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Pesticide Use on Sweet Corn Grown in Connecticut: 1990

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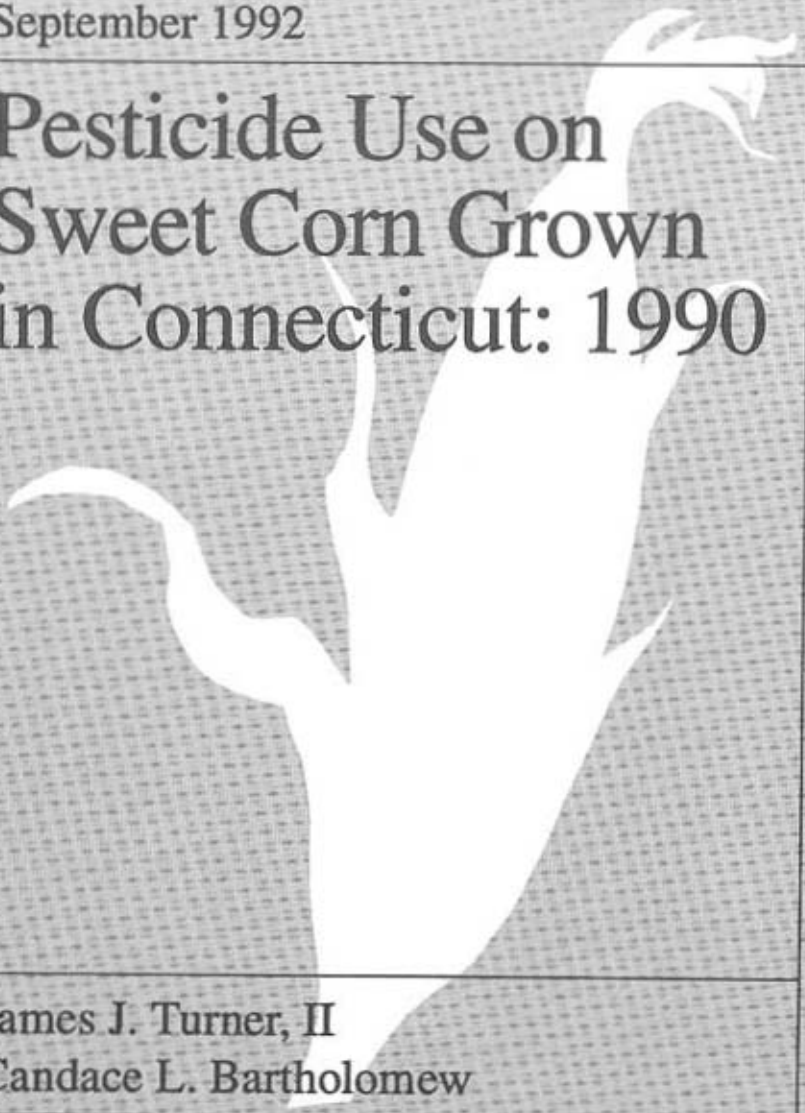

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UNIVERSITY OF CONNECTICUT

COOPERATIVE EXTENSION SYSTEM

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Special thanks goes to T. Jude Boucher of the the University of Connecticut Cooperative Extension System for his critical review of the questionnaire during its development. The questionnaire was desktop published by Ethel Murdoch of the Agricultural Publications Department and the tables were typed by Sandra Cooper of the West Hartford Cooperative Extension System Office.

Special thanks to the sweet corn growers and pesticide dealers of Connecticut who devoted time and effort to make this survey a success.

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Pesticide Use on Sweet Corn Grown in Connecticut: 1990

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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 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 used to control sweet corn pests in Connecticut during 1990. Grower's opinions on quality, yield and cost of alternative pest control measures were also collected for comparative purposes.

Materials and Methods

A written survey was determined to be the most cost effective and least time consuming method of data collection. Several state organizations and individuals were contacted for ideas on data collection and survey design. The most useful information on collecting alternative pest control methods was found in Tom Feurer's sweet corn survey, designed for the Delaware Agricultural Statistics Service (Feurer, 1990). For pesticide application information, the survey designed by Steve Wood for the New England Fruit Growers' Association, Committee on the Environment was useful (Wood, 1989). Jude Boucher, Cooperative Extension Educator/Vegetable IPM Program Coordinator at the University of Connecticut, was helpful in designing the final survey. See Appendix A.

According to the *New England Crop Summary 1990* (USDA, 1991) there were 4,600 acres of sweet corn planted in Connecticut in 1990. Names and addresses of 203 growers were obtained from the *Connecticut Agricultural Marketing Directory* (Connecticut Department of Agriculture, 1990), the 1986 to 1990 soil test reports for sweet corn from the Soil Testing Laboratory at the University of Connecticut, the 1990 soil test reports for sweet corn from the Soil Testing Laboratory at the Connecticut Agricultural Experiment Station and from a Connecticut Cooperative Extension System Educator's client list.

The survey was 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. Alternative control methods
D. Potential yield changes from alternatives.

The survey form was divided into the following three sections:

Section A: General Instructions. Growers were asked to report each application of every pesticide, the actual area treated and the 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.

Section B: 1990 Regular Spray Program Information. The first part of this section requested information about the total number of acres planted, sprayed and harvested. Figures were requested for how many dozen ears were produced per acre for wholesale and retail and the average price range per dozen ears wholesale and retail. In the sec-

ond part, a table format was used to collect pesticide application data. Information requested included acres treated, trade name and formulation, application rate per acre, crop stage, application technique and pests targeted.

Section C: Alternative Program Information. A table format was used to collect information and opinions on alternative pesticides and/or methods of pest control which could be used in lieu of the pesticides reported in Section B. To indicate what effect on quality, yield and cost an alternative pesticide and/or method of pest control would have compared to the pesticide, growers checked "no change", "increase", "decrease", or "don't know". If there was an increase or decrease, they were asked "how much?"

