heavily outweighed the use of insecticides (Table 7). A total of 2,281 acres were treated using 4,700 lbs a.i. of material for weed control. A

total of 16 different herbicide products were used for weed control during 1991. The herbicide most commonly applied was an atrazine and metolachlor combination (605 acres) followed by cyanazine (427 acres), dicamba (228 acres), metolachlor alone (215 acres) and atrazine (199 acres). Other materials used included combinations of atrazine and alachlor, atrazine and cyanazine, alachlor, paraquat and nicosulfuron. Atrazine and metolachlor combination (2,268 lbs a.i.) represented the highest number of pounds applied followed by cyanazine (774 lbs a.i.), metolachlor (430 lbs a.i.), an alachlor and atrazine combination (428 lbs a.i.) and an atrazine and cyanazine combination (406 lbs a.i.).

For the insecticides applied to field corn, only 4 materials were applied. The total usage was 172 treated acres representing a use of 184 lbs a.i. of material. Carbofuran ranked number one in usage at 112 acres treated and 145 lbs. a.i. applied followed by terbufos (25 acres, 26 lbs a.i.), chlorpyrifos and permethrin. Carbofuran, chlorpyrifos and terbufos were applied for both Northern and Western corn rootworm control. Permethrin was used by one grower for cutworm control.

Herbicides were the only materials applied to soybeans during the 1991 season (Table 8). Alachlor was the most used material both in acres treated (68 acres) and total amount applied (180 lbs a.i.). Linuron, both as a flowable and a wettable powder formulation, ranked second in terms of lbs a.i. applied at 49 followed by bentazon at 8 lbs a.i. applied. The total acreage treated with linuron was equal to that treated with alachlor. Only 10 acres were treated with bentazon. Alachlor and linuron were applied for control of both broadleaf weeds and grasses, while bentazon was applied for broadleaf weed control.

Table 5. Number of pesticide treated acres by crop and target pest.

Crop	Pest	Acres Treated
Alfalfa	grasses	47.50
	chickweed	10.00
	potato leafhopper	976.80
	mustard	48.00
	broadleaf weeds	388.40
	unknown	7.00
Corn	corn rootworm	147.50
	cutworm	25.00
	general weeds	2,309.80
	quackgrass	8.00
Soybeans	general weeds	146.00

Table 6. Pesticides applied to alfalfa during 1991.

Active Ingredient	Type ¹	lbs. a.i. Per Acre	Acres Treated	lbs. a.i. Applied
2,4-DB	H	1.50	48.0	13.50
malathion 57% EC	I	0.94	43.0	40.42
dimethoate 43.5E	I	0.50	407.1	203.60
EPTC 7E	H	2.60	63.5	165.10
carbofuran 4F	I	1.00	282.7	282.70
paraquat	H	0.25	77.4	19.35
chlorpyrifos 4E	I	0.50	122.5	61.25
sethoxydim	H	0.30	33.5	10.05
permethrin 3.2E	I	0.05	102.5	5.13
metribuzen 4	H	0.38	20.5	7.79
carbaryl 80S	I	1.50	17.0	25.50
hexazinone L	H	1.00	251.0	251.00

¹ Type: H = Herbicide, I = Insecticide.

Table 7. Pesticides applied to field corn during 1991.

Active Ingredient	Type ¹	lbs. a.i. Per Acre	Acres Treated	lbs. a.i. Applied
nicosulfuron 75DG	H	0.50	71.0	35.50
atrazine 4L	H	1.00	74.0	74.00
atrazine 80W	H	0.80	125.0	100.00
dicamba	H	0.50	228.3	31.25
atrazine & metolachlor	H	3.75	604.8	2,268.00
cyanazine 4L	H	1.25	75.1	93.88
cyanazine 80W	H	1.60	45.0	72.00
cyanazine 90DF	H	1.98	307.2	608.23
alachlor & atrazine	H	2.50	171.0	427.50
terbufos 15G	I	1.05	25.0	26.25
2,4-D	H	0.23	157.0	36.11
metolachlor 8E	H	2.00	215.0	430.00
atrazine & cyanazine 4L	H	5.25	57.0	299.25
atrazine & cyanazine DF	H	2.97	36.0	106.92
carbofuran 15G	I	1.29	112.0	144.48
paraquat	H	0.31	58.0	17.98
alachlor	H	2.64	26.0	68.64
alachlor 4E	H	1.00	31.0	31.00
chlorpyrifos 15G	I	1.05	10.0	10.50
permethrin 3.2E	I	0.10	25.0	2.50

¹ Type: H = Herbicide, I = Insecticide.

Table 8. Pesticides applied to soybeans during 1991.

Active Ingredient	Type¹	lbs. a.i. Per Acre Treated	Acres	lbs. a.i. Applied
bentazon	H	0.75	58.3	7.50
linuron	H	0.49	10.0	4.88
alachlor	H	1.50	68.3	180.31
linuron 50W	H	0.75	58.3	43.73

¹ Type: H = Herbicide.

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