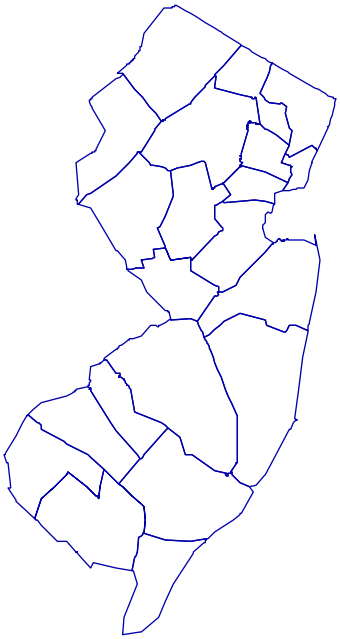
RUTGERS COOPERATIVE EXTENSION
NEW JERSEY AGRICULTURAL STATION

A Survey of the Pesticides Applied to IPM Grown Sweet Corn in New Jersey



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EXECUTIVE SUMMARY

Sweet corn is a major vegetable crop in New Jersey. Its importance as a viable commodity is evidenced by its number one ranking in terms of acreage and yield, and number two ranking in cash receipts for fresh market vegetable production. Corresponding to sweet corn's high acreage, its cash value, and fresh market potential is the intensive use of pesticides necessary to produce ears free of worms and damage.

For the above reasons, this study proposed to collect pesticide use, acreage, and yield data for sweet corn during the 1991 growing season. To accomplish this study, the on-going Rutgers Cooperative Extension Sweet Corn IPM Program was utilized. This program is ideal for this type of data collection because participating growers account for a major portion of the sweet corn acreage grown in the state. Logistically, they are distributed throughout the state and cover all growing conditions and use practices which are representative for each locale within the state. Data collected from these farms included total acreage planted, pests encountered, pesticides used to control pests (timing, number of applications, method of application, rates, acreage treated, etc.), and total yield.

During 1991, 1,791 plantings of sweet corn were grown. These plantings were distributed over 107 varieties on 3,006.9 acres. On average, growers grew 6.4 varieties on 39.5 acres covering 22.5 plantings.

Four insect pests were monitored during 1991, corn earworm, European corn borer, fall armyworm and corn flea beetle. Of these insects, corn earworm and European corn borer were the pests most commonly encountered. Differences in populations were also seen between various parts of the state for each pest, with higher populations occurring in the southern portions of New Jersey. Fall armyworm populations were prevelant during 1991, however, economic thresholds were only reached in a few counties.

Overall, 110,261.73 lbs of active ingredient were applied in 1991. Insecticides accounted for the bulk of this usage (46,403.42 lbs ai) followed by herbicides, fungicides, and other pesticides. Of the insecticides applied, methomyl, esfenvalerate, carbofuran, and thiodicarb had the highest usage in terms of active ingredient applied. Alachlor and atrazine were the most applied herbicides either alone or in combination with other active ingredients. For fungicides, chlorothalonil and manganese+zinc were the only materials applied. Growers also utilized spreader/sticker materials which were used most commonly with methomyl.

INTRODUCTION

Sweet corn is a crop of major importance to agriculture in New Jersey. During the 1990 growing season, sweet corn ranked number one in both number of harvested acres and total production (NJ DOA, 1991) (ca. 9,500 acres and 741,000 cwt., respectively) for the 11 major vegetable crops grown in New Jersey. On the basis of this level of production, sweet corn ranked second to only tomatoes in total cash receipts in 1987 (ca. $10,448,000.00). Similarly, these levels continue today.

As a result of sweet corn's high value as a crop in New Jersey, the use of pesticides is high (ca. 37,718 lbs. of formulated product in 1988) (Hamilton and Meyer, 1992). This high use level occurs for two reasons. First, because of its high value, the cost benefit ratio associated with the use of a pesticide is biased towards the benefits. The cost of a pesticide application is offset by the monetary return from the crop. The second reason, and possibly most important, is consumer demand. Consumers over the past three decades have become accustomed to worm and damage free sweet corn. With the increase in the cost per ear during the last five years, the desire by the consumer for "clean ears" has intensified. Parallel to this intensification is the increased need, on the part of sweet corn growers, for pesticides to provide "clean ears" thus strengthening the classical "pesticide treadmill" effect.

Given the high use of pesticides in sweet corn production it is important to have accurate estimates of the total amount of different materials used. These estimates are necessary because of the growing concern about groundwater contamination, and food safety, etc. Accurate data is also essential in light of EPA concerns about materials such as alachlor, parathion, methomyl, and phorate, all of which are labeled for use on sweet corn.

In the past, the collection of pesticide use data in New Jersey has, at best, been minimal and circumspect. Prior to 1986, the effort to collect such data was conducted by the New Jersey State Department of Health (NJDOH, 1979).

To correct this situation, in 1986, the New Jersey Department of Environmental Protection (NJDEP), Pesticide Control Program and Rutgers Cooperative Extension conducted a mandatory mail-in survey of all certified private applicators in New Jersey. This survey was conducted under the auspices of New Jersey's Pesticide Control Act (NJDEP, 1986) which requires private applicators (i.e. growers) to keep records of all pesticide applications and to submit these records to NJDEP upon request. The survey conducted requested growers to list all applications by brand name and formulation, amount applied, number of applications, acreage treated and the crop(s) treated.

The 1986 survey was highly successful resulting in a 90% return rate and covered data for approximately 75% of New Jersey's farming operations (Lewis, et. al., 1989). Brief results of the survey include a total use of 1,579,284 lbs. of product distributed over 176 active ingredients. Due to the successful nature of the original survey, New Jersey growers were resurveyed during 1989 and will continue to be on a three year basis.

Unfortunately, these surveys did not collect data in regards to the pests controlled, average yield estimates and acreage planted. The New Jersey Department of Agriculture (NJDA) does conduct surveys of crop acreage and yield estimates for major crops in New Jersey on a yearly basis. However, the results of this survey are published two years following collection.

The lack of this type of integrated data is further compounded by the fact that over 1,000 pesticide products (152 individual active ingredients) are registered for use on sweet corn in New

Jersey. Many of these products can be used to control the same pests. This fact makes it difficult to determine which pests are being controlled with a particular pesticide.

In order to obtain an accurate picture of all the variables necessary to provide meaningful data to USDA in response to special review benefit data requests, all of the above items need to be integrated into one survey for a one year time frame.

It was for these reasons that this project proposed:

1. to collect incidence data for the pests attacking New Jersey sweet corn during the 1991 growing season,

2. to collect pesticide use data for the materials used against the pests during the 1991 growing season, and

3. to collect data for the number of sweet corn planted acres and their respective yields for the 1991 growing season.

PROCEDURES

All data collected as part of this project were obtained under the auspices of the Rutgers Cooperative Extension Sweet Corn IPM Program. The data collection timetable for this project was from May through October of 1991.

In order to accomplish the objectives of this study, all growers enrolled in the 1991 Rutgers Cooperative Extension Sweet Corn IPM program were asked to participate. At the beginning of the growing season growers provided information on the varieties and anticipated acreage they planned to plant during 1991. Using this information, sampling strategies including locations of blacklight and pheromone traps were developed and initiated.

Ninety 15W blacklight traps were placed on growers' farms. These traps were used for monitoring the adult flight periods of corn earworm, European corn borer and fall armyworm. Twelve strategically placed Texas pheromone traps were also utilized in order to monitor the flight of male corn earworm moths.

Once the program was initiated, each participant was visited twice weekly by a scout trained in pest identification. During each visit, blacklight and pheromone traps were inspected and the number of individuals of corn earworm, European corn borer and fall armyworm were counted. Scouts then visually inspected fields as specified in Table 1.

Twice weekly, from seedling to tassel stage corn, 10 locations within a planting or variety were sampled to obtain estimates of insect damage by whorl feeding insects. Once the planting reached the silking stage of development, field sampling was discontinued. Treatments were applied based on threshold levels established by the number of moths caught in blacklight traps. At the silking

Table 1. Sweet Corn IPM Scouting Criteria

Time Period or Growth Stage	# of Samples per Location	Species or Damage Sampled
seedlings (May)	10 plants @ 10 locations	Flea Beetle*
Presilking	5 plants @ 10 locations	European Corn borer Fall Armyworm
Silking	None	

* Only conducted if no soil insecticide was applied or a Stewart's bacterial wilt resistant variety was not planted.

stage, threshold levels are very low making field monitoring economically unfeasible and unproductive.

Trap and field scouting data results were reported immediately to growers by the pest management scouts. Growers then made pesticide applications based on whether or not threshold levels had been exceeded and to what extent. The selection of the actual pesticide applied was the sole responsibility of the grower.

At the end of the growing season, each participant was visited and asked to provide the following information:

A. Crop Data

1. Varieties planted
2. Acreage planted for each variety
3. Yield for each variety planted

B. Pesticide Data

1. Date of application
2. Pesticide applied
3. Rate used
4. Total acreage treated
5. Method of application

C. Location Data

1. County
2. Zip Code

Each grower was then assigned an ID number and county code (Table 2) to assure anonymity. Using these data, information on the total amount of material and active ingredient were developed. All data collected were computerized and analyzed using DBase III+ and SAS statistical package software.