To encourage growers to return the survey and ensure collection of data for 70% of the acreage of sweet corn harvested, several steps were taken. First, an explanation of the purpose of the survey and the need for participation was included in a cover letter. Second, language familiar to sweet corn growers was used so that survey questions were easily understood. Third, the form was kept short. The survey took less than an hour to complete. This was accomplished by condensing the data regarding sweet corn pests to how many acres of sweet corn were treated for each pest and which chemicals were used to treat for that pest.

Two newsletter articles explaining the survey and the need for grower participation were printed in the *Grower: Vegetable and Small Fruit Newsletter* (Turner, 1991) and the *Connecticut Market Bulletin* (Connecticut Department of Agriculture, 1991).

On April 5, 1991, the surveys were mailed with a cover letter. Follow-up postcards were sent one week later reminding growers that their input was needed. Growers with the greatest amount of acreage were contacted by phone to assure their cooperation with the program. Handwritten post cards were mailed five weeks after the survey to all growers who had not returned the survey. Post cards were used based on the assumption that growers would be more likely to take the time to read a short post card versus a letter; and they were handwritten in order to personalize them and to keep them from looking like "junk mail".

Once the growing season started, efforts to collect data were suspended until the fall. On October 21, 1991, phone calls were made and duplicate surveys were sent to any grower who was known to have 50 acres or more and had not sent back the survey. Follow-up phone calls were made four weeks later.

Several growers returned surveys indicating they did not use pesticides. These growers were contacted by phone and asked how they managed weeds and insects.

Results and Discussion

Regular Spray Program

One hundred and two surveys (50.2%) were returned out of two hundred and three mailed. Sixty-eight of the returned surveys contained data representing 2,650.3 acres (57.6%) of the 4,600 acres of sweet corn planted. The remaining thirty-four surveys were returned stating no sweet corn was grown, they were out of business, or had moved and left no forwarding address. One hundred and one growers (49.8%) did not respond.

Based on general information regarding 2,650.3 acres of sweet corn planted, 2,616.5 acres (98.7%) were treated with pesticides. The remaining 33.8 acres (1.3%) were not treated. Of these untreated acres, 26.8 acres were planted by seven growers. The other 7 acres were planted by two growers who treated the majority of their acreage with pesticides.

Thirty-eight of the 68 surveys returned, representing 1,955.5 acres, had usable information about yield. The average number of dozen ears produced per acre for each farm where pesticides were used was 720.5 dozen ears/acre. The median yield was 750 dozen ears/acre with a range of 220 to 1,300 dozen ears/acre. Of this, 20.1% was sold retail and 79.9% wholesale.

Fifty-two of the 68 surveys returned, representing 2,033 acres, had usable information about the average price per dozen ears for each farm where pesticides were used. Though the price "range" per dozen ears was requested, growers provided the average price per dozen ears for the season. Average gross income/dozen ears for each farm was $2.91 retail and $1.46 wholesale. Median retail cost was $3.00 with a range of $1.40 to $4.00. Median wholesale cost was $1.45 with a range of $.90 to $2.30. Average gross income/harvested acre where pesticides were used was $1,813.49 retail and $1,047.66 wholesale.

On the seven farms where pesticides were not used, the average gross income per dozen ears for each farm was $2.96 retail. The median was $3.00 retail with a range of $1.50 to $4.00. All corn was sold retail. Of the growers who did not use chemicals, only one provided sufficient data to calculate a yield of 350 dozen ears/acre and an average gross income/harvested acre of $1,050.00.

Yield comparisons between sweet corn treated and not treated with pesticides cannot be made due to the small sample size of acres not treated with pesticides. The median retail price for both was $3.00 per dozen ears and the price ranges were similar.

Of the 2,616.5 acres sprayed, 2,589.5 acres had complete and usable pesticide information. Therefore, information about chemical

use in this report is based on data collected for 2,589.5 acres or 56.2% of the 4,600 acres of sweet corn planted in Connecticut in 1990.

Tables 1.a. and 1.b. 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 $135,546.44 on pesticides to treat 2,589.5 acres. Herbicides cost $48,684.31 (35.9%) and insecticides cost $86,862.13 (64.1%).

In Table 1.a. and 1.b. the rate/acre/year was calculated as: (total amount of formulation reported used for the year) ÷ (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). The other half of the equation (i.e., acres treated) is obtained by adding together all of the acres growers treated one time with a given formulation.

In Table 1.b. the rate/acre/application was calculated as: (total amount of formulation reported used for the year) ÷ (total acres treated). The only difference between this equation and the equation for determining the rate/acre/year is **total** acres treated. Total acres treated is calculated by adding (number of acres a grower treated one time with a given formulation) x (number of treatments).

Formulation costs for each material were obtained in October 1991 from three agricultural chemical retailers in Connecticut. Prices for 1991 were used because 1990 prices were not available for most of the materials. Price for Asana 1.9EC is from 1989 because this was the last year the product was marketed in the state. No price was reported for Parathion 4EC, because no price was available and it is no longer marketed in Connecticut.

Table 2.a. presents the number of acres treated with each herbicide, the rates of active ingredients used per application and per year, and the total pounds of active ingredient per year for each herbicide. Sweet corn growers surveyed used 11,947.9 lbs. of pesticide active ingredient (a.i.) to treat 2,589.5 acres. Of the 11,947.9 lbs. a.i. used, herbicides accounted for 8,038.1 lbs. a.i. (67.3%). All herbicide treatments were made at the time of planting, except for bentazon, dicamba and glyphosate which were applied at whorl. Only one application of any given herbicide was made per acre during the year.

Table 2.b. presents the number of acres treated with each insecticide, the crop stage during which each insecticide was applied, the number of applications of each insecticide, the rates of active ingredients used per application and per year and the total pounds of active ingredient per year for each insecticide used. Of the 11,947.9 lbs. a.i. used to treat 2,589.5 acres, insecticides accounted for 3,909.8 lbs. a.i. (32.7%). Insecticide treatments were made during all stages of corn

growth. One to twelve applications of any given insecticide was made per acre during the year.

In Table 2.a. and 2.b. the "rate (lb. a.i./A) per application (average)" and "rate (lb. a.i./A) per year (average)" were calculated by converting the amount of formulation for rate/acre/application and rate/acre/year from Table 1.a. and 1.b. into pounds of pesticide active ingredient.

