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Pesticide Use on Specialty Crops in Nebraska - 1992

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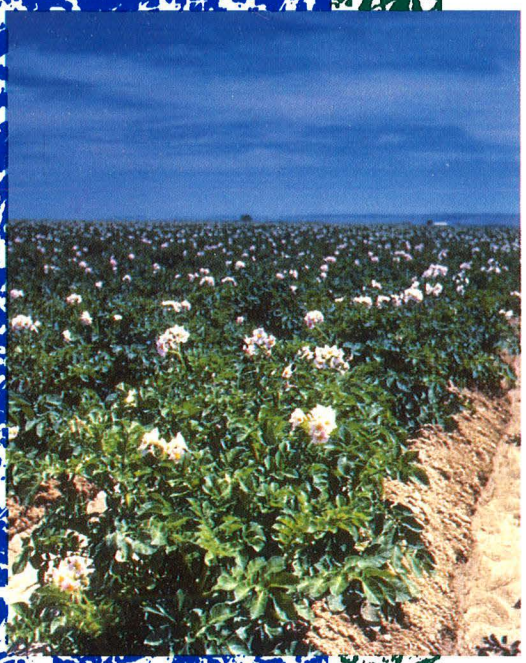

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Pesticide Use on Specialty Crops in Nebraska - 1992[1]

Gary L. Hein[2], Shripat T. Kamble[3], Warren Vorhees[2] and William Waggoner[2]

Introduction

Nebraska is one of the leading states in agricultural production in the United States, and pesticide use is of major importance to crop production in Nebraska. Large amounts of pesticides are used on the approximately 18 million acres of cropland in Nebraska (Johnson and Kamble 1984 and Baker et al. 1990). Nebraska's primary agricultural commodities are livestock, corn, wheat, soybeans, sorghum and alfalfa. However, several specialty crops are also grown in Nebraska. Many of these crops grow in specific regions of the state and are not concentrated in the areas where most of the corn, soybeans and sorghum are raised. They are grown in areas of lower farm concentration by a limited number of growers.

Dry beans are grown mainly in the Panhandle and southwestern Nebraska. Because of processing facilities in the Panhandle, sugarbeets are grown only in the Panhandle. Potatoes are grown throughout the state, but acreages are aggregated around several production areas. Sunflowers are also grown throughout the state, but larger acreages are located close to a stable market (processing facilities) which currently is in western Kansas. Therefore, most of the sunflower growers are in the western part of Nebraska. Proso millet fits best into the winter wheat-fallow cropping system in the western part of the state.

Because of the regionalization of these crops, the limited number of acreages involved and the low density of farms in the growing areas, a general pesticide use survey of farmers in Nebraska does not include a large enough sample of the specialty crop growers to provide a meaningful survey of pesticide use on crops. Also, the regionalization of the specialty crops and the high value of some of them makes these crops extremely important to the economies of the areas where they are grown. Pesticide use surveys for sugarbeets, dry edible beans, and potatoes in Nebraska were done in 1978 by Wilson (1979) and in 1987 by Baker et al. (1990), but no pesticide use surveys have been done on sunflowers, proso millet or onions in Nebraska. Therefore, this survey was undertaken to assess pesticide use patterns and related information on dry beans, onions, potatoes, proso millet, sugarbeets and sunflowers.

Materials and Methods

Participating Departments

The pesticide use survey was a cooperative effort of several University of Nebraska-Lincoln faculty from the departments of Agricultural Economics, Agronomy, Biometry, Entomology, Water Center/Environmental Programs, Plant Pathology and Forestry, Fisheries and Wildlife, along with numerous Extension Educators throughout the state. Assistance was also obtained from the Nebraska Department of Agriculture, Statistics Division.

Survey Questionnaire (Instrument)

Because most growers only raise one or two of these specialty crops and crop areas for these crops do not always significantly overlap, each of the crops was surveyed individually with a survey instrument specifically designed for that crop. Questionnaires included information on total acreages, pesticide use patterns, pest management practices, pesticide use practices, pests targeted, pesticide safety practices, and alternative pest management methods. An example of the questionnaire used is shown in Appendix G.

