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Pesticide Use on Broccoli, Cabbage, Cauliflower and Peppers Grown in Connecticut: 1991

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Introduction

Establishing a database of pesticide use by crop is necessary to respond to numerous issues including groundwater quality, protection of endangered species and pesticide residues on food. State-level pesticide use data are also needed to respond to benefits assessments of pesticides in the EPA special review process.

The objective of this project was to collect information on the types and amounts of pesticides and nonpesticide methods used to control cole crop (i.e., broccoli, cabbage and cauliflower) and pepper pests in Connecticut during 1991.

Broccoli and cauliflower were not part of the original NAPIAP (National Agricultural Pesticide Impact Assessment Program) proposal. However, while designing the cabbage survey, it was decided that information for the other two major cole crops in Connecticut could be obtained with minimal effort. Information about broccoli and cauliflower, therefore, was collected in conjunction with the cabbage survey.

The *1987 Census of Agriculture* (USDC, 1989) states that there were 345 acres of peppers, 171 acres of broccoli, and 68 acres of cauliflower harvested in Connecticut in 1987. While the *1987 Census of Agriculture* report reflects information on acreage harvested, this report presents information on acreage planted and harvested for each crop. There are no known published sources reporting acreage of cabbage harvested or planted in Connecticut.

Materials and Methods

Written surveys, one for cole crops and one for peppers, were determined to be the most cost effective and least time consuming method of data collection. Information gained from previous NAPIAP surveys conducted in Connecticut was used (Turner and Bartholomew, in press) to develop data collection procedures and to design the two surveys. Jude Boucher, University of Connecticut Cooperative Extension Educator/Vegetable IPM Program Coordinator, was helpful in designing the surveys. See Appendices A and B.

The surveys were designed to collect the following information:

A. Acres planted and average yield
B. Chemicals used for control of each pest
   1. Number of treatments and rates
   2. Cost of chemicals per acre
   3. Method of applications
   4. Time of applications
C. Nonpesticide methods used for control of each pest
   1. Number of treatments
   2. Time of applications
   3. Effectiveness of method
D. Sources of information.

Both survey forms were divided into the following four sections:

Section A: General Instructions/Information. Growers were asked to report each application of every pesticide and nonpesticide method, the actual area treated and amount of formulation applied including unit of measurement. They were instructed to fill out the form as completely as possible even if there were questions they could not answer. If they did not grow cole crops or peppers, they were asked to mark the survey "no cole crops" or "no peppers" and return it.

Section B: 1991 Regular Spray Program Information. The first part of this section requested information about the total number of acres or plants planted, sprayed and harvested. Figures were requested for number of containers harvested for wholesale and retail sale and average price per container. In the second part of Section B, a table format was used to collect pesticide application data. Information requested included crop treated, acres or plants treated, trade name and formulation, pests targeted, application rate per acre, number of treatments, crop stage and type of application.

Section C: 1991 Nonpesticide Methods. A table format was used to collect data about nonpesticide methods of pest control. Information requested included crop treated, acres or plants treated, nonpesti-

cide method used, pests targeted, number of times method used, crop stage and whether method was effective.

Section D: Sources of Information. A check list of different sources of information was used to collect data as to where growers obtained vegetable production and pest control information.

A mailing list with names and addresses of 239 vegetable growers was compiled by using the Connecticut Department of Environmental Protection list of certified private applicators in the vegetable category. Any individuals not on this list, but who were known to have participated in the vegetable IPM (integrated pest management) program the last five years, or the 1985 Connecticut Broccoli Marketing Project, were added to the list.

Several steps were taken to encourage growers to return the surveys. First, an explanation of the purpose of the surveys and the need for participation was included in a cover letter. Second, language familiar to cole crop/pepper growers was used on the surveys so that questions were easily understood. Third, the surveys were kept short. Finally, growers were asked to return the surveys marked "no cole crops" or "no peppers" if they did not grow the crop.

Two newsletter articles explaining the survey and the need for grower participation were printed in the *Grower: Vegetable and Small Fruit Newsletter* (Turner, 1992) and the *Connecticut Weekly Agricultural Report* (Connecticut Department of Agriculture, 1992).

On February 27, 1992, the surveys were mailed together with a cover letter. Post cards were sent two weeks later reminding growers that their input was needed. Telephone calls were made four weeks after the survey was mailed to all growers who had not responded. Where messages could not be left, handwritten post cards were sent. These post cards were handwritten in order to personalize them and to keep them from looking like "junk mail." Six weeks after the first mailing, handwritten post cards were again sent encouraging response. Growers known to have grown cole crops and/or peppers were sent a duplicate survey at eight weeks.

Retail prices for most formulations of pesticides were obtained in October 1991 from two agricultural chemical retailers in Connecticut. The prices for Bravo 500, Sencor DF, Treflan EC, Malathion 8EC, Malathion 25W, Malathion 57EC and MVP are for 1992 and are from the same two retailers.

In preparing Tables 1.a. and 1.c. for cole crops and Tables 5.a. and 5.c. for peppers, the method of calculating formulation rate/acre/application was: (total amount of formulation reported used for the year) ÷ (**total** acres treated). The amount of formulation in this equation is obtained by adding (acres treated with a given formulation) x (application rate/acre) x (number of treatments). Total acres treated is calcu-

lated by adding (number of acres a grower treated one time with a given formulation) x (number of treatments). By way of example, if 10 acres were sprayed three times with Ridomil 2E, the total number of acres treated is 30.

The formulation rate/acre/year in Tables 1.a. to 1.c. and 5.a. to 5.c. was calculated as: (total amount of formulation reported used for the year) ÷ (acres treated). The only difference between this equation and the equation for determining the formulation rate/acre/application is **total** acres treated. Acres treated is obtained by adding together all of the acres growers treated one time with a given formulation. If 10 acres were sprayed three times with Ridomil 2E, the actual number of acres treated is 10.

In preparing Tables 2.a. to 2.c. for cole crops and Tables 6.a. to 6.c. for peppers, the "rate (lb. a.i./A) per application" and "rate (lb. a.i./A) per year" were calculated by converting the amount of formulation rate/acre/application and formulation rate/acre/year from Tables 1 and 5 into pounds of pesticide active ingredient.

Results and Discussion: Cole Crops

Regular spray program

One hundred and eighty-three surveys were returned, 77% of two hundred and thirty-nine mailed. Forty-nine growers returned surveys that contained data for 215 acres planted to cole crops. Of the 49 growers, 29 planted 106 acres of broccoli, 36 planted 104 acres of cabbage, and 18 planted 5 acres of cauliflower. This represents 62% of the 171 acres of broccoli and 7% of the 68 acres of cauliflower production reported in the *1987 Census of Agriculture* (USDC,1989). There are no published sources reporting acreage of cabbage. One hundred and thirty-four surveys were returned; 6 surveys indicated they were the same business with multiple locations, and 128 indicated no cole crops were grown or they were out of business.

Based on general information regarding 215 acres of cole crops planted, 207 acres (96%) were treated with pesticides. Two of the 207 acres were treated only with *Bacillus thuringiensis* var. *kurstaki*. The remaining eight acres were not treated with chemicals.

Of the 29 broccoli growers responding to the survey, 15 provided complete information about yield. Yields were measured in 50 lb. crates. Eight of the 15 growers used pesticides on 98 acres. The median yield per harvested acre where pesticides were used was 275 with a range of 100 to 1,200 crates/acre. Median price/crate was $12.40 with a range of $5.00 to $21.01/crate. Median gross income/planted acre was $3,975 with a range of $557 to $6,000/acre.

Seven growers produced broccoli without using pesticides on five acres. The median yield per harvested acre without pesticides was 250 with a range of 40 to 400 crates/acre. Median price/crate was $12.00 with a range of $5.00 to $28.00/crate. Median gross income/planted acre was $2,400 with a range of $200 to $4,800/acre.

Of the 36 cabbage growers responding to the survey, 21 provided complete information about yield. Yields were measured in 55 lb. crates. Sixteen of the 21 growers used pesticides on 84 acres. The median yield per harvested acre where pesticides were used was 478 crates with a range of 60 to 900 crates/acre. Median price/crate was $6.00 with a range of $4.00 to $19.25/crate. Median gross income/planted acre was $2,553 with a range of $160 to $6,000/acre.