Nearly all acreage treated with pesticides (2,589.5 acres) was treated with a herbicide (2,526.5 acres or 97.6%). The three major herbicides used were atrazine, atrazine/alachlor and atrazine/metolachlor. These were used on 2,098.5 acres (83.1%) of the 2,526.5 acres treated with herbicides, comprised 5,318.7 lbs. a.i. (66.2%) of the 8,038.1 lbs. a.i. of herbicide, and accounted for $27,964.06 (57.4%) of the $48,684.31 spent on herbicides. Atrazine alone accounted for 2,873.6 lbs. a.i. (35.8%) of the 8,038.1 lbs. a.i. of herbicide applied.

Insecticides were used on 2,344.5 acres (90.5%) of the 2,589.5 acres treated with a pesticide. The three major insecticides used were methomyl, methyl parathion and permethrin. These were used on 2,211.5 acres (94.3%) of the 2,344.5 acres treated with insecticides, comprised 3,153.7 lbs. a.i. (80.7%) of the 3,909.8 lbs. a.i. of insecticides used and accounted for $79,624.02 (91.7%) of the $86,862.13 spent on insecticides.

When applying pesticides, the most common method of application for herbicides was a boom sprayer on 93.7% of the acres. The remaining acreage was treated by one grower with an undetermined method. For insecticides, a boom sprayer was used on 51.7% of the acres, a mist sprayer 37.1% and a handgun 3.3%. The balance of methods for applying insecticides was undetermined.

Alternative Control Measures

Tables 3.a. and 3.b. show the individual opinions of growers about how the use of alternative pesticides and methods would change the quality, yield and cost of producing the crop. Twenty-four alternatives were listed for eight different herbicides in Table 3.a. Of the twenty-four alternatives, four (16.7%) of them were other herbicides. The other twenty (83.3%) recommended cultivation. Seven growers stated that there were no alternatives for the herbicides they listed in Section B of the survey.

Of the twenty growers who recommended cultivation as an alternative to herbicides, 80% felt there would be a decrease in the quality of the crop, 85% felt there would be a decrease in the yield and 75% felt there would be an increase in the cost. The remaining growers' opinions varied.

Eighteen alternatives were listed for nine different insecticides or insecticide combinations in Table 3.b. Of the eighteen alternatives, eleven (61.1%) were other insecticides. Seven (38.9%) were nontraditional chemicals or methods (ex., *Bacillus thuringiensis, Trichogramma,* and moth traps). Fifteen growers stated there were no alternatives for the insecticides listed in Section B of the survey.

Opinions varied as to how the use of other insecticides would affect the quality, yield and cost of producing the crop. Of the seven growers who recommended nontraditional alternatives, four of them did not know what effect the alternative would have on quality, yield or cost.

Eleven of the sixty-eight surveys returned stated they did not use pesticides on 59.8 acres. These eleven growers were contacted to find out how they managed weeds and insects in sweet corn. Four of the eleven did use herbicides to control weeds on 33.8 acres. The other seven growers representing 26.8 acres used no synthetic or natural pesticides. These seven growers controlled weeds by using a cultivator an average of three times between the rows and a hoe one time within the rows.

Most of the growers who did not use insecticides, cut the insect damage off the ears of corn, gave their customers a baker's dozen, and/or educated customers about the benefits of not using insecticides. To minimize insect damage, two growers grew mostly early season corn and a third grower rotated his crop with pumpkins every other year.

Pests and Problems

As stated in the results and discussion section of this report, 2,344.5 acres (90.5%) of the 2,589.5 acres sprayed were treated with some type of insecticide. Forty-four surveys contained usable information on the number of acres treated for and the lbs. of a.i./year used for each sweet corn insect. This information represents 2,118.5 acres. The three insects affecting the greatest number of acreage were corn borer, corn earworm and fall armyworm. Corn borers were treated with 2,982.3 lbs. a.i. of insecticide on 1,782.5 acres (84.1%). Corn earworms were treated with 2,309.6 lbs. a.i. of insecticide on 1,614 acres (76.2%). Fall armyworms were treated with 1,585 lbs. a.i. of insecticide on 1,169.5 acres (55.2%). It should be noted that all three insects were frequently treated with the same pesticide at the same time. Therefore, there is duplication between the amounts of active ingredients used for each insect. See Table 4.

The number of times each individual pest was treated for cannot be determined from data collected. Any given insecticide application could target more than one pest. Additionally, the pests targeted var-

ied with the growth stage of the corn, and the growth stage of the corn varied from field to field depending on variety grown.

Weeds, which consisted of broadleaf and grass types were treated for on 2,526.5 acres (97.6%) of the 2,589.5 acres totaling 8,038.1 lbs. a.i. of herbicide used.

Summary

Growers are dependent on chemicals to grow sweet corn. Records showed 11,947.9 lbs. a.i. were used on 2,589.5 acres in 1990. This represents an average of 4.6 lbs. a.i. of pesticides per acre at a cost of $52.34/acre (3.2% of the average gross income/harvested acre for each farm that used pesticides). Only 33.8 acres (1.3%) of the 2,650.3 acres were not treated with pesticides.

In addition to the above numbers, growers' comments revealed their dependency on pesticides. As one grower stated, "Connecticut consumers are not ready for organic food because a) consumers complain if corn is not perfect and b) stores buying wholesale will reject your load if more than 5% of your corn has insect damage." Another grower stated, "Without pesticides, we would probably go out of the corn business. Some of the plantings would be a complete failure. Total loss for all the plantings would probably be 75%."

Each grower who used insecticides applied an average of 3.7 applications of insecticides to their fields. The median was 3.2 applications per acre with a range of 1 to 12 applications. Each grower who used herbicides applied an average of 1.1 applications of herbicide to their fields. The median for herbicide was 1 application per acre with a range of 1 to 1.7 applications.

It should be noted that retail costs are comparable for sweet corn treated and not treated with pesticides. The median retail cost for both is $3.00 per dozen ears. However, the high rejection rate by wholesale buyers of loads with 5% or more insect damage limits the wholesale market to growers who produce sweet corn with no blemishes.