Sample Size and Mailing

With the cooperation of the Nebraska State Department of Agriculture, a stratified random sample of dry bean growers based on acreage was

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[1]This study was funded in part by the National Agricultural Pesticide Impact Assessment Program, Extension Service, U. S. Department of Agriculture, Project No. 92-EPIX-1-0091.
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used. The strata were based on the following acreage divisions: 1-24, 25-99, 100-249, 250 and above. Surveys were sent to 35 percent of the dry bean growers in each strata (430 total). The Nebraska State Department of Agriculture provided a mailing list for sunflower growers, and surveys were sent to 249 sunflower growers which represented 50 percent of the mailing list. A sugarbeet mailing list of 35 percent of the growers (271) was obtained with the cooperation of Western Sugar Company and Holly Sugar Corp., the two companies that process Nebraska sugarbeets. Potato surveys were sent to all known potato growers in the state (87). A millet mailing list was compiled by surveying all the county Extension Educators for the names of growers in their counties. This mailing list was far from complete, but surveys were sent to all of the proso millet growers that were identified (116). Only two commercial onion growers were located in Nebraska. Surveys and phone interviews were used to obtain information from these growers.

Surveys were mailed in February and March 1993, with a follow-up notice mailed three to four weeks later. Crops that had lower response rates were targeted for telephone calls to those not responding.

Data Processing and Reporting

Responses were tallied and averages determined for all pesticides and crops. Expansion factors were determined to provide an estimate of usage for all pesticides reported from the surveys. The expansion factor for each pesticide was calculated by multiplying the average rate for a pesticide (lbs of active ingredient per acre; Appendices A-F) from the survey sample, the average number of treatments per acre and the acreage on which that pesticide was reported to be used. This acreage was determined by multiplying the estimated statewide acreage (*Table 2*) for a crop by the percentage of surveyed acreage treated with the pesticide in question (Appendices A-F).

Results and Discussion

Survey Response

The total population size and the number of usable survey responses are listed in *Table 1*. The response rates for usable surveys ranged from 10 percent (sunflowers) to 28 percent (proso millet). Only 55 percent of the returned surveys were usable; the others were not used primarily because the respondent did not grow the crop in 1992. The number of usable surveys ranged from only 24 percent for sunflowers to 92 percent for sugarbeets. A high number of non-grower responses were obtained for sunflowers, potatoes and dry beans. This likely results because a lot of growers move in and out of production of these crops, and accurate mailing lists are difficult to maintain.

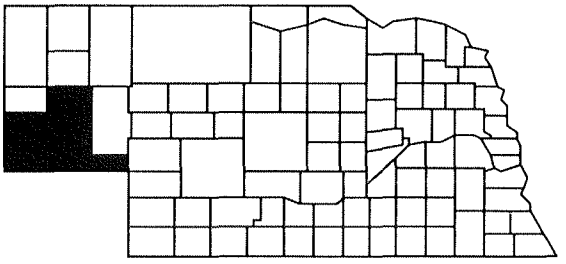
The acreage surveyed as compared to the total state acreage ranged from 6 percent (dry beans) to 51 percent (potatoes) (*Table 2*). The survey represents 9.5 percent of the specialty crop acreage in Nebraska. Survey responses were obtained from all areas of the state. Figure 1 shows the counties from which responses were received for the different crop surveys.

Total Acres Treated With Pesticides

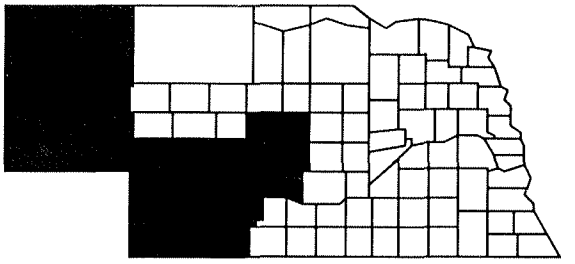
Table 2 also shows the acreage and percentage of the surveyed acres that were treated with the various types of pesticides. All of the onion acres and over 99 percent of the sugarbeets, potatoes, and dry beans were treated with pesticides. The lowest percentages for treated acres were for proso millet (44 percent) and sunflowers (77 percent). Multiple herbicide treatments were used on some acres of sugarbeets, potatoes, dry beans, sunflowers and onions. Multiple treatments were also used for insecticide applications on onions and potatoes and fungicide applications on onions. *Table 3* gives a breakdown of the production acreage categories for the crops surveyed and the percentages of growers in the categories using the different pesticide types.