One grower who only used *Bt.* var. *kurstaki* on two acres of cabbage is included with pesticides above. He/she harvested 400 crates/acre, had an average price of $5.00/crate, and had a gross income/planted acre of $2,000.

Four growers produced cabbage on two acres without using pesticides. The median yield per harvested acre where pesticides were not

used was 193 with a range of 100 to 300 crates/acre. Median price/crate was $6.00 with a range of $5.00 to $12.00/crate. Median gross income/planted acre was $1,435 with a range of $500 to $2,100/acre.

Of the 18 cauliflower growers responding to the survey, 10 provided complete information about yield. Yields were measured in 30 lb. crates. Seven of the 10 growers used pesticides on four acres. The median yield per harvested acre where pesticides were used was 842 with a range of 60 to 3,332 crates/acre. Median price/crate was $9.00 with a range of $5.00 to $13.50/crate. Median gross income/planted acre was $4,000 with a range of $720 to $13,500/acre.

Two growers produced cauliflower without using pesticides on one acre. The median yield per harvested acre without pesticides was 755 with a range of 400 to 1,110 crates/acre. Median price/crate was $10.51 with a range of $7.50 to $13.51/crate. Median gross income/planted acre was $2,182 with a range of $1,364 to $3,000/acre.

Though the average price per crate was requested on the survey, it was not made clear what the difference was between wholesale and retail prices. For example, some growers who sold broccoli at their road side stand considered broccoli sold by the crate to be wholesale and broccoli sold by the pound to be sold retail. This lack of clarification does not allow separate prices for retail and wholesale to be determined.

Complete pesticide use information was reported for 202 acres of cole crops planted in 1991. Therefore, information about chemical use in this report is based on data collected for 202 acres. Tables 1.a. to 1.c. present information on the rate of pesticide applied by formulation per acre and per year and the formulation cost per acre for both a single application and for the year. Growers spent $21,025 on pesticides to treat 202 acres. Insecticides cost $9,089 (43%) (Table 1.c.), fungicides and bactericides cost $6,525 (31%) (Table 1.a.) and herbicides cost $5,411 (26%) (Table 1.b.).

Tables 2.a. to 2.c. present the number of acres treated with each pesticide, the time frame during which each pesticide was applied, the number of applications of each pesticide, the rates of active ingredients used per application and per year and the total pounds of active ingredient per year for each chemical used. Cole crop growers surveyed used 1,142 lbs. of pesticide active ingredient (a.i.) to treat 202 acres. Of the 1,142 lbs. a.i. used, herbicides accounted for 579 lbs. a.i. (51%) (Table 2.b.), insecticides for 393 lbs. a.i. (34%) (Table 2.c.), and fungicides/bactericides for 170 lbs. a.i. (15%) (Table 2.a.).

Insecticides were used on all 202 acres. The most heavily used insecticides were chlorpyrifos and *Bt.* var. *kurstaki*. Chlorpyrifos comprised 156 lbs. a.i. and *Bt.* var. *kurstaki* 144 lbs. a.i. of the 393 lbs. a.i. of insecticides used and were applied to 91 acres and 135 acres respec-

tively. Of the $9,089 spent on insecticides, chlorpyrifos cost $1,842 and *Bt.* var. *kurstaki* cost $5,306.

Herbicides were used on 160 acres of the 202 acres treated with pesticides. The two most heavily used herbicides were DCPA and trifluralin (Tables 1.b. and 2.b.). These were used on 130 acres, 81% of the acreage treated for weed control. These two materials comprised 535 lbs. a.i., 92% of the 579 lbs. a.i. of herbicide, and accounted for $4,344, 80% of the $5,411 spent for weed control.

Fungicides and/or bactericides were used on 104 acres of the 202 acres treated pesticides. The two primary fungicides/bactericides used were metalaxyl and chlorothalonil (Tables 1.a. and 2.a.). These were used on 97 acres, 93% of the acreage treated for disease control. These two materials comprised 150 lbs. a.i., 88% of the 170 lbs. a.i. of fungicides/bactericides, and accounted for $6,366, 98% of the $6,525 spent on fungicides/bactericides.

The method of pesticide application used for herbicides was a boom sprayer. For fungicides/bactericides a boom sprayer was used on 92% of the acreage and a mist sprayer on the balance. For insecticides, a boom sprayer was used on 64% of the acreage, a mist sprayer 22%, drench 12%, hand sprayer or backpack sprayer 2% and dusting less than 0.1%.

Nonpesticide methods

The nonchemical methods of weed control used by 33 growers on 125 acres are listed in Table 3. Also shown are the number of times each nonpesticide method was used, number of acres treated with only nonpesticide methods and number of acres treated with both pesticide and nonpesticide methods. Mechanical cultivation and/or hand cultivation were used on 123 acres, 98% of the 125 acres treated with a nonchemical weed control. When asked, growers stated nonpesticide methods were effective on 100% of the acreage. However, it should be noted that 84 acres, 67% of the 125 acres treated with a nonpesticide method, were also treated with a herbicide.

Row covers were used by one grower to control cabbage looper, aphids, cabbage maggot and slugs on .25 acre. The grower felt that row covers were effective and no insecticides were needed.

Pests targeted

Tables 4.a. and 4.b. list which pesticides were used to treat each pest and how many acres were treated. Pest data for broccoli, cabbage and cauliflower are combined because similar pest problems affect all three crops. Thirty-eight of the surveys returned by growers contained usable information on the control of various pests. This information

represents 207 acres planted. Total amounts of individual pesticides used for a given pest cannot be determined from data collected, since growers reported targeting multiple pests with a single application. Insects were treated on 206 acres. The two insects affecting the greatest number of acres were cabbage looper on 199 acres and imported cabbageworm on 146 acres (Table 4.b.). Weeds (i.e., broadleaf and grass types) were treated on 162 acres. Diseases were treated on 104 acres. The disease affecting the greatest number of acres was damping-off on 75 acres (Table 4.a.).

Sources of information for growers

Forty-three of the cole crop surveys had usable data about where growers obtained vegetable production and pest control information. The survey asked for the three major sources of information used. However, growers provided one to eight sources. Responses indicate the sources most frequently used were suppliers/dealers 49%, trade journals 44%, Extension newsletter 44%, Extension Educators/Specialists 42%, *New England Vegetable Management Guide* 33%, Experiment Station 28%, neighbors 19%, personal experience and family 16%, and Soil Conservation Service 5%.

Results and Discussion: Peppers

Regular spray program

One hundred and eighty-three surveys were returned, 77% of two hundred and thirty-nine mailed. Fifty-nine growers returned surveys that contained data for 246 acres planted to peppers, representing 71% of the 345 acres of pepper production reported in the *1987 Census of Agriculture* (USDC, 1989). One hundred and twenty-four surveys were returned; 6 surveys indicated they were the same business with multiple locations, and 118 indicated no peppers were grown or they were out of business.

Based on general information regarding 246 acres of peppers planted, 225 acres (91%) were treated with pesticides. The remaining 21 acres (9%) were not treated with chemicals.

Of the 59 pepper growers responding to the survey, 27 provided complete information about yield. Yields were measured in 24 lb. boxes. Twenty-two of the 27 growers used pesticides on 197 acres. The average yield per harvested acre where pesticides were used was 248 boxes. Median yield was 345 with a range of 0 to 800 boxes/acre. Average price/box was $6.50. Median price was $7.00 with a range of $5.00 to $16.33/box. Average gross income/planted acre was $1,527. Median gross income/planted acre was $1,991 with a range of $0 to $9,800/acre.

Five growers produced peppers without using pesticides on eight acres. The average yield per harvested acre without pesticides was 118 boxes. Median yield was 150 with a range of 59 to 1,250 boxes/acre. Average price/ box was $4.30. Median price was $5.00 with a range of $5.00 to $19.20/box. Average gross income/planted acre was $516. Median gross income/planted acre was $750 with a range of $200 to $14,400/acre.

Though the average price per box was requested on the survey, it was not made clear what the difference was between wholesale and retail prices. For example, some growers who sold peppers at their roadside stand considered peppers sold by the box to be wholesale and peppers sold by the pound to be sold retail. This lack of clarification does not allow separate prices for retail and wholesale to be determined.