Table 2. County Identification Codes

County	Code	# of Growers
Sussex	1	3
Morris	2	7
Warren	3	4
Hunterdon	4	4
Somerset	5	0
Middlesex	6	3
Monmouth	7	2
Mercer	8	4
Ocean	9	3
Burlington	10	13
Camden	11	2
Gloucester	12	9

RESULTS

The Survey Group

The survey group for this study consisted of the growers who participated in the 1991 Rutgers Cooperative Extension Sweet Corn IPM Program. During 1991 there were 76 growers distributed throughout the state of New Jersey (Figure 1). Of this total, 67 growers agreed to supply information regarding their production practices. The predominate number of growers surveyed were located in Burlington County (Table 2) followed by Gloucester, Morris and Cape May counties. All of the top four counties, with the exception of Morris county can be considered southern New Jersey areas. Morris county is located in the northern part of the state as is Warren, Hunterdon and Sussex. This distinction is important as growing conditions, pest problems and production practices are different between the two regions.

Varietal Information

During 1991, 1,791 plantings of sweet corn utilizing 107 varieties were grown for New Jersey's fresh market (Table 3). The plantings were grown on a total of 3,006.9 acres. The high number of plantings and acreage are due to the need to have ears ready for market on a weekly basis from July 4 through Labor Day. To accomplish this, varieties are selected and staggered based on their time to maturity. Small acreages of the selected cultivars are then planted on a weekly basis. The average number of plantings of any one variety was 16.7 on an average of 28.1 acres. The most grown varieties during 1991 were Silver Queen (495 plantings on 1,017.6 acres), Silverado (158 plantings on 205.1 acres) and SSuper Sweet (64 plantings on 121.6 acres), and Aspen (26 plantings on 112.5 acres).

When the varietal data is examined on a individual grower basis (Table 4) the highest number of varieties grown by any one grower was 26. The lowest number of varieties planted by one grower was 1. On average growers planted 6.4 different varieties on 39.5 acres (range: 3 - 300.7 acres). Growers grew a total of 1,791 plantings (range/grower: 1 - 79) with an average of 22.5 per grower.

Based on varieties where information was available (Table 3), yield estimates on a per acre basis range from 30.7 ears (Zest) to over 15,484.4 ears (Top Notch). Overall, a total of 8,669,056 ears were harvested by growers in the program with an average of 2,655.6 ears per acre. The wide range in per acre estimates can be accounted for by the wide range of varieties grown and the differences in yields between early and late season corn. Early season corn is usually low yielding while mid and late season corn yields are substantially higher. For the varieties where data was not available, the lack of yield information can be explained by early planted varieties which never matured, by acreage planted throughout the season which was never harvested, or by lack of accounting on the part of growers.

Again, on a per grower basis (Table 4), yields ranged from 23,920 ears (Grower 15) to 142.7 ears (Grower 8). The average total number of ears harvested by growers was 113,343.4 with a per acre mean of 3.105.9 ears.

The seasonal price of sweet corn at roadside stands during 1991 ranged from $6.00 in July to $2.50 per dozen late in the season. Using an average seasonal price of $4.25 per dozen, the total cash value of the crop during 1991 is estimated at $3,070,290.60. The value of the crop on a per acre basis is estimated at $1,021.08.

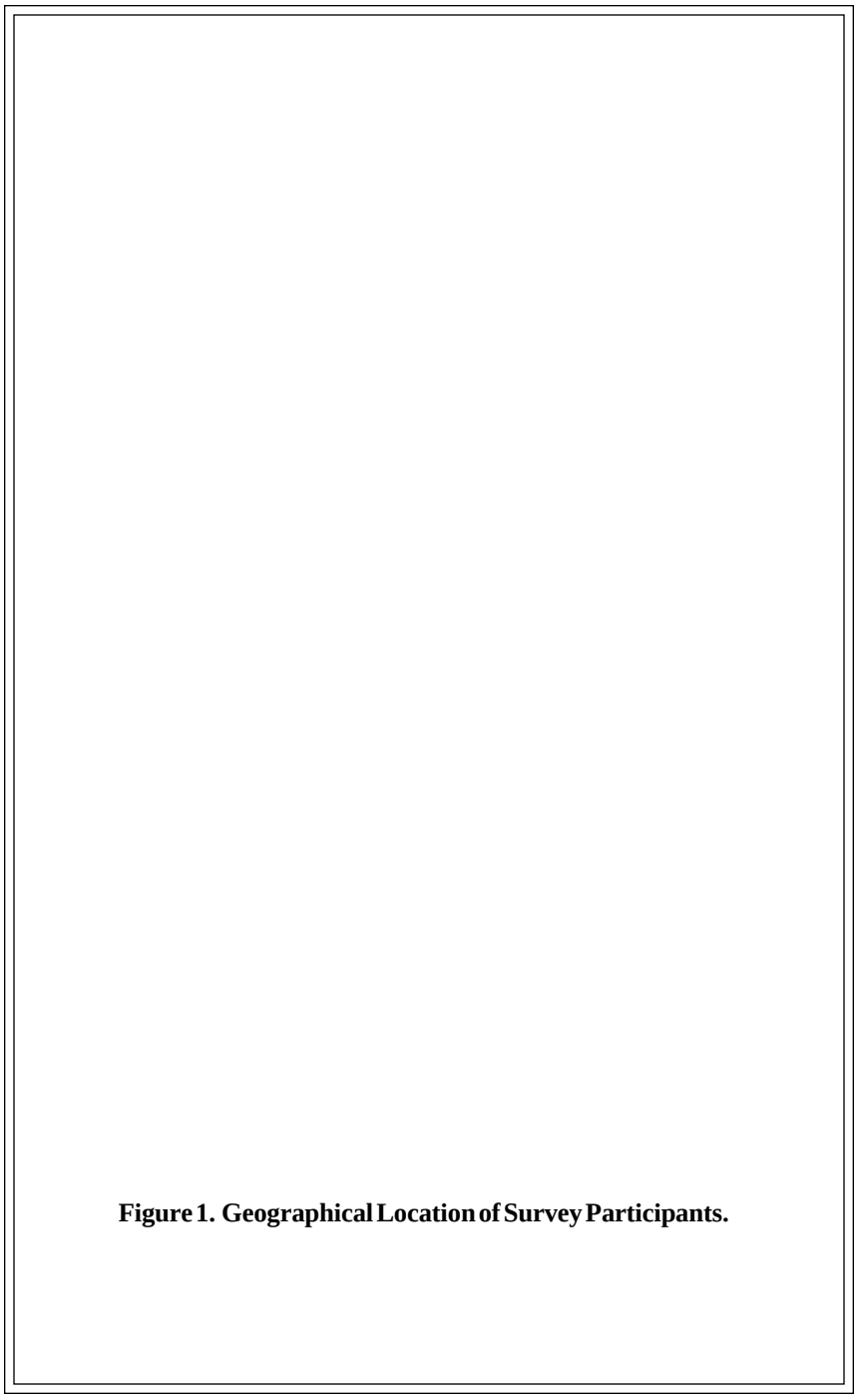


Figure 1. Geographical Location of Survey Participants.

Table 3. - Sweet Corn Varietal Information for 1991.

Variety	# of Plantings	# of Acres	Total # of Ears	# of Ears Per Acre
3017	2.0	3.8	1,378.0	362.6
3680	3.0	11.3	19,500.0	1,725.7
3686	44.0	87.6	114,394.0	4,650.2
7702	21.0	4.2	——	——
8101	7.0	20.0	63,336.0	3,166.8
902371	1.0	2.0	6,760.0	3,380.0
70Y	1.0	0.5	——	——
80W	2.0	6.0	26,000.0	4,333.3
Abbot & Cobb Supersweet	2.0	16.0	15,600.0	975.0
Agway WL	1.0	0.4	——	——
Alliance	10.0	7.5	44,252.0	5,900.3
Aloha	1.0	0.3	2,444.0	9,776.0
Alpine	61.0	106.1	357,212.0	3,365.8
Argent	1.0	0.7	——	——
Aspen	26.0	112.5	17,761.0	1,148.0
Bellringer	2.0	1.8	——	——
Bi-Honey	1.0	4.0	6,500.0	1,625.0
Biqueen	18.0	13.0	——	——
Bodacious	7.0	25.5	28,900.0	1,133.3
Burpee 2782	1.0	0.8	——	——
Burpee Breeders Bicolor	1.0	0.5	——	——
Cadet	2.0	1.0	——	——
Calico Belle	41.0	64.4	16,900.0	262.4
Camelot	5.0	5.8	48,400.0	8,417.4
Candy Store	30.0	13.3	51,428.0	3,872.6
Carnation	1.0	0.7	——	——
Challenger	4.0	18.0	36,452.0	2,025.1
Champ	9.0	15.9	18,000.0	1,132.1
Crossword	14.0	23.9	14,450.0	605.6
Dazzle	30.0	24.4	92,612.0	3,790.9
Diablo	2.0	2.3	14,300.0	6,355.6
Divinity	22.0	16.6	——	——
Domino	1.0	0.5	——	——
Early Dawn	1.0	0.5	——	——
Escalade	6.0	6.3	31,200.0	4,992.0
Even Sweeter	49.0	47.0	229,734.0	4,892.1
Gold & Pearl	3.0	2.0	——	——
Harmony	15.0	36.4	57,250.0	1,573.7
Harris Snow White 7355	20.0	29.7	247,000.0	8,727.9
HM 75	5.0	7.9	——	——
HMX 7355	7.0	8.3	7,673.0	924.5
HMX 7364	3.0	3.3	14,492.0	4,391.5
Honey N Pearl	1.0	0.3	3,692.0	11,187.9
Honey Riffic	1.0	2.0	5,200.0	2,600.0
How Sweet It Is	4.0	2.2	23,400.0	10,883.7
Illumination	1.0	5.0	6,500.0	1,300.0
Incredible	17.0	24.9	13,000.0	521.7
Kandy Korn	4.0	2.8	——	——
Landmark	8.0	8.3	14,196.0	8,872.5
Legend	7.0	6.1	——	——
Mariah	4.0	9.0	39,520.0	4,391.1
Medley	4.0	1.7	——	——
Melody	1.0	10.0	300.0	30.0