Table 1. Growers population size and survey response: pesticide use on specialty crops in Nebraska-1992.

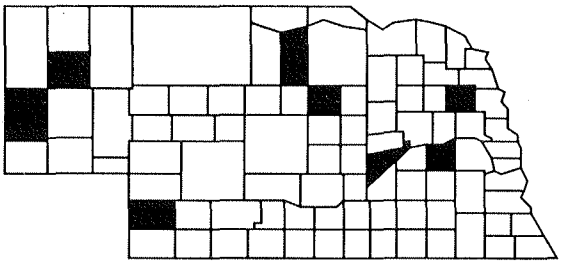
Crop	*Population size*	*Surveys mailed*	*Number of surveys returned*	*Number of usable surveys*
Dry beans	1229	430	100	61
Potatoes	87	87	23	10
Proso millet	116	116	52	33
Sugarbeets	774	271	65	60
Sunflowers	498	249	107	26



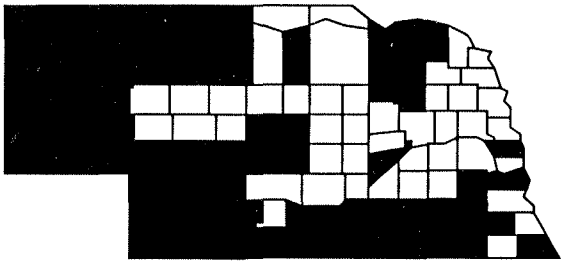
Sugarbeets



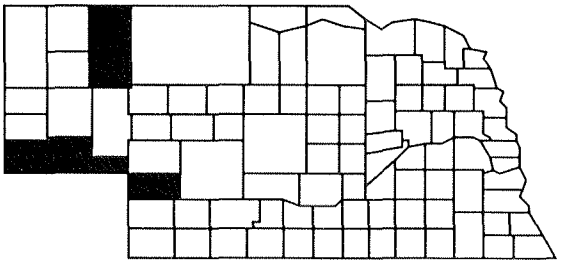
Dry Beans



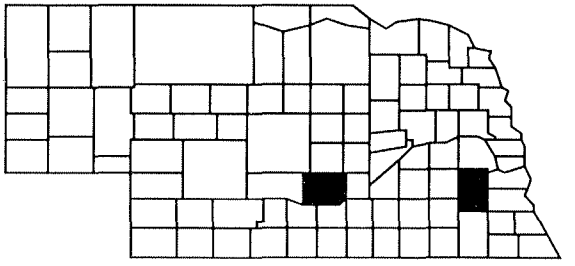
Potatoes



Sunflowers



Proso Millet



Onions

Figure 1. Nebraska counties surveyed for specialty crop pesticide use in 1992.

Three in four growers indicated 1992 pesticide usage was the same as in 1991. Equal percentages of growers reported more and fewer acres treated in 1992. Of those reporting fewer pesticides used, 50 percent said it was not economically feasible to treat, 41 percent said they experienced more favorable weather conditions, 27 percent said they used alternate control practices, 9 percent reported fewer pests and 9 percent reported better scouting for more timely application.

Tables 4, 5, and *6* give the pounds (lbs) of active ingredients (AI) for herbicides, insecticides, and fungicides/nematicides, respectively, used on the specialty crops in 1992. These tables are based on the data contained in Appendices A-F which contains the areas treated, percentage of total acreage, and average use rates for the various pesticide formulations.