Complete pesticide use information was reported for 199 acres of peppers, 58% of the 345 acres harvested in 1987 (USDC,1989). Therefore, information about chemical use in this report is based on data collected for 199 acres planted. Tables 5.a. to 5.c. present information on the rate of pesticide applied by formulation per acre and per year, and the formulation cost per acre for both a single applica-

tion and for the year. Growers spent $13,703 on pesticides to treat 199 acres. Insecticides cost $7,983 (58%) (Table 5.c.), fungicides and bactericides cost $3,550 (26%) (Table 5.a.) and herbicides cost $2,170 (16%) (Table 5.c.).

Tables 6.a. to 6.c. present the number of acres treated with each pesticide, the time frame during which each pesticide was applied, the number of applications of each pesticide, the rates of active ingredients used per application and per year, and the total pounds of active ingredient per year for each chemical used. Pepper growers surveyed used 1,476 lbs. of pesticide active ingredient (a.i.) to treat 199 acres. Of the 1,476 lbs. a.i. used, insecticides accounted for 669 lbs. a.i. (45%) (Table 6.c.), fungicides/ bactericides for 641 lbs. a.i. (44%) (Table 6.a.) and herbicides for 166 lbs. a.i. (11%) (Table 6.b.).

Insecticides were used on 196 acres of the 199 acres treated with pesticides. The two primary insecticides used were acephate and dimethoate (Tables 5.c. and 6.c.). These were used on 152 acres, 78% of the 196 acres treated with insecticides; comprised 436 lbs. a.i., 65% of the 669 lbs. a.i. of insecticides used; and accounted for $4,953, 62% of the $7,983 spent on insecticides.

Potassium salts of fatty acid and *Bt.* var. *kurstaki* figures are included with insecticides above and in Tables 5.c. and 6.c. Potassium salts of fatty acids were used on three acres, 2% of the 196 acres treated with insecticides, and totaled 10 lbs. a.i. at a cost of $39. *Bt.* var. *kurstaki* was used on one acre, 0.5% of the 196 acres, and totaled 0.1 lbs. a.i. at a cost of $15.

Fungicides and/or bactericides were used on 173 acres of the 199 acres treated with pesticides. The two fungicides/bactericides most heavily used were copper hydroxide and copper hydroxide/basic copper sulfate (Tables 5.a. and 6.a.). These were used on 158 acres, 91% of the 173 acres treated with fungicides/bactericides; comprised 612 lbs. a.i., 96% of the 641 lbs. a.i. of fungicide/bactericide; and accounted for $2,356, 66% of the $3,550 spent on fungicides/bactericides.

Herbicides were used on 109 acres of the 199 acres treated with pesticides. The most heavily used herbicides were napropamide and trifluralin (Tables 5.b. and 6.b.). These were used on 79 acres, 73% of the 109 acres treated with herbicides; comprised 120 lbs. a.i., 72% of the 166 lbs. a.i. of herbicide; and accounted for $1,584, 73% of the $2,170 spent on herbicides.

The method of pesticide application used for herbicides was a boom sprayer. For fungicides/bactericides, a mist sprayer was used on 78% of the acreage and a boom sprayer on 22%. For insecticides, a mist sprayer was used on 67% of the acreage, a boom sprayer 33%, and other methods (i.e. drench, dusting, and handgun) less than 0.1%.

Nonpesticide methods

The nonchemical methods of weed control used by 42 growers on 207 acres are listed in Table 7. Also shown are the number of times each nonpesticide method was used, number of acres treated with only nonpesticide methods and number of acres treated with both pesticide and nonpesticide methods. Mechanical cultivation and/or black plastic were used on 206 of the 207 acres treated with a nonchemical weed control. Growers stated nonpesticide methods were effective on 141 acres. Black plastic was used as the only means of weed control on 59 acres and found ineffective. It should be noted that 100 acres, 48% of the 207 acres treated with a nonpesticide method, were also treated with a herbicide.

Natural predators were used by two growers to control hornworms and corn borers on one acre. One grower used companion plantings to attract natural predators and the other grower purchased and released predators. Both growers felt that natural predators were effective and no insecticides were needed.

Pests targeted

Tables 8.a. and 8.b. list which pesticides were used to treat each pest and how many acres were treated. Total amounts of individual pesticides used for a given pest cannot be determined from data collected since growers reported targeting multiple pests with a single application. Thirty-eight of the surveys returned by growers contained usable information on the control of various pests. This information represents 216 acres planted. Insects were treated for on 212 acres. The three insects affecting the greatest number of acres were aphids on 166 acres, European corn borer on 165 acres and pepper maggot on 145 acres (Table 4.b.). Diseases were treated for on 170 acres. The two diseases affecting the greatest number of acres were bacterial spot on 165 acres and viruses on 105 acres (Table 4.a.). Weeds (i.e., broadleaf and grass types) were treated on 112 acres.

Sources of information for growers

Fifty of the pepper surveys had usable data about where growers obtained vegetable production and pest control information. The survey asked for the three major sources of information used. However, growers provided one to eight sources. Responses indicate the sources most frequently used were Extension newsletter 60%, suppliers/dealers 52%, *New England Vegetable Management Guide* 46%, Extension Educators/Specialists 44%, trade journals 32%, neighbors 22%,

Experiment Station 20%, personal experience and family 10% and Soil Conservation Service 2%.

Summary

Using a written survey as the means of collecting information was received well by the growers. Seventy-seven percent of the surveys were returned. Only one was completed over the telephone.

Of the 183 people who returned surveys, 12 grew 117 acres of cole crops, 21 grew 71 acres of peppers, 38 grew 98 acres of cole crops and 175 acres of peppers. One hundred and twelve surveys were returned, six surveys indicated they were the same business with multiple locations, and 106 indicated no cole crops or peppers were grown or they were out of business.

Growers are dependent on chemicals to grow cole crops and peppers. Only 5% of the cole crop and 9% of the pepper acreage were grown without pesticides. Cole crop growers used an average of 6 lbs. a.i. of pesticides per acre at a cost of $103/acre, 6% of the average gross income/planted acre where pesticides were used. Pepper growers used an average of 7 lbs. a.i. of pesticides per acre at a cost of $69/acre, 5% of the average gross income/planted acre where pesticides were used.

When cole crop and pepper growers were asked to list the nonpesticide methods of pest control they used, only three growers listed noninsecticidal methods. More than half of the growers who listed nonpesticide methods of controlling weeds, also used herbicides.

Growers' dependency on chemicals is further revealed by the fact that the median gross income/planted acre was 40% to 62% greater for crops grown with pesticides versus without pesticides.

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Table 1.a. Fungicides and Bactericides: Formulations on COLE CROPS, amount used, and cost.[a]

Fungicide and Bactericide	Trade Name and Formulation	Formulation Cost/Unit	Formulation Rate/A/ Application (Average)	Formulation Cost/A/ Application	Formulation Rate/A/ Year (Average)	Formulation Cost/A/ Year	Acres Treated[b]	Total Amount of Formulation Applied/Year	Total Formulation Cost/Year
chlorotha-lonil	Bravo 720(F)	$ 48.52 gl	1.5 pt	$ 9.10	4.47 pt	$ 27.11	22	50 qt	$ 604
copper hydroxide	Kocide 101 (WP)	2.47 lb	2.0 lb	4.94	4.0 lb	9.88	2	7 lb	18
metalaxyl	Ridomil 2E	153.64 gl	2.0 qt	76.82	2.0 qt	76.82	75	150 qt	5,762
pentachloro-nitrobenzene	Terraclor 75WP	7.82 lb	2.0 lb	15.64	4.0 lb	31.28	5	18 lb	141
Total fungicide/bactericide		-	-	-	-	-	-	-	$6,525

[a] Prices listed are for 1991.

[b] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Pounce 3.2EC, the actual number of acres treated is 5.

Table 1.b. Herbicides: Formulations used on COLE CROPS, amount used, and cost.[a,b]

Herbicide	Trade Name and Formulation	Formulation Cost/Unit	Formulation Rate/A/ Year (Average)	Formulation Cost/A/ Year	Acres Treated	Total Amount of Formulation Applied/Year	Total Formulation Cost/Year
DCPA	Dacthal 75WP	$ 6.00 lb	7.75 lb	$ 46.50	83	646 lb	$3,877
napropamide	Devrinol 50DF	8.32 lb	3.91 lb	32.53	18	69 lb	570
oxyfluorfen	Goal 1.6E	79.54 gl	1.25 qt	24.86	20	25 qt	497
trifluralin	Treflan EC	36.99 gl[c]	.83 pt	3.84	121	101 pt	467
Total herbicide		-	-	-	-	-	$5,411

[a] Prices listed are for 1991 unless otherwise indicated.