Variety	# of Plantings	# of Acres	Total # of Ears	# of Ears Per Acre
Merit	36.0	2.8	——	——
Northen Extra Sweet	2.0	4.0	22,880.0	5,720.0
Pearl	43.0	67.4	237,676.0	3,526.4
Pegasus	11.0	20.9	83,468.0	4,003.3
Precocious	1.0	3.0	5,200.0	1,733.3
Quasar	2.0	8.0	7,800.0	975.0
Quick Silver	23.0	84.0	134,468.0	1,600.2
Rise & Shine	7.0	6.2	——	——
Seneca Brave	2.0	1.5	11,300.0	7,533.3
Seneca Dawn	1.0	10.0	——	——
Seneca Horizon	16.0	37.8	26,306.0	696.3
Seneca Star	2.0	2.6	4,650.0	1,788.5
Seneca Starshine	3.0	1.5	——	——
Seneca Sunshine	4.0	9.5	29,000.0	3,052.6
Seneca Wardance	2.0	0.7	——	——
Sensor	12.0	10.0	——	——
Showcase	2.0	8.0	7,800.0	975.0
Silver Bullet	1.0	1.0	——	——
Silver Chief	3.0	1.2	——	——
Silver Queen	495.0	1,017.6	3,155,449.0	3,101.0
Silver Treat	9.0	7.1	15,130.0	2,131.0
Silverado	158.0	205.1	309,760.0	1,510.7
Silverette	13.0	47.5	69,780.0	1,470.0
Sky Line	4.0	6.8	41,080.0	6,085.9
Snow Belle	4.0	14.0	38,250.0	2,732.1
Sparkle Sweet	1.0	0.4	——-	——-
Spring White	27.0	44.8	185,049.0	4,128.7
Sprite	8.0	5.3	18,200.0	3,447.0
SSuper Sweet	64.0	121.6	159,952.0	3,671.2
Stardust	21.0	33.2	127,648.0	3,844.8
Stars ‘N Stripes	2.0	0.5	——	——
Starstruck	1.0	0.3	2,444.0	9,776.0
Sterling	1.0	0.8	——	——
Summer Flavor	74.0	92.2	211,796.0	13,657.3
Sundance	6.0	21.2	20,800.0	983.5
Sweet Dawn	12.0	17.7	11,100.0	627.1
Sweet Sal	14.0	19.3	——	——-
Sweet Sue	24.0	18.6	——	——
Sweeter By Far	17.0	23.9	36,868.0	1,542.6
Telstar	2.0	1.4	8,320.0	5,942.9
Top Notch	28.0	109.4	1,693,220.0	15,484.4
Tuxedo	2.0	1.0	——	——
Twilight	20.0	18.8	——	——
Viceroy	1.0	2.0	7,280.0	3,640.0
Viva	5.0	6.5	11,510.0	1,784.5
White Magic	32.0	34.3	262,045.0	7,639.8
XBH2654	1.0	1.5	11,700.0	7,800.0
XP147	1.0	2.2	——	——
XP357	1.0	0.6	6,136.0	10,226.7
XP589	1.0	1.0	——	——
XPH2675	2.0	1.5	——	——
XPHS017	3.0	0.6	4,800.0	8,000.0
Zenith	12.0	9.4	——	——
Zest	17.0	14.8	455.0	30.7

Table 4. Sweet Corn Varietal Information by Grower

Grower Code	# of Varieties	# of Plantings	# of Acres	Total # of Ears	# of Ears Per Acre
1	5.0	36.0	18.0	45,500.0	2,527.8
2	4.0	19.0	25.0	197,600.0	7,904.0
3	8.0	29.0	40.0	70,250.0	1,756.3
4	7.0	20.0	13.3	113,900.0	8,563.9
5	5.0	15.0	55.0	875,000.0	15,909.1
6	4.0	18.0	16.4	———	———
7	7.0	20.0	119.0	351,000.0	2,949.6
8	———	———	———	———	———
9	6.0	17.0	26.0	154,700.0	5,950.0
10	3.0	7.0	73.0	68,900.0	943.8
11	6.0	35.0	69.5	428,000.0	6,158.3
12	7.0	20.0	7.1	56,160.0	7,966.0
13	9.0	20.0	62.0	29,854.0	481.5
14	1.0	1.0	3.0	10,400.0	3,466.7
15	4.0	40.0	20.0	9,200.0	460.0
16	8.0	25.0	50.0	297,440.0	5,948.8
17	8.0	8.0	65.0	47,700.0	733.8
18	8.0	8.0	26.0	84,800.0	3,261.5
19	3.0	25.0	25.0	188,760.0	7,550.4
20	3.0	10.0	23.5	78,101.0	3,323.4
21	4.0	13.0	32.5	99,840.0	3,072.0
22	10.0	56.0	139.0	46,800.0	336.7
23	5.0	21.0	56.0	190,008.0	3,393.0
24	17.0	35.0	62.3	319,950.0	5,139.8
25	13.0	27.0	137.0	52,000.0	379.6
26	6.0	45.0	78.0	585,000.0	7,500.0
27	———	———	———	———	———
28	9.0	9.0	60.0	132,600.0	2,210.0
29	5.0	27.0	42.0	520,000.0	12,381.0
30	6.0	39.0	85.9	344,760.0	4,013.5
31	———	———	———	———	———
32					
33	10.0	57.0	57.6	469,776.0	8,157.2
34	5.0	22.0	52.5	221,000.0	4,209.5
35	4.0	10.0	25.0	21,300.0	852.0
36	9.0	13.0	21.0	132,600.0	6,314.3
37	6.0	69.0	69.5	39,000.0	561.2
38	13.0	36.0	31.2	31,200.0	1,000.0
39	5.0	38.0	32.1	65,000.0	2,026.2
40	6.0	27.0	23.3	23,400.0	1,006.5
41	———	———	———	———	———
42	5.0	17.0	18.0	31,200.0	1,733.3
43	13.0	26.0	168.1	160,940.0	957.7
44	———	———	———	———	———
45	———	———	———	———	———
46	17.0	38.0	116.4	375,434.0	3,225.4
47	4.0	18.0	10.1	29,120.0	2,883.2
48	6.0	25.0	12.5	54,080.0	4,326.4
49	———	———	———	———	———
50	10.0	26.0	11.7	27,040.0	2,321.0
51	———	———	———	———	———
Grower	**# of**	**# of**	**# of**	**Total #**	**# of Ears**

Code	Varieties	Plantings	Acres	of Ears	Per Acre
52	———	———	———	———	———
53	———	———	———	———	———
54	4.0	14.0	20.5	22,880.0	1,116.1
55	———	———	———	———	———
56	———	———	———	———	———
57	6.0	22.0	11.0	———	———
58	10.0	40.0	58.0	31,200.0	537.9
59	4.0	11.0	10.5	112,320.0	10,697.1
60	4.0	8.0	30.0	43,680.0	1,456.0
61	3.0	8.0	18.0	29,640.0	1,646.7
62	8.0	17.0	19.3	———	———
63	18.0	57.0	41.7	278,564.0	6,683.4
64	6.0	25.0	25.0	14,040.0	560.7
65	26.0	79.0	64.3	22,100.0	344.0
66	———	———	———	———	———
67	10.0	33.0	22.6	22,360.0	991.6
68	15.0	46.0	25.1	34,320.0	1,367.3
69	11.0	52.0	90.9	———	———
70	———	———	———	———	———
71	16.0	82.0	65.0	25,740.0	396.0
72	8.0	22.0	11.8	43,680.0	3,714.3
73	6.0	11.0	34.0	9,880.0	290.6
74	17.0	54.0	48.0	116,480.0	2,427.7
75	6.0	18.0	13.0	52,000.0	4,000.0
76	6.0	22.0	13.3	163,800.0	12,362.3

Pest Information

The activity of four major insect pests were monitored on a regular basis. Early in the season visual plant inspections are made to evaluate damage by European corn borer, corn flea beetle, and fall armyworm. European corn borer and fall armyworm cause direct feeding damage to plants prior to the presilk stage of the crop. Corn flea beetles, while causing limited direct damage, transmit Stewart's wilt disease as a result of feeding. After the presilking stage, blacklight and pheromone traps are relied upon for monitoring. The main insect monitored after silking was the corn earworm. Control decisions are then made on the basis of the data collected (Table 5).