New England Agricultural Statistics Service is the only published source with number of acres of sweet corn planted in Connecticut. Their basis for determining that 4,600 acres was planted in 1990 is the *1987 Agriculture Census* (USDC, 1989). Jude Boucher, Cooperative Extension Educator/ Vegetable Crops IPM Program Coordinator at the University of Connecticut, estimates there were approximately 7,000 acres planted in sweet corn in Connecticut. One reason for the discrepancy in acreage planted to sweet corn is that there is no complete list of sweet corn growers. The mailing list for this project was compiled from four different sources. Of the 102 surveys returned, 34

surveys (16.8% of the 203 mailed) stated no sweet corn was grown, they were out of business or had moved and left no forwarding address. A second reason is that growers do increase and decrease the number of acres they plant year to year. The decision whether or not to plant sweet corn is apparently driven by a projected market value of the crop.

Using a written survey as the means of collecting information was received well by the growers. Only four surveys were completed over the phone.

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TABLE 1.a. HERBICIDES: Formulation useage and cost[a]

HERBICIDE	Trade Name and Formulation	Formulation Cost/Unit[b]	Rate/A/ Year (Average)	Formulation Cost/A/ Year	Acres Treated	Total Amount of Formulation Applied/Year[c]	Total Formulation Cost/Year[d]
alachlor	Lasso (EC)	$ 28.15 gl	2.4 qt	$ 16.89	204.5	122.7 gl	$ 3,454.01
atrazine	AAtrerx 4L	13.89 gl	1.0 qt	3.47	356.5	89.1 gl	1,237.06
	AAtrex Nine-0 (WDG)	3.03 lb	2.1 lb	6.36	297.5	624.8 lb	1,892.10
	Total atrazine	-	-	-	654.0	-	3,129.16
atrazine/ alachlor	Bullet (F)	20.98 gl	2.6 qt	13.64	72.5	47.1 gl	988.90
	Lariat (F)	22.30 gl	3.0 qt	16.73	40.0	30.0 gl	669.20
	Total atrazine/ alachlor	-	-	-	112.5	-	1,658.10
atrazine/ metolachlor	Bicep 6L	34.80 gl	2.0 qt	17.40	1,332.0	666.0 gl	23,176.80
bentazon	Basagran (liquid)	70.96 gl	1.8 pt	15.97	187.0	42.1 gl	2,986.39
butylate	Sutan + 6.7E	24.20 gl	1.68 qt	10.16	289.0	121.4 gl	2,937.88
cyanazine	Bladex 4L	25.84 gl	2.1 qt	13.57	69.0	36.2 gl	936.33
	Bladex 90DF	5.63 lb	2.6 lb	5.63	19.0	49.4 lb	106.97
	Total cyanazine	-	-	-	88.0	-	1,043.30

TABLE 1.a. Herbicides (continued)

HERBICIDE	Trade Name and Formulation	Formulation Cost/Unit[b]	Rate/A/ Year (Average)	Formulation Cost/A Year	Acres Treated	Total Amount of Formulation Applied/Year[c]	Total Formulation Cost/Year[d]
2,4-D	2,4-D (liquid)	$ 11.77 gl	2.8 pt	$ 4.12	34.0	12.0 gl	$ 140.08
dicamba	Banvel[e] (liquid)	77.27 gl	1.0 qt	19.32	6.0	1.5 gl	115.92
glyphosate	Roundup (liquid)	56.38 gl	1.0 qt	14.10	20.0	5.0 gl	282.00
metolachlor	Dual 8E	70.45 gl	1.8 pt	15.85	484.5	109.0 gl	7,679.33
simazine	Princep	3.57 lb	2.2 lb	7.85	60.0	132.0 lb	471.00
	Caliber 90[e] (WDG)						
trifuralin	Treflan EC[e]	35.96 gl	1.0 pt	4.50	.5	.5 pt	2.25
Total herbicides		-	-	-	3,472.0	-	$48,684.31

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

[b] Source: Connecticut retailers who sell agricultural chemicals (October, 1991) unless otherwise footnoted.

[c] Calculated on rate/A/year x acres treated.

[d] Calculated on formulation cost/A/year x acres treated.

[e] Material reported is not labeled for use on sweet corn.

TABLE 1.b. INSECTICIDE: Formulation useage and cost

INSECTICIDE	Trade Name and Formulation	[a] Formulation Cost/Unit	Rate/A/ Application (Average)	Formulation Cost/A/ Application	Rate/A/ Year (Average)	Formulation Cost/A/ Year	[b] Acres Treated	[c] Total Amount of Formulation Applied/Year	[d] Total Formulation Cost/Year
Bacillus thuringiensis	Dipel 2X (WP)	$ 14.91 lb	1.5 lb	$ 22.37	1.5 lb	$ 22.37	1.0	1.5 lb	$ 22.37
carbaryl	Sevin XLR Plus (AS)	26.41 gl	.9 qt	5.94	1.8 qt	11.88	56.0	25.2 gl	665.28
	Sevin 50W	2.90 lb	1.5 lb	4.35	4.2 lb	11.60	79.5	318.0 lb	922.21
	Total carbaryl	-	-	-	-	-	135.5	-	1,587.48
carbofuran	Furadan 15G	1.70 lb	5.9 lb	10.03	5.9 lb	10.03	65.5	386.5 lb	656.97
chlorpyrifos	Lorsban 4E	47.32 gl	1.0 qt	11.83	1.2 qt	14.20	75.0	22.5 gl	1,065.00
	Lorsban 15G	1.89 lb	6.0 lb	11.34	6.0 lb	11.34	294.0	1,764 lb	3,333.96
	Total chlorpyrifos	-	-	-	-	-	369.0	-	4,398.96
diazinon	Diazinon AG500 (ES)	30.32 gl	.6 pt	2.27	1.6 pt	6.06	4.5	1.8 gl	27.27
esfenvalerate	Asana XL (EC)	130.11 gl	7.3 fl oz	7.42	16.3 fl oz	16.57	13.5	1.7 gl	223.70
	Asana 1.9EC	315.91 gl [e]	3.0 fl oz	7.40	9.0 fl oz	22.21	5.0	45 fl oz	111.05
	Total esfenvalerate	-	-	-	-	-	18.5	-	334.75
fenvalerate	Pydrin 2.4EC	65.00 gl	6.2 fl oz	3.14	19.3 fl oz	9.80	9.5	1.4 gl	93.10
methomyl	Lannate (SP)	20.51 lb	.5 lb	10.26	1.6 lb	32.82	804.5	1,287.2 lb	26,403.69
	Lannate L	41.11 gl	1 qt	10.28	2.3 qt	23.64	604.5	347.6 gl	14,290.38
	Total methomyl	-	-	-	-	-	1,374.0 [f]	-	40,694.07