[b] Only one application of any given herbicide was made during the year.

[c] Price listed is for 1992.

Table 1.c. Insecticides: Formulations used on COLE CROPS, amount used, and cost.[a]

Insecticide	Trade Name and Formulation	Formulation Cost/Unit	Formulation Rate/A/ Application (Average)	Formulation Cost/A/ Application	Formulation Rate/A/ Year (Average)	Formulation Cost/A/ Year	Acres[b] Treated	Total Amount of Formulation Applied/Year	Total Formulation Cost/Year
Bacillus thuringiensis var. kurstaki	Dipel 2X (WP)	$ 14.91 lb	.52 lb	$ 7.75	1.37 lb	$ 20.43	7	9 lb	$ 137
	Dipel 4L	37.29 gl	.70 qt	6.53	1.74 qt	16.22	9	4 gl	147
	Javelin WG	15.58 lb	1.0 lb	15.58	1.0 lb	15.58	22	22 lb	343
	MVP (AF)	29.90 gl[c]	.63 gl	18.84	1.61 gl	48.14	97	157 gl	4,679
	Total Bt var. kurstaki	-	-	-	-	-	135	-	5,306
carbaryl	Sevin XLR Plus	26.41 gl	4.0 fl oz	.83	4.0 fl oz	.83	1	4 fl oz	1
	Sevin 50W	2.90 lb	1.0 lb	2.90	1.0 lb	2.90	5	5 lb	13
	Total carbaryl	-	-	-	-	-	6	-	14
chlorpyrifos	Lorsban 4E	47.32 gl	1.72 qt	20.35	1.72 qt	20.35	91	39 gl	1,847
diazinon	Diazinon 50W	4.35 lb	.6 lb	2.61	.6 lb	2.61	2	1 lb	5
	Diazinon AG500 (ES)	30.32 gl	.71 pt	2.69	1.82 pt	6.90	27	6 gl	183
	Total diazinon	-	-	-	-	-	29	-	188
endosulfan	Thiodan 50WP	6.00 lb	1.02 lb	6.12	2.07 lb	12.42	31	64 lb	383
esfenvalerate	Asana XL	130.11 gl	3.0 fl oz	3.05	6.0 fl oz	6.10	.03	.18 fl oz	.18

Table 1.c. Insecticides (continued)

Insecticide	Trade Name and Formulation	Formulation Cost/Unit	Formulation Rate/A/ Application (Average)	Formulation Cost/A/ Application	Formulation Rate/A/ Year (Average)	Formulation Cost/A/ Year	Acres Treated [b]	Total Amount of Formulation Applied/Year	Total Formulation Cost/Year
malathion	Malathion 8EC	$ 29.06 gl [c]	1.25 qt	$ 9.08	2.5 qt	$ 18.16	.03	2 fl oz	$ .45
	Malathion 57EC	20.59 gl [c]	1.0 qt	5.15	2.0 qt	10.30	1	2 qt	10
	Total malathion	-	-	-	-	-	1	-	11
methamidophos	Monitor 4 (liquid)	70.47 gl	2.0 pt	17.62	2.0 pt	17.62	2	4 pt	32
methomyl	Lannate L	41.11 gl	2.38 pt	12.23	6.33 pt	32.53	7	44 pt	231
permethrin	Ambush 2E	114.55 gl	.39 pt	5.58	1.16 pt	16.61	33	19 qt	548
	Pounce 3.2EC	187.05 gl	5.62 fl oz	8.21	8.45 fl oz	12.35	43	23 pt	534
	Total permethrin	-	-	-	-	-	76	-	1,082
Total insecticide		-	-	-	-	-	-	-	$9,089

[a] Prices listed are for 1991 unless otherwise indicated.

[b] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Pounce 3.2EC, the actual number of acres treated is 5.

[c] Price listed is for 1992.

Table 2.a. Fungicides and Bactericides: Active ingredient used on COLE CROPS, acreage treated, timing, number and rate of application.

Fungicide and Bactericide	Trade Name and Formulation	Acres Treated[a]	Crop Stage at Application	No. of Applications (Range)	Rate (lb ai/A) Per Application (Range)	Rate (lb ai/A) Per Application (Average)	Rate (lb ai/A) Per Year (Average)	Total Pounds Active Ingredient/ Year
chloro-thalonil	Bravo 720 (F)	22	Transplant - heading	1-3	1.13-1.5	1.13	3.05	75
copper hydroxide	Kocide 101 (WP)	2	Transplant - preheading	2	1.54	1.54	3.08	6
metalaxyl	Ridomil 2E	75	-	1	1.0	1.0	1.0	75
penta-chloronitrobenzene	Terraclor 75WP	5	Preheading	2	1.5	1.5	3.0	14
Total fungicide/bactericide		-	-	-	-	-	-	170

[a] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Pounce 3.2EC, the actual number of acres treated is 5.

Table 2.b. Herbicides: Active ingredient used on COLE CROPS, acreage treated, and rate of application.[a]

Herbicides	Trade Name and Formulation	Acres Treated	Rate (lb ai/A) Per Application (Range)	Rate (lb ai/A) Per Year (Average)	Total Pounds Active Ingredient/ Year
DCPA	Dacthal 75WP	83	3.0-9.0	5.81	485
napropamide	Devrinol 50DF	18	.5-2.0	1.96	34
oxyfluorfen	Goal 1.6E	20	.5	.5	10
trifluralin	Treflan EC	121	.25-1.0	.42	50
Total herbicide		-	-	-	579

[a] All herbicides applications were made prior to transplant or at transplant. Only one application of any given herbicide was made during the year.

Table 2.c. Insecticides: Active ingredient used on COLE CROPS, acreage treated, timing, number and rate of application.

Insecticide	Trade Name and Formulation	Acres Treated[a]	Crop Stage at Application	No. of Applications (Range)	Rate (lb ai/A) Per Application (Range)	Rate (lb ai/A) Per Application (Average)	Rate (lb ai/A) Per Year (Average)	Total Pounds Active Ingredient/ Year
Bacillus thuringiensis var. kurstaki	Dipel 2X (WP)	7	Preheading - heading	1-6	.03-.8	.03	.09	1[b]
	Dipel 4L	9	Transplant - heading	1-4	.006-.12	.02	.06	1[c]
	Javelin WG	22	Preheading	1	.06	.06	.06	1[d]
	MVP (AF)	97	Preheading - heading	1-3	.45-1.8	.57	1.45	141[e]
	Total Bt var. kurstaki	135	Transplant - heading	1-6	.006-1.8	.46	1.06	144[f]
carbaryl	Sevin XLR Plus	1	Transplant	1	.12	.12	.12	.1
	Sevin 50W	5	Preheading - heading	1	.5	.5	.5	2
	Total carbaryl	6	Transplant - heading	1	.12-.5	.43	.43	2
chlorpyrifos	Lorsban 4E	91	Transplant - preheading	1	.5-2.25	1.72	1.72	156

Insecticide	Trade Name and Formulation	a Acres Treated	Crop Stage at Application	No. of Applications (Range)	Rate (lb ai/A) Per Application (Range)	Rate (lb ai/A) Per Application (Average)	Rate (lb ai/A) Per Year (Average)	Total Pounds Active Ingredient/ Year
diazinon	Diazinon 50W	2	Prior to transplant - preheading	1	.28-1.0	.3	.3	1
	Diazinon AG500 (ES)	27	Transplant - heading	1-3	.25-1.0	.36	.91	24
	Total diazinon	29	Transplant - heading	1-3	.25-1.0	.36	.87	25
endosulfan	Thiodan 50WP	31	Transplant - heading	2-3	.5-1.55	.51	1.04	32
esfenvale-rate	Asana XL	.03	-	2	.02	.02	.03	.0009
malathion	Malathion 8EC	.03	Preheading - heading	2	2.5	2.5	5.0	.13
	Malathion 57EC	1	Preheading	2	1.25	1.25	2.5	3
	Total malathion	1	Preheading - heading	2	1.25-2.5	1.28	2.56	3
methami-dophos	Monitor 4 (liquid)	2	Preheading	1	1.0	1.0	1.0	2
methomyl	Lannate L	7	Preheading - heading	1-3	.34-.9	.54	1.42	10

Table 2.c. Insecticides (continued)

Insecticide	Trade Name and Formulation	[a] Acres Treated	Crop Stage at Application	No. of Applications (Range)	Rate (lb ai/A) Per Application (Range)	Rate (lb ai/A) Per Application (Average)	Rate (lb ai/A) Per Year (Average)	Total Pounds Active Ingredient/ Year
permethrin	Ambush 2E	33	Preheading - heading	3	.09-.1	.1	.29	10
	Pounce 3.2EC	43	Prior to transplant - heading	1-3	.08-.4	.14	.21	9
	Total permethrin	76	Prior to transplant - heading	1-3	.08-.4	.11	.25	19
Total insecticide		-	-	-	-	-	-	393

[a] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Pounce 3.2EC, the actual number of acres treated is 5.