Normally, the use of wilt resistant corn varieties or the application of a soil insecticide at planting will control corn flea beetles. However, if these are not utilized and populations reach threshold levels, one foliar application is recommended. Similarly, if European corn borer or fall armyworm reach threshold levels prior to silking one foliar application is recommended each time the threshold is exceeded.

Table 5. Economic Thresholds for the Pests Monitored in Sweet Corn During 1991.

Pest	Crop Stage	Threshold
Corn Flea Beetle	seedlings	6 beetles/100 plants
European corn borer	presilk	12% infested plants
Fall armyworm	presilk	12% infested plants
Corn earworm	1st silk	1 moths/5 nights*

* Begins a six-day spray schedule.

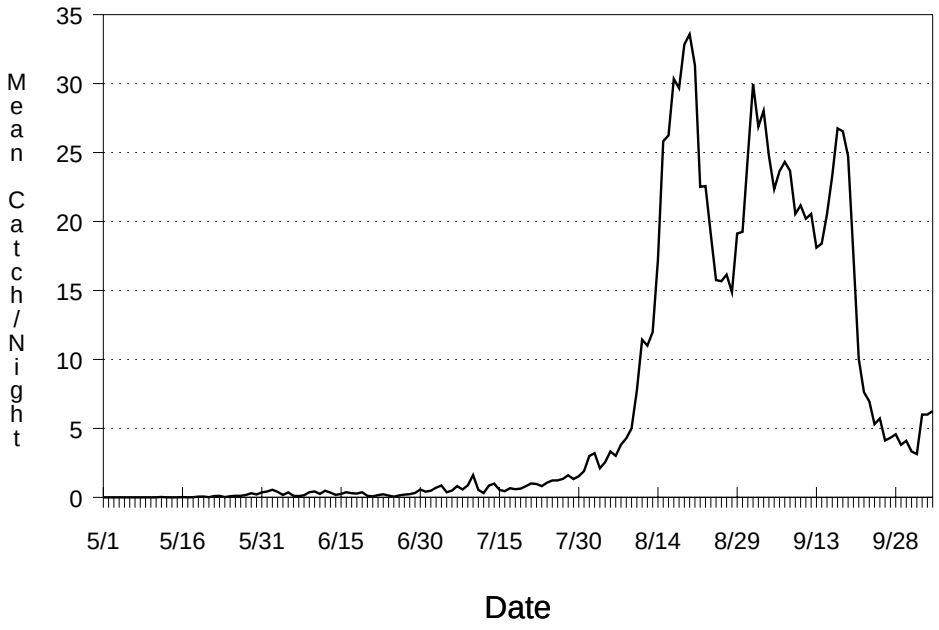
During 1991 most growers either planted wilt resistant varieties or applied a soil insecticide. These measures resulted in the need for no additional sprays for corn flea beetles.

Control recommendations for corn earworm are dependant on the number of moths caught on a five night basis. Texas pheromone trap counts are used to identify high male moth flight periods, however, blacklight trap catches are relied upon for control recommendations. Based on the catches observed, control recommendations range from spraying on a 2- to 6-day schedule until harvest (Table 6). The sprays are initiated at first silk and continue until harvest, but may be altered depending on trap catches.

Table 6. Recommended Spray Schedules for Silking Corn Based on Blacklight Trap Catches of Corn Earworm.

Total # of Moths per 5 Nights	Recommended Schedule
1	Spray every 6 days
2	Spray every 5 days
3	Spray every 4 days
4 - 38	Spray every 3 days
>38	Spray every 2 days

The 1991 statewide mean corn earworm (CEW) catches per night from blacklight traps distributed throughout New Jersey are presented in Figure 2. Corn earworm mean populations remained low until the beginning of August and then fluctuated above five moths/night until late-September. The highest mean level for 1991 was 34 moths per night. Conversion of these data to the total number of moths caught per five nights, while exhibiting similar populations peaks, presented greatly different information in terms of numbers. Populations began increasing in July and remained



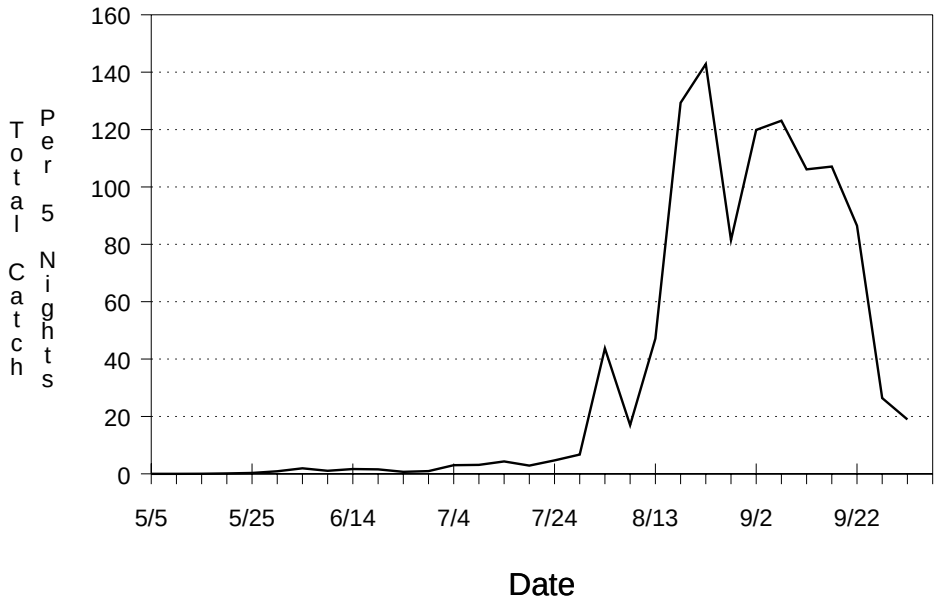


Figure 2. Corn Earworm Blacklight Trap Catches During 1991, Statewide Averages.

above ten moths/five nights for the remainder of the season. Based on this data, CEW populations were above threshold for most of the season and required tight spray schedules from July 4 until the end of September.

However, control decisions for this key pest are not based on average statewide populations. Decisions for each farm are made based on counts from traps positioned either on that farm or in the vicinity. With this in mind, statewide data has been collapsed into county averages for the 1991 season (Figures 3 and 4). Examination of the data in this manner shows large differences between northern and central New Jersey (Counties 1-9) and the seven southern counties (10-16). Southern populations reached the highest levels, ranging between 100 - 300 moths per five nights. The highest peak levels observed occurred in Camden (11), Salem (14), and Cumberland (15) counties. Populations in North and Central New Jersey peaked between 25 and 150 moths per five nights with the highest levels occurring in Middlesex (6) County. As a result, more pesticides were used in southern New Jersey as compared to northern areas of the state.

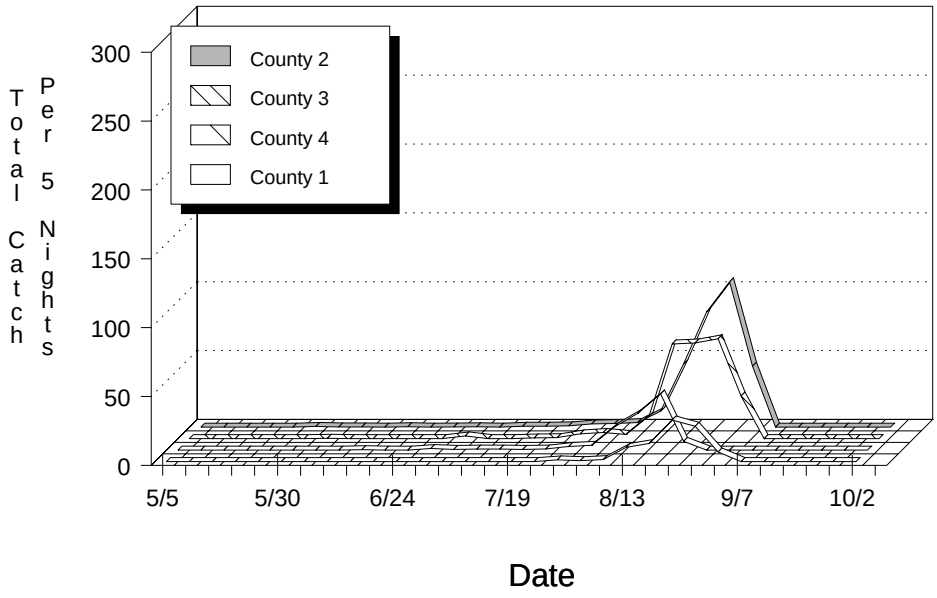
The mean statewide catches per night for European corn borer (ECB) are presented in Figure 5. During 1991, daily estimates of statewide populations remained low from May to September. These populations did, however, exhibit three peaks with the third reaching slightly above four moths/night in August. Conversion of these data to the total number of moths caught per five nights exhibited similar population peaks as the daily means. The magnitude of these peaks, however, were four to five times higher than the daily mean peaks.