TABLE 1.b. Insecticide (continued)

INSECTICIDE	Trade Name and Formulation	Formulation Cost/Unit[a]	Rate/A/ Application (Average)	Formulation Cost/A/ Application	Rate/A/ Year (Average)	Formulation Cost/A/ Year	Acres Treated[b]	Total Amount of Formulation Applied/Year[c]	Total Formulation Cost/Year[d]
methyl parathion	Penncap-M (F)	$ 22.70 gl	1.4 qt	$ 7.95	3.7 qt	$ 21.00	502.5	464.8 gl	$10,552.50
parathion	Parathion 4EC	-[g]	.5 pt	-	1.2 pt	-	62.0	9.3 gl	-
permethrin	Ambush 2E	114.55 gl	11.5 fl oz	10.29	34.6 fl oz	30.96	782.5	211.5 gl	24,226.20
	Pounce 3.2EC	187.05 gl	6.9 fl oz	10.08	15.4 fl oz	22.50	184.5	22.2 gl	4,151.25
	Total permethrin	-	-	-		-	966.5[f]	-	28,377.45
thiodicarb	Larvin 3.2 (AF)	53.52 gl	28.0 fl oz	11.71	56.0 fl oz	23.42	5.0	2.19 gl	177.21
Total insecticides		-	-	-	-	-	3,513.5		$86,862.13[h]

[a] Source: Connecticut retailers who sell agricultural chemicals (October, 1991) unless otherwise footnoted.

[b] Acres treated is the number of acres treated with one application of a given material. Example: If 100 acres was sprayed three times with Lannate L, the number of acres treated is 100.

[c] Calculated on rate/A/year x acres treated.

[d] Calculated on formulation cost/A/year x acres treated.

[e] Source: Connecticut retailers who sell agricultural chemicals (1989).

[f] This figure is less than the above acres added together; because both formulations were used on the same acres.

[g] No price available from Connecticut retailers who sell agricultural chemicals.

[h] Does not include Parathion 4EC. See footnote g.

TABLE 2.a. HERBICIDES: Active ingredient used, acres treated, rates of applications, and total applied[a]

HERBICIDE	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[b]
alachlor	Lasso (EC)	204.5	.5-3.0	2.4	490.8
atrazine	AAtrex 4L	356.5	1.0-2.0	1.04	370.8
	AAtrex Nine-0 (WDG)	297.5	.81-2.7	1.89	562.3
	Total atrazine	654.0	.81-2.7	1.43	935.2
atrazine/ alachlor	Bullet (F)	72.5	atrazine .28-1.31	.97	70.3
			alachlor .47-2.19	1.61	116.7
	Lariat (F)	40.0	atrazine 1.13	1.13	45.2
			alachlor 1.88	1.88	75.2
	Total atrazine/alachlor		atrazine .28-1.31	1.02	115.3
			alachlor .47-2.19	1.71	192.3
atrazine/ metolachlor	Bicep 6L	1,332.0	atrazine .67-2.67	1.36	1,813.0
			metolachlor .83-3.33	1.70	2,262.9
Total of all atrazine		2,097.5[c]	.28-2.7	1.37	2,873.6
bentazon	Basagran (liquid)	187.0	.5-1.35	.88	164.6
butylate	Sutan + 6.7E	289.0	2.51-3.35	2.81	812.1
cyanazine	Bladex 4L	69.0	1.0-3.0	2.1	144.9
	Bladex 90DF	19.0	1.35-2.7	2.32	44.1
	Total cyanazine	88.0	1.0-3.0	2.15	189.2

Table 2.a. Herbicides (continued)

HERBICIDE	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[b]
2,4-D	2,4-D (liquid)	34.0	.71-1.43	1.34	45.6
dicamba	Banvel (liquid)[d]	6.0	1.0	1.0	6.0
glyphosate	Roundup (liquid)	20.0	.75	.75	15.0
metolachlor	Dual 8E	484.5	1.0-2.0	1.81	877.0
simazine	Princep Caliber 90 (WDG)[d]	60.0	1.98	1.98	118.8
trifluralin	Treflan EC[d]	.5	.5	.5	.25
Total herbicides		3,472.0			8,030.1

[a] All herbicide applications were made at time of planting, except for bentazon, dicamba, and glyphosate which were applied at whorl. Only one application of any given herbicide was made during the year.

[b] Calculated on acres treated x rate (lb ai/A) per year.

[c] This figure is less than the total of the above acres. Two formulations were used on the same acre.

[d] Material reported is not labeled for use on sweet corn.