[b] Dipel 2X consists of 14.52 Billion International Units (BIU) per pound of formulation. Total lbs ai/year is equivalent to 133.26 BIU.

[c] Dipel 4L consists of 32 BIU per gallon of formulation. Total lbs ai/year is equivalent to 125.70 BIU.

[d] Javelin WG consists of 14.4 BIU per pound of formulation. Total lb ai/year is equivalent to 316.8 BIU.

[e] MVP consists of 37.8 BIU per gallon of formulation. Total lb ai/year is equivalent to 5,903.42 BIU.

[f] Total lb ai/year is equivalent to 6,491.49 BIU.

Table 3. Nonpesticide methods used to control weeds on COLE CROPS, number of times method used, and acreage treated in conjunction with herbicides.

Nonpesticide Method(s) Used	Number of Times Method Used	Acres Treated Only With Nonpesticide Method	Acres Treated With Both Nonpesticide Method and Herbicide	Total Acres Treated
Hand cultivation	-	0	3	3
Mechanical cultivation	2-8	6	74	80
Mechanical cultivation/ hoeing	2-6 1-6	34	6	40
Black plastic	1	1	0	1
Mulch	2	0	1	1
Total	-	41	84	125

Table 4.a. Fungicides and Bactericides used to control diseases on COLE CROPS.

Disease	Fungicide/ Bactericide	Trade Name and Formulation	Acres Treated[a]
Alternaria leaf spot (*Alternaria brassicae* and *brassiciola*)	chlorothalonil	Bravo 720 (F)	22
	copper hydroxide	Kocide 101 (WP)	2
	Actual acres treated for alternaria leaf spot		24
Black rot (*Xanthomonas campestris* pv. *campestris*)	chlorothalonil	Bravo 720 (F)	.3
	pentachloronitro-benzene	Terraclor 75WP	5
	Actual acres treated for black rot		5
Club root (*Plasmodiophora brassicae*)	pentachloronitro-benzene	Terraclor 75WP	5
Damping-off (*Phythium* spp.)	metalaxyl	Ridomil 2E	75

[a] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Pounce 3.2EC, the actual number of acres treated is 5.

Table 4.b. Insecticides used to control insects on COLE CROPS.

Insect	Insecticide	Trade Name and Formulation	Acres Treated[a]
Imported cabbageworm (*Artogeia rapae*)	*Bacillus thuringiensis* var. *kurstaki*	Dipel 2X (WP)	13
		Dipel 4L	4
		Javelin WG	22
		MVP (AF)	97
		Total *Bt* var. *kurstaki*	113[b]
	carbaryl	Sevin 50W	5
	diazinon	Diazinon AG500 (ES)	5
	endosulfan	Thiodan 50WP	2
	methamidophos	Monitor 4 (liquid)	2
	methomyl	Lannate L	7
	permethrin	Ambush 2E	.1
		Pounce 3.2EC	52
		Total permethrin	52
	Actual acres treated for imported cabbageworm		146[c]

Table 4.b. Insects (continued)

Insect	Insecticide	Trade Name and Formulation	Acres Treated[a]
Cabbage looper (*Trichoplusia ni*)	*Bacillus thuringienses* var. *kurstaki*	Dipel 2X(WP)	13
		Dipel 4L	6
		Javelin WG	22
		MVP (AF)	97
		Total *Bt* var. *kurstaki*	116[b]
	carbaryl	Sevin 50W	5
	diazinon	AG500 (ES)	23
	endosulfan	Thiodan 50WP	2
	esfenvalerate	Asana XL	.03
	malathion	Malathion 57EC	1
	methamidophos	Monitor 4 (liquid)	2
	methomyl	Lannate L	7
	permethrin	Ambush 2E	33
		Pounce 3.2EC	52
		Total permethrin	85
	Actual acres treated for cabbage looper		199[c]

Table 4.b. Insects (continued)

Insect	Insecticide	Trade Name and Formulation	Acres Treated[a]
Diamondback moth (*Plutella xylostella*)	*Bacillus thuringiensis* var. *kurstaki*	Dipel 2X (WP)	11
		Javelin WG	22
		MVP (AF)	97
		Total *Bt* var. *kurstaki*	108[b]
	carbaryl	Sevin 50W	5
	diazinon	Diazinon AG500 (ES)	5
	endosulfan	Thiodan 50WP	2
	methamidophos	Monitor 4 (liquid)	2
	methomyl	Lannate L	7
	permethrin	Pounce 3.2EC	31
	Actual acres treated for diamondback moth		121[c]
Flea beetles	diazinon	Diazinon AG500 (ES)	5
	endosulfan	Thiodan 50WP	31
	Actual acres treated for flea beetles		36

Table 4.b. Insects (continued)

Insect	Insecticide	Trade Name and Formulation	Acres Treated[a]
Aphids	*Bacillus thuringiensis* var. *kurstaki*	MVP (AF)	75
	carbaryl	Sevin XLR Plus	1
	diazinon	Diazinon AG500 (ES)	4
	endosulfan	Thiodan 50WP	32
	esfenvalerate	Asana XL	.03
	malathion	Malathion 8EC	.03
		Malathion 57EC	1
		Total malathion	1
	permethrin	Pounce 3.2EC	1
	Actual acres treated for aphids		112[c]
Cabbage maggot (*Delia radicum*)	*Bacillus thuringiensis* var. *kurstaki*	Dipel 2X (WP)	1
		Dipel 4L	3
		Total *Bt* var. *kurstaki*	4

Table 4.b. Insects (continued)

Insect	Insecticide	Trade Name and Formulation	Acres Treated[a]
	chlorpyrifos	Lorsban 4E	97
	diazinon	Diazinon 50W	2
		Diazinon 14G	1
		Diazinon AG500 (ES)	23
		Total diazinon	26
	endosulfan	Thiodan 50WP	1
	permethrin	Ambush 2E	3
		Pounce 3.2EC	1
		Total permethrin	4
	Actual acres treated for cabbage maggot		123[c]
Slugs	carbaryl	Sevin XLR Plus	1
	chlorpyrifos	Lorsban 4E	75
	esfenvalerate	Asana XL	.03
	Actual acres treated for slugs		76

[a] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Pounce 3.2EC, the actual number of acres treated is 5.

[b] This figure is less than the total of the above acres; more than one formulation of Bacillus thuringiensis var. kurstaki was used on the same acreage.

[c] Acres treated for this insect is less than the total of the above acres. Some acres were treated with more than one active ingredient.

Fungicide and Bactercide	Trade Name and Formulation	Formulation Cost/Unit	Formulation Rate/A/ Application (Average)	Formulation Cost/A/ Application	Formulation Rate/A/ Year (Average)	Formulation Cost/A/ Year	Acres Treated[b]	Total Amount of Formulation Applied/Year	Total Formulation Cost/Year
chlorotha-lonil	Bravo 500 (F)	$ 80.00 gl[c]	.5 qt	$ 10.00	1.6 qt	$ 32.00	10	4 gl	$ 320
copper hydroxide	Kocide DF	2.64 lb	2.0 lb	5.28	6.0 lb	15.84	10	60 lb	158
	Kocide 101 (WP)	2.47 lb	1.71 lb	4.22	7.01 lb	17.32	54	381 lb	940
	Total copper hydroxide	-	-	-	-	-	64	-	1,098
copper oxychloride and basic copper sulfate	COCS 50W	2.23 lb	2.0 lb	4.46	6.0 lb	13.38	94	564 lb	1,258
metalaxyl	Ridomil 2E	153.64 gl	2.0 qt	76.82	2.73 qt	104.86	8	45 pt	864
metalaxyl/ chlorothalonil	Ridomil Bravo 81W	13.64 lb	.75 lb	10.23	1.50 lb	20.46	1	1 lb	10
Total fungicide/bactericide		-	-	-	-	-	-	-	$3,550

[a] Prices listed are for 1991 unless otherwise indicated.