When the county five day averages are examined, differences between Northern, Central and Southern New Jersey are evident (Figures 6 and 7). Populations in the northern counties (1-4) exhibited two major peaks while three population peaks were observed in the central (5-9) and southern (10-16) counties of the state. For northern New Jersey the highest populations were seen in Warren County (3) in August. In central New Jersey, the populations in Mercer (8) and Ocean (9) counties were highest for all three peak flight periods. Salem County (10) had the highest ECB populations in southern New Jersey followed by Burlington (10) and Cumberland. While trap monitoring for ECB is not used for making control decisions (Table 5) it is used for identifying peak flight periods when plant samples should be made. Based on this, growers in the program did not need to make applications to control ECB in 1991. Applications, however, were made by growers on the basis of field damage assessments,

In New Jersey, fall armyworm (FAW) is normally a late season pest of sweet corn. Populations are dependant on its movement into New Jersey from southern states such as Delaware and Virginia. In 1991, FAW populations followed this usual pattern. As evidenced from statewide mean daily pheromone trap catches (Figure 8), FAW entered New Jersey in early July and reached peak levels in late August and early September. The movement of FAW into New Jersey from the south in 1991 can be confirmed from the 5 day county averages. Fall armyworm populations were only observed in 3 southern counties (11, 12, 16) with the highest populations found in Cape May. In most years, FAW populations do reach threshold levels and control is necessary. As with ECB, trap catches are used to identify peak flight periods and signal the need for field monitoring.

Pesticides Applied

During 1991, a total of 42,116.72 acres planted in sweet corn were treated with pesticides. Of these total acres, the bulk (75.7%) of the acreage that was treated was contained within Salem, Gloucester and Burlington counties (Table 7). If the total amount of pesticides applied (lbs ai) is



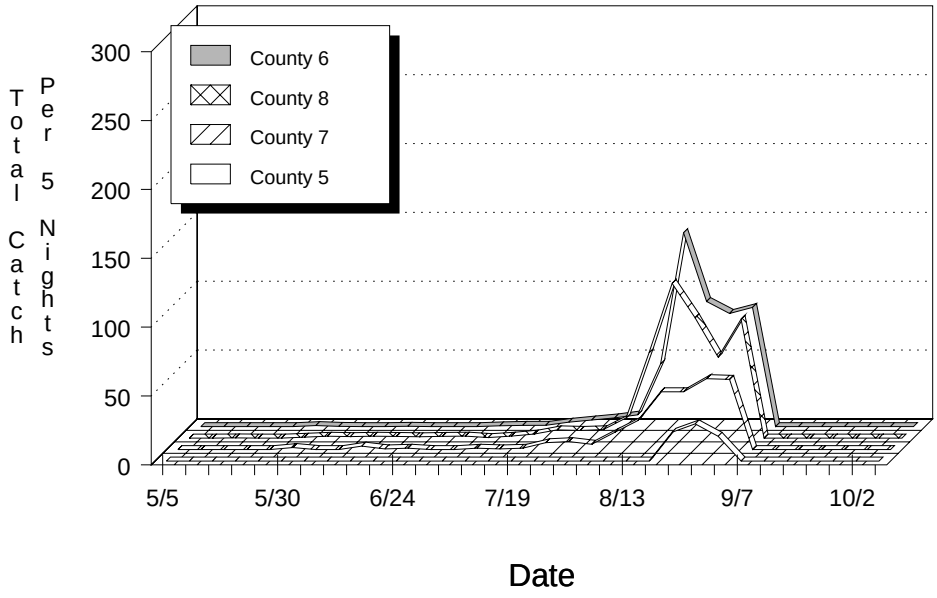


Figure 3. Corn Earworm Blacklight Trap Catches, Counties 1 to 8.

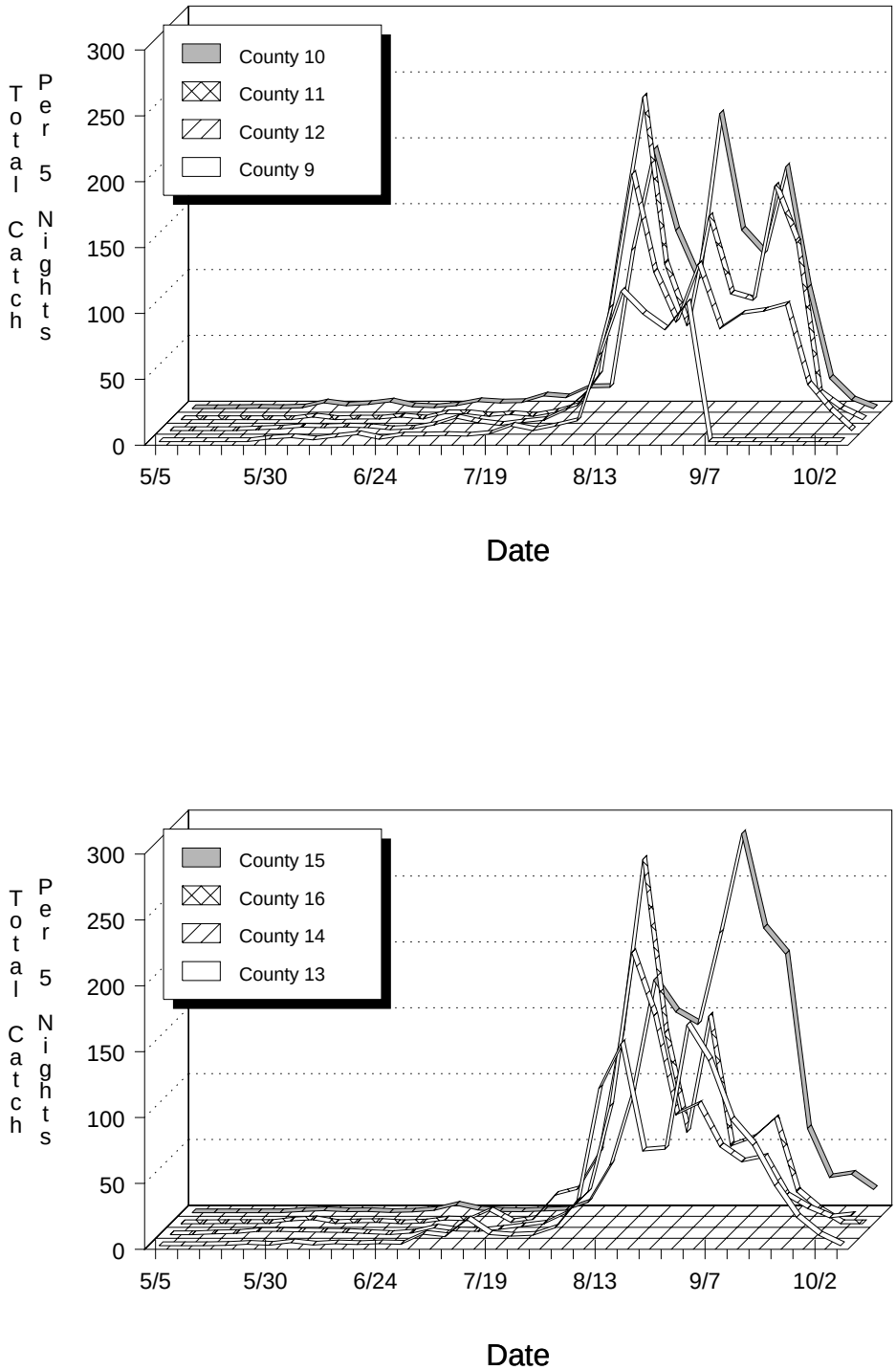


Figure 4. Corn Earworm Blacklight Trap Catches, Counties 9 to 16.