TABLE 2.b. INSECTICIDES: Active ingredient used, acres treated, timing, number and rates of application, and total applied

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[b]
Bacillus thuringiensis	Dipel 2X (WP)	1.0	Silk	1	.1	.1	.1	.1
carbaryl	Sevin XLR Plus (AS)	56.0	Pretassel-silk	1-3	.5-1.0	.9	1.8	100.8
	Sevin 50W	79.5	Whorl-silk	1-5	.3-3.0	.8	2.0	159.0
	Total carbaryl	135.5	Whorl-silk	1-5	.3-3.0	.8	1.9	257.5
carbofuran	Furadan 15G	65.5	Planting	1	.8-.9	.9	.9	59.0
chlorpyrifos	Lorsban 4E	75.0	Planting-silk	1-2	1.0	1.0	1.2	90.0
	Lorsban 15G	294.0	Planting	1	.9-1.0	.9	.9	264.6
	Total chlorpyrifos	369.0	Planting-silk	1-2	.9-1.0	.9	1.0	369.0
diazinon	Diazinon AG 500 (ES)	4.5	Pretassel	1-3	.3-1.0	.3	.8	3.6
esfenvalerate	Asana XL (EC)	13.5	Pretassel-silk	2-3	.03-.05	.04	.08	1.1
	Asana 1.9EC	5.0	Silk	3	.05	.05	.13	.7
	Total esfenvalerate	18.5	Pretassel-silk	2-3	.03-.05	.04	.1	1.9
fenvalerate	Pydrin 2.4EC	9.5	Pretassel-silk	2-5	.09-.15	.12	.36	3.4
methomyl	Lannate (SP)	804.5	Whorl-silk	1-12	.23-.9	.42	1.44	1,158.5
	Lannate L	604.5	Whorl-silk	1-6	.23-.9	.45	1.04	628.7
	Total methomyl	1,374.0[c]	Whorl-silk	1-12	.23-.9	.44	1.26	1,731.2

Table 2.b. Insecticides (continued)

INSECTICIDES	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[b]
methyl parathion	Penncap-M (F)	502.5	Whorl-silk	1-7.5	.5-1.0	.7	1.85	929.6
parathion	Parathion 4EC	62.0	Silk	2-3	.38	.38	.9	55.8
permethrin	Ambush 2E	782.5	Whorl-silk	1-7	.06-.24	.18	.54	422.6
	Pounce 3.2EC	184.5	Whorl-silk	1-4	.13-.20	.17	.39	72.0
	Total permethrin	966.5[c]	Whorl-silk	1-7	.06-.24	.18	.51	492.9
thiodicarb	Larvin 3.2 (AF)	5.0	Pretassel-silk	2	.70	.70	1.40	7.0
Total insecticides		3,513.5						3,909.8

[a] Acres treated is the number of acres treated with one application of a given material. Example: If 100 acres was sprayed three times with Lannate L, the number of acres treated is 100.

[b] Calculated on acres treated x rate (lb ai/A) per year.

[c] This figure is less than the above acres added together; because, two formulations were used on the same acre.

TABLE 3.a. Alternate herbicides and/or methods expected effect on quality, yield, and cost

HERBICIDE	Pest(s) Targeted	Alternate Pesticide and/or Method	Expected Change In Quality with Alternate				Expected Change In Yield with Alternate				Expected Change In Cost with Alternate			
			No chg.	Inc. (+)	Dec. (-)	Don't Know	No chg.	Inc. (+)	Dec. (-)	Don't Know	No chg.	Inc. (+)	Dec. (-)	Don't Know
atrazine	broadleaf weeds	cultivation			x				x			x		
bentazon	lambsquarter, velvetleaf	cultivation			10-20%				30%			100%		
	weeds	cultivate/hoe			50%				50%			100%		
	weeds	don't plant												
	broadleaf weeds	cultivation			70%				50%			50%		
	broadleaf weeds	no treatment			90%				90%				x	
butylate	grass weeds, some broadleafs	AAtrex 4L		x			x					x		
	grass weeds, some broadleafs	cultivation			x				x			x		
cyanazine	weeds	cultivation			x		x					x (much more time is needed)		
	grass and broadleaf weeds	cultivation	x						24%				x	
metolachlor	weeds	cultivate/hoe			50%				50%			100%		
	weeds	don't plant												
	grasses	alachlor			x				x		x			
atrazine/alachlor	grass and broadleaf weeds	cultivation				x				x				x
	grass and broadleaf weeds	cultivation			x				x			x		
atrazine/metolachlor	pigweed, lambsquarter, nutsedge	cultivation			x				x					x
	grasses, broadleaf weeds	Dual	x				x				x			

TABLE 3.a. Alternate herbicides (continued)

HERBICIDE	Pest(s) Targeted	Alternate Pesticide and/or Method	Expected Change In Quality with Alternate				Expected Change In Yield with Alternate				Expected Change In Cost with Alternate			
			No chg.	Inc. (+)	Dec. (-)	Don't Know	No chg.	Inc. (+)	Dec. (-)	Don't Know	No chg.	Inc. (+)	Dec. (-)	Don't Know
	Crabgrass, morning glory, velvet leaf	rotation and cultivation			some				lots				lots	
	Weeds	cultivation			75%				75%			100%		
	Weeds	quit			100%				100%			100%		
	Weeds	cultivate			50%				50%			100%		
	Weeds	don't plant												
	Broadleaf and grass weeds	cultivation			90%				90%			x		
	Broadleaf and weeds	no treatment			100%				100%				x	
	Weeds	cultivate			x				x			x		
	Broadleaf and grass weeds	AAtrex 4L with Lasso				x				x				x
	Velvetleaf	cultivation		x				x				x		
	Weeds	cultivation			60%				50%			30%		
	Broadleaf and grass weeds	cultivation	x						24%				x	
	Broadleaf and grass weeds	cultivation			x				x			x		
cyanazine/ alachlor	Weeds	no alternative												

COMMENTS: "Weed pressure was very high in the check strips. I feel we need herbicides."

"1990 was the first season we used Bladex on sweet corn. Weed and grass control was very poor. We had to cultivate and use 2,4-D to help save the crop. Three of the eight acres were a complete loss. In previous years, we used Bicep with much better results. I expect to return to Bicep this season as long as it's available."

"Our rates of weed controls are working fine, as we do cultivate three times. However, I would hate to do without weed controls. I feel sure some fields would have a 50% decrease in yields."

"Cultivation can't replace herbicides because weed pressure is to high to only control with manual labor. It takes one person 7 - 8 hours to cultivate 4 - 5 acres with a tractor. In 7 - 8 hours, I can spray 60 acres with weed control."

"Bladex 4L/Lasso combination has no carryover. I can plant anything I want after the corn is harvested."