[b] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Orthene 75SP, the actual number of acres treated is 5.

[c] Price listed is for 1992.

Table 5.b. Herbicides: Formulations used on PEPPERS, amount used, and cost.[a,b]

Herbicide	Trade Name and Formulation	Formulation Cost/Unit	Formulation Rate/A/ Year (Average)	Formulation Cost/A/ Year	Acres Treated	Total Amount of Formulation Applied/Year	Total Formulation Cost/Year
DCPA	Dacthal 75WP	$ 6.00 lb	7.5 lb	$45.00	2	15 lb	$ 90
glyphosate	Roundup (liquid)	53.38 gl[c]	2.0 qt	26.69	17	34 qt	454
metribuzin	Sencor DF	27.88 lb	4.0 oz	6.97	6	24 oz	42
napropamide	Devrinol 50DF	8.32 lb	4.4 lb	36.61	29	127 lb	1,053
trifluralin	Treflan EC	36.99 gl[c]	1.89 pt	8.73	61	115 pt	531
Total herbicide		-	-	-	-	-	$ 2,170

[a] Prices listed are for 1991 unless otherwise indicated.

[b] Only one application of any given herbicide was made during the year, except for glyphosate which was applied two times to 17 A.

[c] Price listed is for 1992.

Table 5.c. Insecticides: Formulations used on PEPPERS, amount used, and cost.[a]

Insecticide	Trade Name and Formulation	Formulation Cost/Unit	Formulation Rate/A/ Application (Average)	Formulation Cost/A/ Application	Formulation Rate/A/ Year (Average)	Formulation Cost/A/ Year	Acres Treated[b]	Total Amount of Formulation Applied/Year	Total Formulation Cost/Year
acephate	Orthene 75SP	$ 9.17 lb	.98 lb	$ 8.99	3.2 lb	$ 29.34	147	470 lb	$ 4,311
azinphosmethyl	Guthion 50W	6.76 lb	.33 lb	2.23	1.0 lb	6.76	6	6 lb	41
Bacillus thuringiensis, var. kurstaki	Dipel 2X (WP)	14.91 lb	.50 lb	7.46	1.0 lb	14.91	1	1 lb	15
carbaryl	Sevin XLR Plus	26.41 gl	1.68 qt	11.09	3.0 qt	19.81	12	9 gl	241
	Sevin 50W	2.90 lb	1.08 lb	3.13	2.79 lb	8.09	2	7 lb	19
	Total carbaryl	-	-	-	-	-	14	-	260
diazinon	Diazinon 50W	4.35 lb	2.0 lb	8.70	2.0 lb	8.70	.1	.2 lb	1
	Diazinon AG500(ES)	30.32 gl	1.37 qt	10.39	1.72 qt	13.04	30	13 gl	393
	Total diazinon	-	-	-	-	-	30	-	394
dimethoate	Cygon 400 (EC)	31.11 gl	.51 pt	1.98	1.48 pt	5.76	112	165 pt	642
dyfonate	Dyfonate 4EC	48.07 gl	3.0 qt	36.05	3.0 qt	36.05	17	51 qt	613
endosulfan	Thiodan 3EC	36.41 gl	.7 qt	6.37	1.28 qt	11.65	20	26 qt	236
	Thiodan 50WP	6.00 lb	1.01 lb	6.06	2.12 lb	12.72	1	2 lb	13
	Total endosulfan	-	-	-	-	-	21	-	249
esfenvalerate	Asana XL	130.11 gl	8.0 fl oz	8.13	8.0 fl oz	8.13	1	4 fl oz	4

Table 5.c. Insecticides (continued)

Insecticide	Trade Name and Formulation	Formulation Cost/Unit	Formulation Rate/A/ Application (Average)	Formulation Cost/A/ Application	Formulation Rate/A/ Year (Average)	Formulation Cost/A/ Year	Acres Treated[b]	Total Amount of Formulation Applied/Year	Total Formulation Cost/Year
malathion	Malathion 25W	1.70 gl[c]	10.0 lb	17.00	10.0 lb	17.00	5	50 lb	$ 85
	Malathion 57EC	20.59 gl[c]	1.0 qt	5.15	1.0 qt	5.15	3	3 qt	15
	Total malathion	-	-	-	-	-	8	-	100
methomyl	Lannate L	41.11 gl	1.97 pt	10.12	3.55 pt	18.24	23	83 pt	474
	Lannate 90SP	20.51 lb	.52 lb	10.67	1.07 lb	21.95	10	11 lb	228
	Total methomyl	-	-	-	-	-	33	-	652
permethrin	Ambush 2E	114.55 gl	1.79 pt	25.63	3.57 pt	51.12	.1	4 fl oz	4
	Pounce 3.2EC	187.05 gl	7.98 fl oz	11.66	1.08 pt	25.25	26	14 qt	659
	Total permethrin	-	-	-	-	-	26	-	663
potassium salts of fatty acids	Insecticidal Soap	15.00 gl	1.0 qt	3.75	1.0 gl	15.00	3	10 qt	39
Total insecticide		-	-	-	-	-	-	-	$7,983

[a] Prices listed are for 1991 unless otherwise indicated.

[b] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Orthene 75SP, the actual number of acres treated is 5.

[c] Price listed is for 1992.

Table 6.a. Fungicides and Bactericides: Active ingredient used on PEPPERS, acreage treated, timing, number and rate of application.

Fungicide and Bactericide	Trade Name and Formulation	a Acres Treated	Crop Stage at Application	No. of Applications (Range)	Rate (lb ai/A) Per Application (Range)	Rate (lb ai/A) Per Application (Average)	Rate (lb ai/A) Per Year (Average)	Total Pounds Active Ingredient/ Year
chlorotha-lonil	Bravo 500 (F)	10	Prefruiting-fruiting	2-4	.34-1.04	.82	1.67	17
copper hydroxide	Kocide DF	10	Fruiting	3	1.23	1.23	3.68	37
	Kocide 101 (WP)	54	Prefruiting-fruiting	1-7	.39-2.31	1.32	5.40	293
	Total copper hydroxide	64	Prefruiting-fruiting	1-7	.39-2.31	1.31	5.13	330
copper oxychloride and basic copper sulfate	COCS 50W	94	Fruiting	3	1.0	1.0	3.0	282
metalaxyl	Ridomil 2E	8	Prior to transplant-prefruiting	1-2	1.0	1.0	1.37	11
metalaxyl/ chloro-thalonil	Ridomil Bravo 81W	1	Transplant-prefruiting	2	.61	1.22	.5	1
Total fungicide/bactericide		-	-	-	-	-	-	641

a Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Orthene 75SP, the actual number of acres treated is 5.

Table 6.b. Herbicides: Active ingredient used on PEPPERS, acreage treated, and rate of application.[a]

Herbicide	Trade Name and Formulation	Acres Treated[b]	Rate (lb ai/A) Per Application (Range)	Rate (lb ai/A) Per Year (Average)	Total Pounds Active Ingredient/ Year
DCPA	Dacthal 75WP	2	3.75-7.5	5.63	11
glyphosate	Roundup (liquid)	17	1.0	2.0	34
metribuzin	Sencor DF	6	.19	.19	1
napropamide	Devrinol 50DF	29	1.0-4.0	2.2	63
trifluralin	Treflan EC	61	.5-1.0	.95	57
Total herbicide		-	-	-	166

[a] Only one application of any given herbicide was made during the year (i.e. prior to transplant or at transplant), except glyphosate which was applied two times at prefruiting.

[b] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Orthene 75SP, the actual number of acres treated is 5.

Table 9 c. Insecticides: Active ingredient used on PEPPERS, acreage treated, timing, number and rate of application.