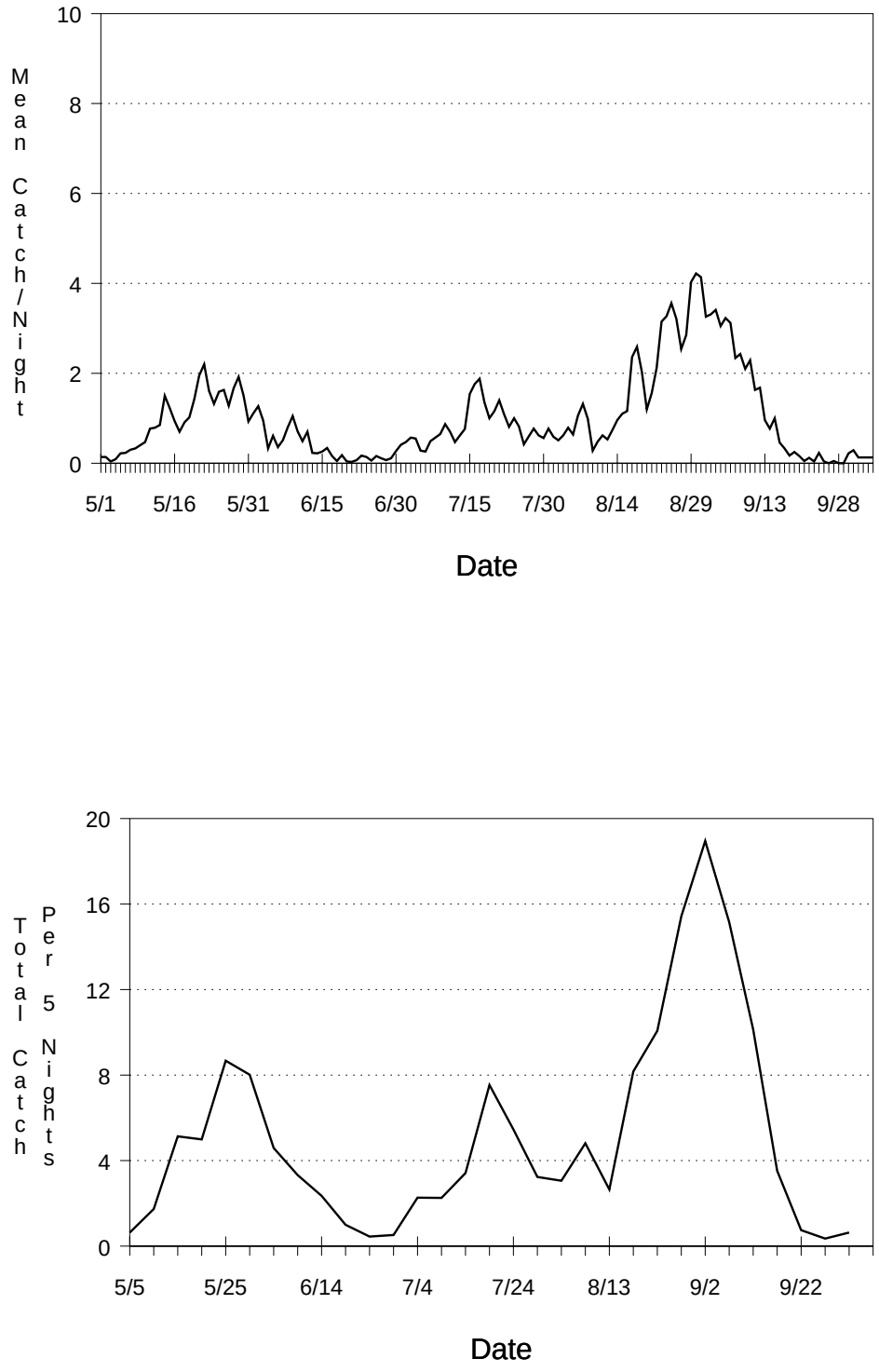


Figure 5. European Corn Borer Blacklight Trap Catches During 1991, Statewide Averages.

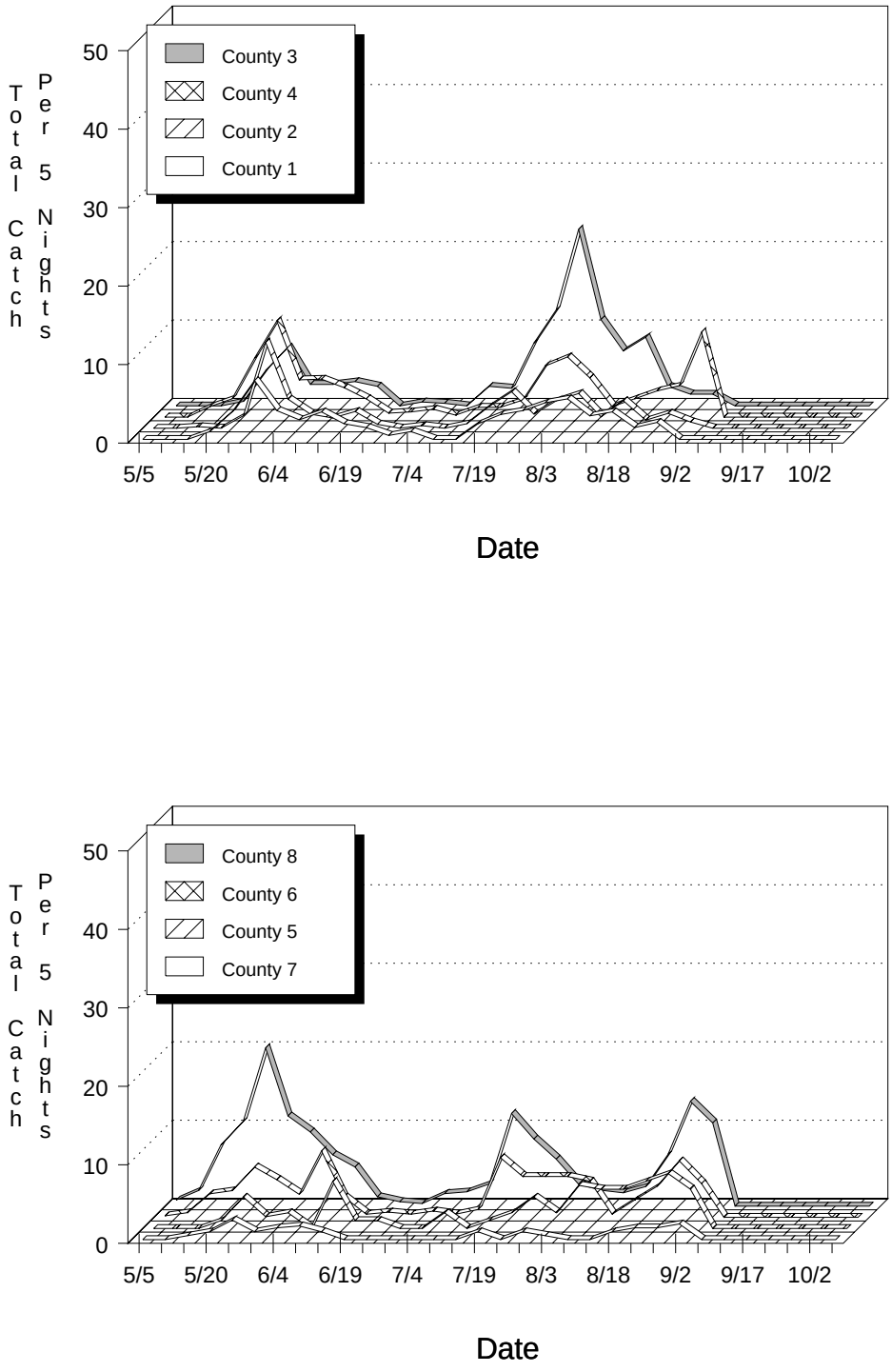
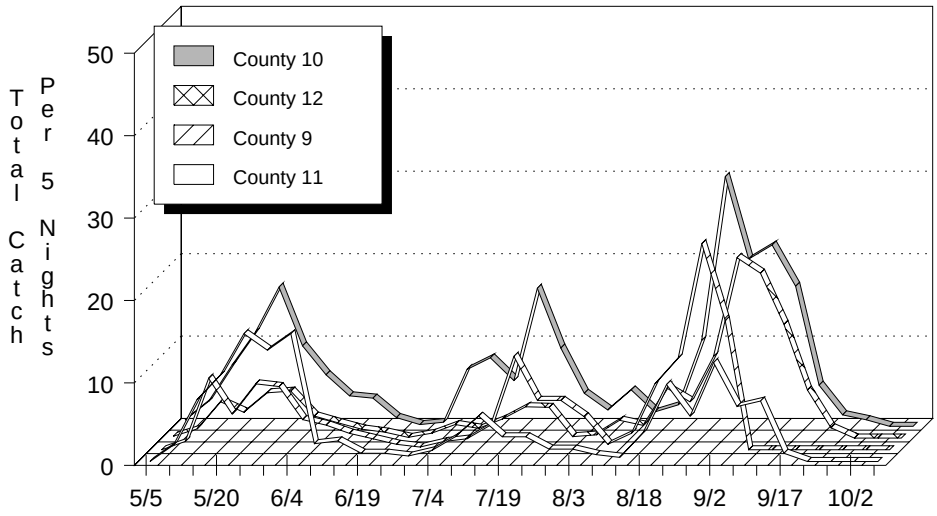


Figure 6. European Corn Borer Blacklight Trap Catches, Counties 1 to 8.