Table 2. Specialty crop acreage surveyed in Nebraska that was treated with pesticides during 1992.

Crops	*Est. Statewide Acreage*	*Total Acreage Surveyed*	*Surveyed Acreage Treated (%)*	*Surveyed Acres Treated (%)*							
				Herbicides		*Insecticides*		*Fungicides*		*Nematicides*	
				Treated	*Not treated*	*Treated*	*Not treated*	*Treated*	*Not treated*	*Treated*	*Not treated*
Dry beans	153,000	9,363	9,283 (99)	9,914	80 (106)	1,643 (0.9)	7,720 (18)	4,218 (82)	7,083 (45)	0 (76)	0
Onions	41	41	41 (100)	15111 (368)	0	69 (168)	0	82 (200)	0	0	0
Potatoes	13,000	6,625	6,609 (99+)	11,077 (167)	86 (1.3)	15,146 (229)	16 (0.2)	6,648 (100)	1,690 (26)	0	0
Proso millet	65,000	7,841	3,821 (44)	3,821 (49)	4,020 (51)	0	0	0	0	00	
Sugarbeets	84,000	10,970	10,901 (99+)	20,169 (184)	69 (0.6)	6,761 (62)	4,981 (45)	399 (3.6)	10,571 (96)	2,806 (26)	8,164 (74)
Sunflowers	40,000	6,315	4,885 (77)	4,684 (74)	1,720 (27)	700 (11)	5,615 (89)	0	0	0	0

Pesticide Use in Dry Beans

Nearly all the dry bean acreage surveyed was treated with herbicides, a small percentage being treated twice. An estimated 369,595 lbs (AI) of herbicides were applied to the dry bean acreage in Nebraska in 1992. Over half of this total was EPTC at 212,471 lbs (AI), followed by alachlor (77,322 lbs, AI) and ethalfluralin (59,191 lbs, AI). Only 18 percent of the dry bean acreage was treated with insecticides. Disulfoton was the most widely used (3,879 lbs, AI) and there were no reports of multiple application of insecticides. Seventy-six percent of the bean acreage was not treated with fungicides. However, multiple treatments were often used with an average of of 1.85 applications per treated acre. The two main fungicides used were chlorothalonil (29,486 lbs, AI) and copper (26,056 lbs, AI).

Pesticide Use in Sugarbeets

Nearly all the sugarbeet acreage was treated with herbicides (0.6 percent untreated), and the treated acreage averaged nearly two treatments or 1.85 treatments per treated acre. These treatments resulted in the use of 86,803 lbs (AI) of herbicides on sugarbeets in Nebraska. The herbicide most often used on sugarbeets was cycloate (40,517 lbs, AI), followed by ethofumesate (25,282 lbs, AI). These two herbicides made up 76 percent of the herbicides used on sugarbeets. Insecticides were applied to 55 percent of the sugarbeet acreage with only a small portion of this receiving more than one application. Carbofuran (18,225 lbs, AI) and aldicarb (15,019 lbs, AI) accounted for over half of the 54,758 lbs (AI) of insecticide used. Only 3.5 percent of the sugarbeet acreage was treated with fungicides with 8,891 lbs of sulfur being used. Nematicides were used on 25 percent of the acreage with the primary usage being from 1-3-dichloropropene at 2,192,237 lbs (AI). A much smaller percentage of the acreage was treated with aldicarb for nematode control. Aldicarb usage is confounded somewhat because it is used as an insecticide and a nematicide. If nematodes are targeted, a much higher rate is used (Appendix E). However, the decision to use aldicarb as an insecticide at the lower rate is often made because of its effects on nematodes as well, even though only marginal nematode control is obtained by the lower rate alone.

Table 3. Percentage of growers within a production category that treated for pests and the average acreages treated within each production category.