TABLE 3.b. Alternate insecticides and/or methods expected effect on quality, yield and cost

INSECTICIDE	Pest(s) Targeted	Alternate Pesticide and/or Method	Expected Change In Quality with Alternate				Expected Change In Yield with Alternate				Expected Change In Cost with Alternate			
			No chg.	Inc. (+)	Dec. (-)	Don't Know	No chg.	Inc. (+)	Dec. (-)	Don't Know	No chg.	Inc. (+)	Dec. (-)	Don't Know
carbaryl	Corn earworm, corn borer	moth traps				x		20%					10%	
	Corn earworm, corn borer	Bacillus thuringiensis				x				x		x		
diazinon	Insects, worms	none												
esfenvalerate	Insects, worms	none												
	Corn earworm, fall armyworm	Lannate			40%				40%		x			
fenvalerate	Insects	Pounce	x				x					x		
methomyl	Corn earworm, corn borer	Pounce or Ambush	x				x				x			
	Corn borer, corn earworm, aphids	none												
	Corn borer, fall armyworm	no alternatives												
	Corn borer, corn earworm	Sevin			Some				Small				x	
	Insects	none			100%				100%			100%		
	Corn borer, corn earworm, fall armyworm	natural predator			x				x					x
	Corn borer, corn earworm, fall armyworm	no treatment			x				x				x	
	Corn borer, armyworm, corn earworm, aphids	Asana or Pounce	x				x					x		
	Corn borer, corn earworm, fall armyworm	Sevin		50%					50%			25%		

TABLE 3.b. Alternate insecticides (continued)

INSECTICIDE	Pest(s) Targeted	Alternate Pesticide and/or Method	Expected Change In Quality with Alternate				Expected Change In Yield with Alternate				Expected Change In Cost with Alternate			
			No chg.	Inc. (+)	Dec. (-)	Don't Know	No chg.	Inc. (+)	Dec. (-)	Don't Know	No chg.	Inc. (+)	Dec. (-)	Don't Know
methomyl	Corn earworm	none												
	Insects, worms	none												
	Corn borer, corn earworm, aphids	no treatment			50-90%				50-90%					x
	Corn borer, fall armyworm, corn earworm	Pounce	x							x				x
	Corn borer, fall armyworm, corn earworm	Bacillus thuringiensis				x				x				x
	Corn borer, corn earworm, aphids	no treatment			x				48%				100%	
	Corn earworm, fall armyworm	pyrethroids			10%				10%		x			
methyl parathion	Corn borer	none			100%				100%			100%		
parathion	Corn borer, corn fall armyworm	no alternatives												
permethrin	Fall armyworm, corn earworm	no treatment			50-90%				50-90%					x
	Corn borer, corn earworm, aphids	no treatment			x				48%				x	
	Corn earworm, borer	Lannate	x				x				x			
	Corn borer, armyworm, corn earworm, flea beetles	Dipel			x				x			x		
	Corn borer, corn earworm, fall armyworm	Lannate	x				x						x	

TABLE 3.b. Alternate insecticides (continued)

INSECTICIDE	Pest(s) Targeted	Alternate Pesticide and/or Method	Expected Change In Quality with Alternate				Expected Change In Yield with Alternate				Expected Change In Cost with Alternate			
			No chg.	Inc. (+)	Dec. (-)	Don't Know	No chg.	Inc. (+)	Dec. (-)	Don't Know	No chg.	Inc. (+)	Dec. (-)	Don't Know
permethrin	Corn borer, fall armyworm, corn earworm	Trichogramma				x				x				x
	Corn borer, corn earworm, aphids	no treatment			x				48%				x	
	Corn earworm, fall armyworm	Lannate			40%				40%		x			
methomyl/ methyl parathion	Corn borer, fall armyworm, corn earworm	Dipel				x				x				x

COMMENTS: "Nonchemical methods do not work as well as Lannate. You can't have worms in corn!"

"Lannate will burn early corn. Therefore, still need pyrethroids."

"Connecticut consumers are not ready for organic stuff because; a) consumers complain if corn is not perfect and b) stores buying wholesale will reject your load if more than 5% of your corn has insect damage."

"If control moths when corn is chest high, before tassel, you won't have problems with corn earworm."

"I have used Furadan for several years consecutively. It again held stewart wilt in control this year. Why are they only concerned about a couple of black birds versus the food supply?"

"Prefer to use pyrethroids versus methomyl for safety reasons. However, pyrethroids perform poorly in hot weather."

TABLE 4. Pesticides used to control insect pests and acres treated[a]

INSECT	Insecticide	Trade Name and Formulation	Acres Treated[b]
European corn borer (*Ostrinia nubilalis*)	*Bacillus thuringiensis*	Dipel 2X (WP)	1.0
	carbaryl	Sevin XLR Plus (AS)	52.0
		Sevin 50W	64.0
		Total carbaryl	116.0
	carbofuran	Furadan 15G	3.5
	chlorpyrifos	Lorsban 4E	75.0
	diazinon	Diazinon AG500 (ES)	4.0
	esfenvalerate	Asana XL (EC)	8.0
	fenvalerate	Pydrin 2.4EC	9.5
	methomyl	Lannate (SP)	568.5
		Lannate L	290.5
		Total methomyl	824.0[c]
	methyl parathion	Penncap-M (F)	498.5
	parathion	Parathion 4EC	62.0
	permethrin	Ambush 2E	741.5
		Pounce 3.2EC	115.5
		Total permethrin	857.0
	thiodicarb	Larvin 3.2 (AF)	5.0
	Total European corn borer		1,782.5[d]