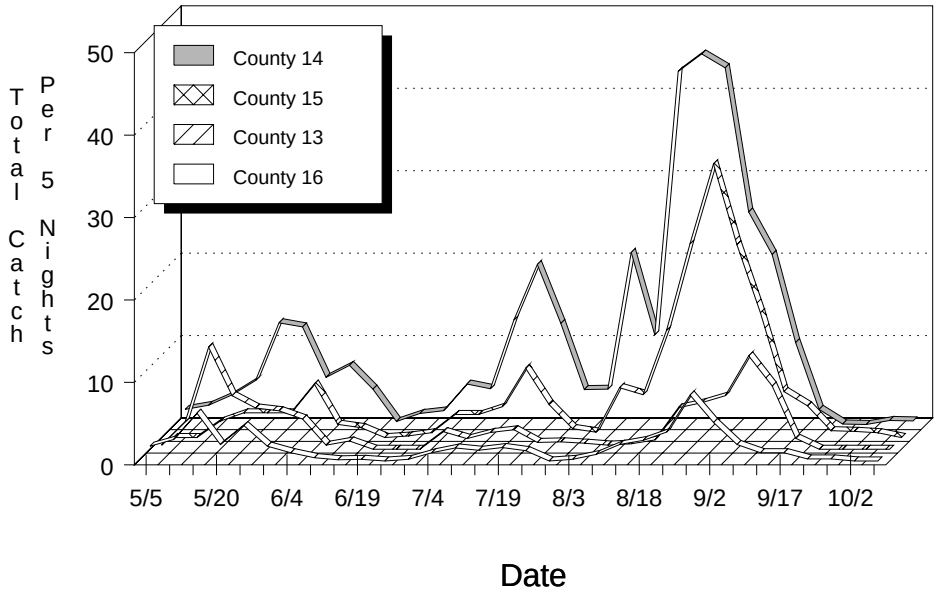
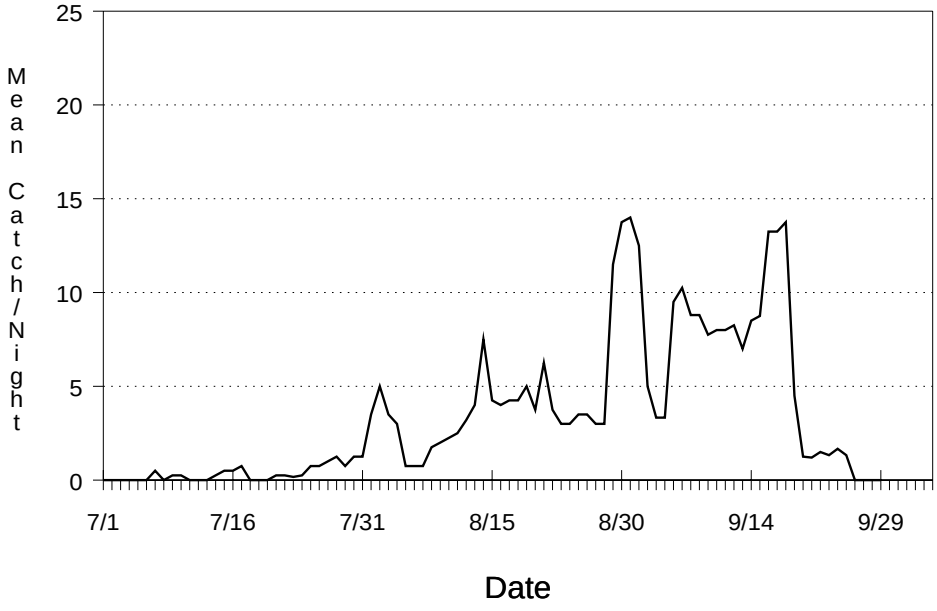


Figure 7. Corn Earworm Blacklight Trap Catches, Counties 9 to 16.



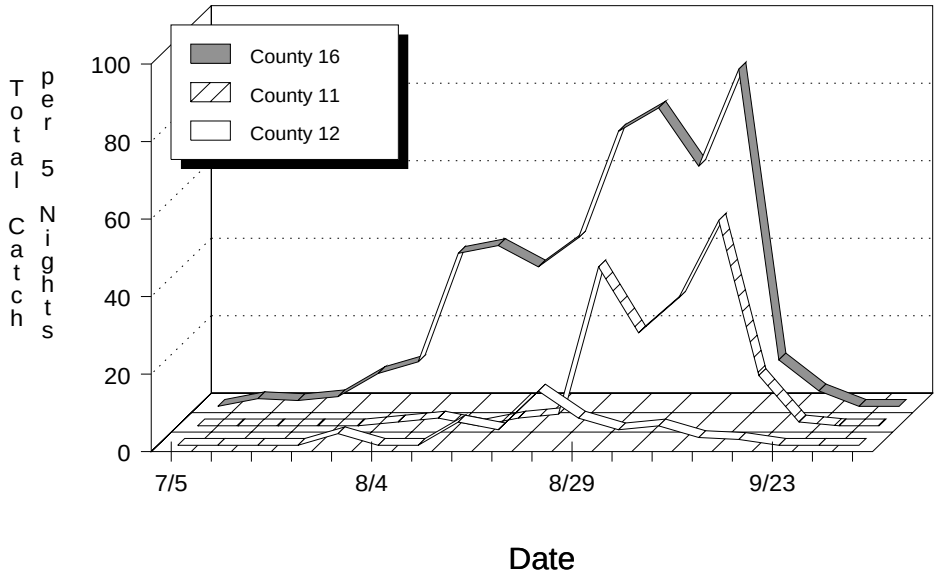


Figure 8. Fall Armyworm Pheromone Trap Catches During 1991 (Statewide Averages, County 11, 12, and 16).

examined this picture is slightly different. Overall, 110,261.73 pounds of active ingredient were applied in 1991. This data also reveals that Salem, Burlington, Atlantic, Gloucester and Mercer Counties received 74.2% of the total amount of material applied. These levels, however, represent multiple applications to the same fields. Due to this, the data was examined based on the total amount of pounds of active ingredient applied per acre. This analysis showed that, in fact, Atlantic county (6.99 lbs ai/A) had the highest use pattern of any county. This usage was 1.34 times higher than the next highest county (Hunterdon - 5.21 lbs ai/A). Analysis of this data on a per grower basis shows, however, that Cumberland county (3.35 lbs ai/A/grower) had the highest use pattern followed by Atlantic county (2.33 lb ai/A/grower). The remaining counties ranged between 0.05 lb ai/A and 1.66 lb ai/A.

When the data are examined according to type of pesticide applied, insecticides were by far the most applied material, both in terms of acreage treated and lbs ai applied (Figure 9). During 1991, 46,403.42 lb ai of insecticides were applied to 111,028.27 acres. The next most applied group was herbicides (19,477.90 lbs ai) followed by fungicides (990.83 lbs ai) and other pesticides (839.0 lbs ai). Other pesticides includes items such as feeding stimulants and synergists.

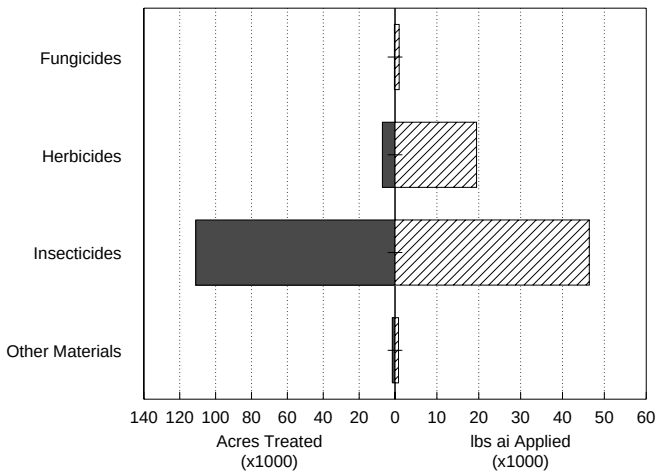


Figure 9. Use of Pesticides in Sweet Corn During 1991 by Type of Material Applied.

Table 7. Pesticide Use by County, 1991.

County	Acres Treated	lbs. ai. Applied	lbs. ai. per Acre	lbs. ai./ Acre/ Grower
Atlantic	1,082.70	7,570.38	6.99	2.33
Burlington	6,971.07	4,269.88	0.61	0.05
Camden	1,498.00	1,707.38	1.14	0.57
Cape May	1,382.20	4,136.93	2.99	0.60
Cumberland	116.40	389.65	3.35	3.35
Gloucester	20,260.25	61,016.82	3.01	0.33
Hunterdon	418.10	2,177.48	5.21	1.30
Mercer	1,199.25	6,445.51	5.37	1.34
Middlesex	359.50	1,667.73	4.64	1.55
Monmouth	1,413.70	2,266.01	1.60	0.80
Morris	1,068.35	4,163.97	3.90	0.56
Ocean	593.55	2,961.08	4.99	1.66
Salem	4,669.80	6,809.34	1.46	0.36
Somerset	———	———	———	———
Sussex	334.00	1,191.11	3.57	1.19
Warren	749.85	3,488.46	4.65	1.16

The use of pesticides applied sweet corn in 1991 by active ingredient for fungicides and herbicides is presented in Table 8. Two fungicides were utilized by sweet corn growers in 1991. Of these two, chlorothalonil had the highest use pattern. This material was applied 97 times to 334.5 acres. These applications represented a total use of 979.50 lbs of active ingredient. On a per acre basis the use of chlorothalonil was 4.5 times higher than manganese+zinc (0.64 lbs ai/A), the only other material applied.