Insecticide	Trade Name and Formulation	Acres Treated[a]	Crop Stage at Application	No. of Applications (Range)	Rate (lb ai/A) Per Application (Range)	Rate (lb ai/A) Per Application (Average)	Rate (lb ai/A) Per Year (Average)	Total Pounds Active Ingredient/ Year
acephate	Orthene 75SP	147	Prefruiting-fruiting	1-7	.34-1.88	.74	2.4	353
azinphos-methyl	Guthion 50W	6	Prefruiting-fruiting	1-2	.13-.25	.17	.5	3
Bacillus thuringiensis var. kurstaki	Dipel 2X (WP)	1	Prefruiting-fruiting	2	.03	.03	.06	.1[b]
carbaryl	Sevin XLR Plus	12	Prefruiting-fruiting	1-3	.13-4.0	1.68	3.0	36
	Sevin 50W	2	Prefruiting-fruiting	1-3	.5-1.0	.54	1.40	3
	Total carbaryl	14	Prefruiting-fruiting	1-3	.13-4.0	1.43	2.74	39
diazinon	Diazinon 50W	.1	Transplant	1	1.0	1.0	1.0	.1
	Diazinon AG500 (ES)	30	Prior to transplant-fruiting	1-2	.25-2.0	1.37	1.72	52
	Total diazinon	30	Prior to transplant-fruiting	1-2	.25-2.0	1.37	1.72	52

Table 6.c. Insecticides (continued)

Insecticide	Trade Name and Formulation	Acres Treated[a]	Crop Stage at Application	No. of Applications (Range)	Rate (lb ai/A) Per Application (Range)	Rate (lb ai/A) Per Application (Average)	Rate (lb ai/A) Per Year (Average)	Total Pounds Active Ingredient/ Year
dimethoate	Cygon 400 (EC)	112	Prefruiting-fruiting	2-3	.25-.33	.26	.74	83
dyfonate	Dyfonate 4EC	17	Prior to transplant	1	3.0	3.0	3.0	51
endosulfan	Thiodan 3EC	20	Prefruiting-fruiting	1-3	.19-.75	.52	.96	20
	Thiodan 50WP	1	Transplant-prefruiting	1-3	.5-10.0	.51	1.06	1
	Total endosulfan	21	Transplant - fruiting	1-3	.19-10.0	.52	.97	21
esfenvalerate	Asana XL	1	Prefruiting	1	.04	.04	.04	.02
malathion	Malathion 25W	5	-	1	2.5	2.5	2.5	13
	Malathion 57EC	3	Prefruiting	1	1.25	1.25	1.25	4
	Total malathion	8	Prefruiting	1	1.25-2.5	2.03	2.03	17
methomyl	Lannate L	23	Prefruiting-fruiting	1-3	.23-.45	.44	.80	19
	Lannate 90SP	10	Prefruiting-fruiting	2-5	.30-.90	.47	.96	10
	Total methomyl	33	Prefruiting-fruiting	1-5	.23-.90	.45	.85	29

Table 6.c. Insecticides (continued)

Insecticide	Trade Name and Formulation	Acres Treated[a]	Crop State at Application	No. of Applications (Range)	Rate (lb ai/A) Per Application (Range)	Rate (lb ai/A) Per Application (Average)	Rate (lb ai/A) Per Year (Average)	Total Pounds Active Ingredient/ Year
permethrin	Ambush 2E	.1	Fruiting	2	.45	.45	.89	.1
	Pounce 3.2EC	26	Fruiting	2-4	.15-.2	.2	.43	11
	Total permethrin	26	Fruiting	2-4	.15-45	.2	.43	11
potassium salts of fatty acids	Insecticidal Soap	3	Prefruiting-fruiting	4	.95	.95	3.8	10
Total insecticide		-	-	-	-	-	-	669

[a] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Orthene 75SP, the actual number of acres treated is 5.

[b] Dipel 2X consists of 14.52 Billion International Units (BIU) per pound of formulation. Total lbs ai/year is equivalent to 14.52 BIU.

Table 7. Nonpesticide methods used to control weeds on **PEPPERS**, number off times method used, and acreage treated in conjunction with herbicides.

Nonpesticide Method(s) Used	Number of Times Method Used	Acres Treated Only With Nonpesticide Method	Acres Treated With Both Nonpesticide Method and Herbicide	Total Acres Treated
Mechanical cultivation	2-8	6	62	68
Mechanical cultivation/ hoeing	2-8 1-6	4	46	50
Mechanical cultivation/ hoeing/ black plastic	5 2 1	4	0	4
Mechanical cultivation/ black plastic	5 1	0	6	6
Black plastic	1	59	19	78
Mulch	2	0	1	1
Total	-	73	134	207

Table 8.a. Fungicides and Bactericides used to control diseases on PEPPERS.

Disease	Fungicide/ Bactericide	Trade Name and Formulation	Acres Treated[a]
Bacterial spot (*Xanthomonas campestris* pv. *vesicatoria*)	chlorothalonil	Bravo 500 (F)	6
	copper hydroxide	Kocide DF	10
		Kocide 101 (WP)	54
		Total copper hydroxide	64
	copper oxychloride and basic copper sulfate	COCS 50W	94
	metalaxyl	Ridomil 2E	.3
	metalaxyl/ chlorothalonil	Ridomil Bravo 81W	.5
	Actual acres treated for bacterial spot		165
Phytopthora blight (*Phytophthora capsici*)	copper hydroxide	Kocide 101 (WP)	9
	metalaxyl	Ridomil 2E	10
	Actual acres treated for phytopthora blight		19

Table 8.a. Diseases (continued)

Disease	Fungicide/ Bactericide	Trade Name and Formulation	Acres Treated[a]
Viruses	copper hydroxide	Kocide DF	10
	copper oxychloride and basic copper sulfate	COCS 50W	94
	metalaxyl	Ridomil 2E	.3
	metalaxyl/ chlorothalonil	Ridomil Bravo 81W	.5
	Actual acres treated for viruses		105

[a] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Orthene 75SP, the actual number of acres treated is 5.

Table 6.b. Insecticides used to control insects on PEPPERS.

Insect	Insecticide	Trade Name and Formulation	Acres Treated[a]
Cutworms	carbaryl	Sevin 50W	2
	chlorpyrifos	Lorsban[b]	16
	diazinon	Diazinon 50W	.1
		Diazinon AG500 (ES)	24
		Total diazinon	24
	dyfonate	Dyfonate 4EC	17
	endosulfan	Thiodan 3EC	2
	Actual acres treated for cutworms		59[c]
European corn borer (*Ostrinia nubilalis*)	acephate	Orthene 75SP	145
	Bacillus thuringiensis var. *kurstaki*	Dipel 2X (WP)	1
	carbaryl	Sevin XLR Plus	1
		Sevin 50W	2
		Total carbaryl	3
	diazinon	Diazinon AG 500 (ES)	4

Table 8.b. Insects (continued)

Insect	Insecticide	Trade Name and Formulation	Acres Treated[a]
	endosulfan	Thiodan 3EC	1
		Thiodan 50W	1
		Total endosulfan	2
	esfenvalerate	Asana XL	1
	methomyl	Lannate L	2
		Lannate 90SP	10
		Total methomyl	12
	permethrin	Pounce 3.2EC	27
	Actual acres treated for European corn borer		165[c]
Aphids	azinphosmethyl	Guthion 50W	6
	acephate	Orthene 75SP	105
	carbaryl	Sevin XLR Plus	12
	diazinon AG500	Diazinon AG500 (ES)	9
	dimethoate	Cygon 400 (EC)	5
	endosulfan	Thiodan 3EC	12
		Thiodan 50WP	1
		Total endosulfan	13

Table 5.N. Insects (continued)

Insect	Insecticide	Trade Name and Formulation	Acres Treated[a]
	malathion	Malathion 57EC	3
	methomyl	Lannate L	22
		Lannate 90SP	10
		Total methomyl	32
	permethrin	Pounce 3.2EC	1
	potassium salts of fatty acids	Insecticidal Soap	3
	Actual acres treated for aphids		166[c]
Hornworms	diazinon	Diazinon AG500 (ES)	.3
	endosulfan	Thiodan 3EC	1
		Thiodan 50W	1
		Total endosulfan	2
	malathion	Malathion 57EC	3
	methomyl	Lannate L	.1
	permethrin	Pounce[b]	1
	Actual acres treated for hornworms		6[c]

Table 8.b. Insects (continued)

Insect	Insecticide	Trade Name and Formulation	Acres Treated[a]
Pepper maggot (*Zonosemat electa*)	acephate	Orthene 75SP	17
	Bacillus thuringiensis var. *kurstaki*	Dipel 2X(WP)	1
	diazinon	Diazinon AG500 (ES)	2
	dimethoate	Cygon 400 (EC)	117
	endosulfan	Thiodan 3EC	14
		Thiodan 50WP	1
		Total endosulfan	15
	malathion	Malathion 25WP	5
	methomyl	Lannate L	5
	permethrin	Ambush 2E	.1
		Pounce 3.2EC	1
		Total permethrin	1
	Actual acres treated for pepper maggot		145[c]
Seed corn maggot (*Hylema platura*)	dyfonate	Dyfonate 4EC	17
	Actual acres treated for seed corn maggot		17

[a] Acres treated is the number of acres treated with one application of a given material. Example: If 5 A were sprayed three times with Orthene 75SP, the actual number of acres treated is 5.