TABLE 4. continued

INSECT	Insecticide	Trade Name and Formulation	Acres Treated[b]
Common and Fall armyworm (*Pseudaletia unipuncta* and *Spodoptera frugiperda*)	carbaryl	Sevin XLR Plus (AS)	11.0
		Sevin 50W	61.0
		Total carbaryl	72.0
	esfenvalerate	Asana XL (EC)	7.0
	fenvalerate	Pydrin 2.4EC	3.5
	methomyl	Lannate (SP)	195.0
		Lannate L	170.5
		Total methomyl	365.5
	methyl parathion	Penncap-M (F)	55.0
	parathion	Parathion 4EC	62.0
	permethrin	Ambush 2E	681.0
		Pounce 3.2EC	69.0
		Total permethrin	750.0
	thiodicarb	Larvin 3.2 (AF)	5.0
	Total fall armyworm		1,169.5[d]
Corn earworm (*Heliothis zea*)	*Bacillus thuringiensis*	Dipel 2X (WP)	1.0
	carbaryl	Sevin XLR Plus (AS)	7.0
		Sevin 50W	61.0
		Total carbaryl	68.0
	chlorpyrifos	Lorsban 4E	15.0

TABLE 4. continued

INSECT	Insecticide	Trade Name and Formulation	Acres Treated[b]
	esfenvalerate	Asana XL (EC)	13.5
		Asana 1.9EC	5.0
		Total esfenvalerate	18.5
	fenvalerate	Pydrin 2.4EC	3.5
	methomyl	Lannate (SP)	785.5
		Lannate L	262.5
		Total methomyl[c]	1,013.0
	methyl parathion	Penncap-M (F)	98.5
	parathion	Parathion 4EC	62.0
	permethrin	Ambush 2E	726.5
		Pounce 3.2EC	165.5
		Total permethrin	892.0
	thiodicarb	Larvin 3.2 (AF)	5.0
	Total corn earworm		1,614.0[d]
Corn flea beetles (Chaetocnema pulicaria)	carbofuran	Furadan 15G	65.5
	chlorpyrifos	Lorsban 4E	15.0

TABLE 4. continued

INSECT	Insecticide	Trade Name and Formulation	Acres Treated[b]
	fenvalerate	Pydrin 2.4EC	3.5
	methomyl	Lannate (SP)	25.0
	methyl parathion	Penncap-M (F)	65.0
	permethrin	Ambush 2E	190.0
		Pounce 3.2EC	10.0
		Total permethrin	200.0
	Total flea beetles		365.5[d]
Corn leaf aphids (Rhopalosiphum dimidiatus)	carbaryl	Sevin 50W	10.5
	methomyl	Lannate (SP)	351.0
		Lannate L	35.0
		Total methomyl	386.0
	parathion	Parathion 4EC	62.0
	permethrin	Ambush 2E	15.5
		Pounce 3.2EC	10.0
		Total permethrin	25.5
	Total aphids		442.5[d]
Cutworms	carbofuran	Furadan 15G	62.0
	chlorpyrifos	Lorsban 15G	275.0
	Total cutworms		337.0

TABLE 4. continued

INSECT	Insecticide	Trade Name and Formulation	b Acres Treated
Seedcorn maggot (Delia platura)	carbofuran	Furadan 15G	65.5
	chlorpyrifos	Lorsban 15G	275.0
	Total seedcorn maggot		340.5
Japanese beetle (Popillia japanica)	methomyl	Lannate (SP)	12.5
	Total japanese beetles		12.5

a
Note: Many applications were for multiple target pests. Therefore, total amount of pesticide used for a given pest cannot be added to the total used for another pest. (i.e. Any given application of methomyl could target european corn borer, fall armyworm, corn earworm, flea beetles, and aphids.)

b
Acres treated is the number of acres treated with one application of a given material. Example: If 100 acres was sprayed three times with Lannate L, the actual number of acres treated is 100.

c
This figure is less than the above acres added together; because, both formulations of Lannate were used on the same acre.

d
Acres treated for this insect is less than the above acres added together. Some acres were treated with more than one insecticide.

Survey No. ____

SECTION A. General Instructions

1. Please report only information about sweet corn in 1990.
2. Report every pesticide (i.e. **general and restricted use**) used in 1990. Include herbicides, insecticides, crop oils, rodenticides, etc.
3. Report all units in ounces, pounds, pints or gallons per acre.
4. Acres Treated: If you spot treated with herbicides, only report the actual area sprayed.
5. Application Rate: How much material did you apply per acre. Record all units as oz/acre, lbs/acre, pt/acre or gal/acre.
6. If you come across a question which you cannot answer, please continue filling out the form as completely as you can.

SECTION B: 1990 Regular Spray Program Information

Total acres of sweet corn planted: _____acres
Total acres of sweet corn sprayed: _____acres
Total acres of sweet corn harvested: _____acres

Number of dozen ears produced per acre Wholesale: _____ears
Retail: _____ears

Average price range per dozen ears Wholesale: $_____
Retail: $_____

Acres Treated (see instruction #4)	Trade Name and Formulation (ex. Lannate 1.8L)	Your Application Rate per Acre (see instruction #5)	Number of Treatments (ex. 3 times)	Crop Stage (Check column(s))			Type of Application (Check column)				All Pest(s) Targeted (Check column(s))									
				Whorl	Pretassel	Silk	Boom Sprayer	Mist Sprayer	Hand Gun	Other	Corn Borer	Fall Armyworm	Corn Earworm	Flea Beetles	Aphids	Cutworms	Seed Corn Maggot	Jap Beetles	Grass Weeds	Broadleaf Weeds

SECTION C: 1990 Alternative Program Information

For each of the pesticides you reported on the front in section B:

What alternate, nonchemical method could have been used? (ex. disease resistant varieties, use of purchased natural predators [i.e. *Trichogramma spp.*], *Bacillus thuringiensis* [i.e. Dipel], cultivation instead of herbicide, no treatment, etc.)

What alternative pesticide could have been used?

Name of Pesticide Reported in Section B	Pest(s) Targeted (specific name of weed, insect, etc.)	Alternate Method and/or Pesticide (be specific)	Expected Change in Quality with Alternate (check one)	Expected Change in Yield with Alternate (check one)	Expected Change in Cost with Alternate (check one)
		____ 1st Alternate	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____
		____ 2nd Alternate	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____
		____ 1st Alternate	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____
		____ 2nd Alternate	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____
		____ 1st Alternate	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____
		____ 2nd Alternate	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____	No change____ How Much? Increase ____ ______ Decrease ____ ______ Don't Know ____