During 1991, growers utilized 18 herbicide products encompassing eight active ingredients. Five of these products contained more than one active ingredient. All five contained atrazine, a common corn herbicide. Of the combinations, atrazine plus metolachlor was most frequently applied. This combination was applied to 265.5 acres at a total amount of 809.57 lbs ai. For the products containing one active ingredient, atrazine, alachlor, and metolachlor were applied the most. Atrazine was applied 70 times to 2,340.33 acres. Alachlor was applied 63 times to 1,995.45 acres and metolachlor was applied 23 times to 1039.56 acres. Of the three, alachlor (10,954.04 lbs ai) ranked number one in terms of total lbs ai applied, followed by atrazine (3,645.76 lbs ai) and metolachlor (1,737.94). On a per acre basis this pattern was the same. Alachlor ranked number one at 29.61 lbs ai/A, atrazine at 4.85 lbs ai/A, and metolachlor at 1.06 lbs ai/A. The other herbicide active ingredients applied during 1991 included bentazon, butylate, cyanazine, linuron, and pendimethalin.

Twenty one insecticide products covering 17 active ingredients were applied to control corn earworm, European corn borer, fall armyworm, or flea beetles during 1991 (Table 9). Of this group, three were applied as granular material. As a granular application, carbofuran (1,498.25 acres) and terbufos (346.00 acres) were the materials of choice. In treating this acreage, 477.94 lb ai of terbufos and 2,913.15 lbs ai of carbofuran were used. Chlorpyrifos (11.25 lbs ai) was also applied as a granular to 7.5 acres.

Table 8. Overall Use of Fungicides and Herbicides on Sweet Corn During 1991

Trade Name	Common Name	# of Applications	Acres Treated	lbs. ai. Applied	lbs. ai. Per Acre
Fungicides					
Bravo 720	chlorothalonil	97	334.50	979.50	2.93
Manzate 200 DF	manganese + zinc	3	17.60	11.33	0.64
Herbicides					
Aatrex Nine-O	atrazine	7	391.36	528.64	1.35
Arena	alachlor	5	266.75	7,403.62	27.75
Atrazine 4L	atrazine	7	330.75	412.47	1.25
Atrazine 50W	atrazine	16	21.27	25.90	1.22
Atrazine 80W	atrazine	40	1,596.95	2,678.75	1.68
Basagran	bentazon	2	23.00	11.50	0.50
Bicep 6L	atrazine + metolachlor	11	265.50	809.57	3.05
Bladex 4L	cyanazine	12	554.26	482.54	0.87
Bullet	alachlor + atrazine	1	64.00	224.00	3.50
Dual 8E	metolachlor	23	1,039.56	1,737.94	1.67
Extrazine II DF	cyanazine + atrazine	2	120.00	81.00	0.68
Lariat	alachlor + atrazine	4	122.50	118.63	0.97
Lasso 4EC	alachlor	56	1,694.70	3,156.42	1.86
Lasso Microtech	alachlor	1	34.00	34.00	1.00
Lorox	linuron	1	18.00	18.00	1.00
Prowl	pendimethalin	1	12.50	12.50	1.00
Sutan+ 6.7EC	butylate	13	436.15	1,440.92	3.30
Sutazine	butylate + atrazine	3	60.00	301.50	5.03

Foliar applications were by far the most utilized method of application (99.7%). Methomyl was applied the most (7,158 times) and accounted for 55,508.16 treated acres. The use of methomyl was followed by esfenvalerate at 18,671.0 acres and thiodicarb at 13,640.51 acres. In terms of total lbs ai applied, methomyl also ranked number one (20,964.0 lb ai). Thiodicarb, however, ranked second (9480.11 lbs ai) followed by diazinon (2919.77 lbs ai) and carbofuran (2,686.90 lbs ai; foliar and soil). These materials are either carbamate or organochlorine insecticides and do not reflect the lower use rates for newer pyrethroid materials. This fact explains why, esfenvalerate ranked second in terms of the total number of acres treated and is ranked 9th behind methomyl in terms of the amount of active ingredient utilized. Other high use materials included ethyl parathion (2,204.53 lbs ai), permethrin (1,499.3 lbs ai), carbaryl (1,053.45 lbs ai), and methyl parathion (546.07 lbs ai). When the use of these materials is examined on a per acre basis, carbofuran ranked number one at 4.99 lb ai, followed by chlorpyrifos, fonophos and carbaryl.

Table 9. Overall Use of Insecticides and Other Materials on Sweet Corn During 1991

Trade Name	Common Name	# of Applications	Acres Treated	lbs. ai. Applied	lbs. ai. Per Acre
Insecticides					
Ambush 2E	permethrin	152	460.15	64.43	0.14
Asana XL	esfenvalerate	1,153	18,671.00	757.98	0.04
Counter 15G	terbufos	12	346.00	477.94	1.38
Diazinon 4EC	diazinon	20	303.30	287.92	0.95
Diazinon 50W	diazinon	1	8.20	4.61	0.56
Diazinon AG500	diazinon	724	3,399.15	2,627.24	0.77
Dipel	Bacillus thuringiensis	20	200.00	5.25	0.03
Dyfonate 4EC	fonophos	2	52.00	104.00	2.00
Furadan 15G	carbofuran	30	1,498.25	2,913.15	1.94
Furadan 4F	carbofuran	17	880.70	2,686.90	3.05
Imidan 50WP	phosmet	2	10.00	3.75	0.38
Lannate 1.8L	methomyl	7,158	55,508.16	20,964.00	0.38
Larvin 3.2	thiodicarb	819	13,640.51	9,480.11	0.69
Lorsban 15G	chlorpyrifos	1	7.50	11.25	1.50
Lorsban 4E	chlorpyrifos	44	543.00	519.62	0.96
Metasystox R	oxydemeton-methyl	20	352.60	138.05	0.39
Parathion 15W	ethyl parathion	3	31.20	9.70	0.31
Parathion 8	ethyl parathion	449	4,790.85	2,194.83	0.46
Penncap-M	methyl parathion	105	1,063.60	546.07	0.51
Pounce 3.2	permethrin	287	8,427.40	1,434.87	0.17
Pydrin 2.4	fenvalerate	15	122.00	18.30	0.15
Sevin 50W	carbaryl	105	612.70	1,053.45	1.72
Thiodan 50W	endosulfan	10	100.00	100.00	1.00
Other Materials					
Butacide	piperonyl butoxide	33	753.00	47.06	0.06
Coax	pharmamedia	48	792.00	792.00	1.00

Two other pesticides were applied to sweet corn by the growers in the study. These were piperonyl butoxide (PBO), which is a insecticide synergist, and pharmamedia, a feeding stimulant. PBO was applied 33 times to 753 acres at a rate of 0.06 lbs ai/A. Pharmamedia or Coax was applied 48 times to 792.0 acres at a rate of 1.0 lb ai/A.

Growers in the study were also surveyed as to their use of spreader/sticker materials. For those growers who used these materials, they were applied to 16,489.85 acres (Table 10). Spreader/stickers were most frequently applied in combination with methomyl (10,113.7 acres), esfenvalerate (2,550.0 acres) and thiodicarb (1,417.0 acres). Other materials reported as being used with a spreader/sticker included ethyl parathion, permethrin, methyl parathion, and pharmamedia.

Table 10. Spreader/Sticker Use by Pesticide Applied During 1991.

Trade Name	Common Name	Acres Treated	Amount a.i. Applied
Fungicides			
Manzate 200DF	manganese + zinc	17.60	11.33
Insecticides			
Ambush 2E	permethrin	234.00	36.31
Asana 66XL	esfenvalerate	2,550.00	116.08
Diazinon 4EC	diazinon	217.30	182.92
Diazinon AG500	diazinon	8.20	4.61
Diazinon AG500	diazinon	446.00	551.50
Lannate 1.8L	methomyl	10,113.70	4,368.95
Larvin 3.2	thiodicarb	1,417.00	1,054.25
Parathion 15W	ethyl parathion	31.20	9.70
Parathion 8	ethyl parathion	1,089.35	478.58
Penncap-M	methyl parathion	46.60	34.45
Pounce 3.2	permethrin	230.90	26.93
Other Materials			
Coax	pharmamedia	88.00	5,632.00
Total		16,489.85	12,507.61

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