[b] Grower did not provide sufficient data to determine formulation.

[c] Acres treated for this insect are less than the total of the above acres.

Broccoli, Cabbage and Cauliflower

SECTION A. General Instructions/Information

1. Please report only information about broccoli, cabbage and cauliflower grown in 1991.
2. Report every nonpesticide method used in 1991 under Section C. Include black plastics, floating row covers, cultivation, etc.
3. Report every pesticide (i.e. **general and restricted use**) used in 1991 under Section B. Include herbicides, insecticides, fungicides, bactericides, molluscacides (i.e. for slugs), fumigants, etc.
4. Report all units in ounces, pounds, fluid ounces, pints or gallons per acre.
5. Application Rate: How much material (formulation) did you apply **per acre**? Record all units as oz/acre, lbs/acre, fl. oz./acre, pt/acre or gal/acre. (If you only sprayed a couple of plants and the rate per acre is unknown, report how much formulation was used per application.)
6. If you did not grow broccoli, cabbage or cauliflower, **please** mark this survey "no cole crops" and mail it back in the prepaid envelope.
7. If you come across a question which you cannot answer, please continue filling out the form as completely as you can.
8. Any questions, call Jim Turner at 241-4840.

SECTION B: 1990 Regular Spray Program Information

Broccoli

Total amount of broccoli planted: _____ acres/plants (circle one)
Total amount of broccoli sprayed: _____ acres/plants (circle one)
Total amount of broccoli harvested: _____ acres/plants (circle one)
Total number of crates (50 lbs) harvested: Wholesale: ___ ___ crates
Retail: ___ ___ crates

Average price per container: Wholesale: $_____ crate
Retail: $_____ head

Cabbage

Total amount of cabbage planted: _____ acres/plants (circle one)
Total amount of cabbage sprayed: _____ acres/plants (circle one)
Total amount of cabbage harvested: _____ acres/plants (circle one)
Total number of crates (55 lbs) and/or bags harvested: Wholesale: _____ crates
Retail: _____ crates
Wholesale: _____ bags
Retail: _____ bags

Average price per container: Wholesale: $_____ crate
Retail: $_____ head
Wholesale: $_____ bag

Cauliflower

Total amount of cauliflower planted: ___ acres/plants (circle one)
Total amount of cauliflower sprayed: ___ acres/plants (circle one)
Total amount of cauliflower harvested: ___ acres/plants (circle one)
Total number of crates (30 lbs) harvested: Wholesale: ___ crates
Retail: ___ crates

Average price per container: Wholesale: $ _____ crate
Retail: $_____ head

Crop(s) Treated	Acres/ Plants Treated (Circle one)	Trade Name and Formulation (ex. Pounce 3.2EC)	All Pest(s) Targeted [Check column(s)]: Imported Cabbage Worm	Cabbage Looper	Diamondback Moth	Flea Beetles	Aphids	Cabbage Maggot	Slugs	Alternaria Leaf Spot	Black Rot	Club Root	Weeds	Your Application Rate per Acre (see instruction #5)	Number of Treatments (ex. 3 times)	Crop Stage [Check Column(s)]: Prior to Transplant	At Transplant	Pre-heading	Heading	Type of Application (Check column): Drench	Boom Sprayer	Mist Sprayer	Other (specify)

SECTION C: 1991 Nonpesticide Methods

What nonpesticide method(s) did you use (ex. black plastic, cultivation with a tractor, floating row covers, hoeing, use of purchased natural predators, etc.)? If you used none, **please** mark "none."

Crop Treated	Acres/ Plants Treated (Circle one)	Nonpesticide Method Used (Be specific)	All Pest(s) Targeted [Check column(s)]											Number of Times Method Used (ex. 3 times)	Crop Stage [Check Column(s)]				Was Nonpesticide Method Effective? [Check column]	
			Imported Cabbage Worm	Cabbage Looper	Diamondback Moth	Flea Beetles	Aphids	Cabbage Maggot	Slugs	Alternaria Leaf Spot	Black Rot	Club Root	Weeds		Prior to Transplant	At Transplant	Pre-heading	Heading	Yes	No

SECTION D: Sources of Information

Where do you get your information about vegetables? Please check your three(3) major sources

____ Extension Educators/Specialists
____ Extension Newsletters
____ N.E. Vegetable Management Guide
____ Experiment Station
____ Soil Conservation Service
____ Trade Journals
____ Suppliers/Dealers
____ Neighbors
____ Other (specify)

Peppers

Survey No. _ _

SECTION A. General Instructions/Information

1. Please report only information about peppers (i.e. sweet, hot, etc.) grown in 1991.
2. Report every nonpesticide method used in 1991 under Section C. Include black plastics, floating row covers, cultivation, etc.
3. Report every pesticide (i.e. **general and restricted use**) used in 1991 under Section B. Include herbicides, insecticides, fungicides, bactericides, etc.
4. Report all units in ounces, pounds, fluid ounces, pints or gallons per acre.
5. Application Rate: How much material (formulation) did you apply **per acre**? Record all units as oz/acre, lbs/acre, fl. oz./acre, pt/acre or gal/acre. (If you only sprayed a couple of plants and the rate per acre is unknown, report how much formulation was used per application.)
6. If you did not grow peppers, **please** mark this survey "no peppers" and mail it back in the prepaid envelope.
7. If you come across a question which you cannot answer, **please** continue filling out the form as completely as you can.
8. Any questions, call Jim Turner at 241-4940.

SECTION B: 1990 Regular Spray Program Information

Total amount of peppers planted: _____acres/plants (circle one)
Total amount of peppers sprayed: _____acres/plants (circle one)
Total amount of peppers harvested: _____acres/plants (circle one)

Total number of boxes (24 lbs.) harvested: Wholesale: _____boxes
Retail _____ boxes

Average price per container: Wholesale: $_____boxes
Retail: $_____ __ boxes/1/2 boxes (circle one)

Acres/ Plants Treated (Circle one)	Trade Name and Formulation (ex. Orthene 75SP)	All Pest(s) Targeted [Check column(s)]									Your Application Rate per Acre (see instruction #5)	Number of Treatments (ex. 3 times)	Crop Stage [Check Column(s)]				Type of Application (Check column)			
		Cutworms	Corn Borer	Aphids	Hornworm	Pepper Maggot	Bacterial Spot	Phytophthora	Virus(es)	Weeds			Prior to Transplant	At Transplant	Pre-fruiting	Fruiting	Drench	Boom Sprayer	Mist Sprayer	Other (specify)

SECTION C: 1991 Nonpesticide Methods

What nonpesticide method(s) did you use (ex. black plastic, cultivation with a tractor, floating row covers, hoeing, use of purchased natural predators, etc.)? If you used none, **please** mark "none."

Acres/ Plants Treated (Circle one)	Nonpesticide Method Used (Be Specific)	All Pest(s) Targeted [Check column(s)]									Number of Times Method Used (ex. 3 times)	Crop Stage [Check Column(s)]				Was Nonpesticide Method Effective? (Check Column)	
		Cutworms	Corn Borer	Aphids	Hornworm	Pepper Maggot	Bacterial Spot	Phytophthora	Virus(es)	Weeds		Prior to Transplant	At Transplant	Pre-fruiting	Fruiting	Yes	No

SECTION D: Sources of Information

Where do you get your information about vegetables? Please check your three(3) major sources.

_____ Extension Educators/Specialists
_____ Extension Newsletters
_____ N.E. Vegetable Management Guide
_____ Experiment Station
_____ Soil Conservation Service
_____ Trade Journals
_____ Suppliers/Dealers
_____ Neighbors
_____ Other (specify)