Crop	*Production acreage respondents*	*Number of survey*	*Weeds*		*Insects*		*Fungi*		*Nematodes*	
			%	*acres*	*%*	*acres*	*%*	*acres*	*%*	*acres*
Dry beans	0-100	27	100	65	22	68	11	71	0	0
	101-500	34	100	202	21	172	29	218	0	0
	501+	1	100	600	0	0	0	0	0	0
Potato	0-100	4	25	10	75	21	50	12	0	0
	101-500	1	100	195	100	195	0	0	0	0
	501+	5	100	1264	100	1270	100	1008	0	0
Proso millet	0-100	12	42	62	0	0	0	0	0	0
	101-500	20	45	185	0	0	0	0	0	0
	501+	2	100	924	0	0	0	0	0	0
Sunflowers oil	0-100	10	70	61	0	0	0	0	0	0
	101-500	8	88	219	0	0	0	0	0	0
	501+	3	100	512	0	0	0	0	0	0
Sunflowers confection	0-100	4	100	44	0	0	0	0	0	0
	101-500	7	71	182	43	233	0	0	0	0
	501+	0	0	0	0	0	0	0	0	0
Sugarbeets	0-100	23	100	66	52	59	4	100	35	52
	101-500	37	100	208	76	197	3	199	51	124
	501+	1	100	610	0	0	0	0	0	0

Table 4. Herbicides applied to specialty crops in Nebraska-1992.

	Dry Beans	*Onion*	*Potatoes*	*Proso Millet*	*Sugarbeets*	*Sunflowers*
Herbicide	*Pounds of Active Ingredient Applied*					
alachlor						
Cannon	1,009					
Lasso	40,877					520
Lasso II	7,872					
Partner	27,564					
atrazine						
Aatrex				9,933		
Atrazine				7,085		
clopyralid						
Stinger					839	
cycloate						
Ro-neet					40,517	
DCPA						
Dacthal		117				
desmedipham						
Betamix					2,886	
dicamba						
Banvel				1,360		
diethatylethyl						
Antor					5,145	
diquat						
Diquat			734			
EPTC						
Eptam	212,471		3,465		5,149	
ethalfluralin						
Sonalan	59,191					
ethofumesate						
Nortron					25,282	
glyphosate						
Roundup			1,079	642	588	161
imazethapy						
Pursuit	337					
Pursuit +	105					

Table 4. Herbicides applied to specialty crops in Nebraska-1992 (cont.).

	Dry Beans	*Onion*	*Potatoes*	*Proso Millet*	*Sugarbeets*	*Sunflowers*
Herbicide	*Pounds of Active Ingredient Applied*					
linuron						
Lorox			188			
metolachor						
Dual	6,618		6,568			
Turbo			11,886			
metribuzin						
Sencor			1,986			
Turbo			2,631			
oxyfluorfen						
Goal		9				
paraquat						
Cyclone				2,464		
Gramoxone Extra			1,194			
pendimethalin						
Prowl	1,071	56	829			19,000
Pursuit +	1,420					
phenmedipham						
Betamix					2,886	
sethoxydim						
Poast	232	165	71		864	
2,4-D						
2,4-D amine				4,229		
2,4-D ester				417		
trifluralin						
Cannon	201					
Treflan	9,639		13		2,647	5,564
Tri-4	988					659
TOTAL*	369,595	347	30,644	26,130	86,803	25,904

*Overall total estimated herbicide usage in 1992 was 539,423 lbs (AI).

Table 5. Insecticides applied to specialty crops in Nebraska-1992.

	Dry Beans	*Onion*	*Potatoes*	*Proso Millet*	*Sugarbeets*	*Sunflowers*
Insecticide			*Pounds of Active Ingredient Applied*			
aldicarb Temik					15,019	
carbaryl Sevin	612		6			
carbofuran Furadan					18,255	
chlorpyrifos Lorsban					9,544	
disulfoton Di-syston	3,879		218			
endosulfan Thiodan			4,602			
esfenvalerate Asana	462		22			161
methamidophos Monitor			2,448			
methyl parathion Penncap-M	1,148	11				
permethrin Ambush Pounce Subtotal		11	311 514 825			
phorate Thimet	1,767		32,881			
terbufos Counter					11,970	
TOTAL*	7,868	22	41,002	0	54,758	161

*Overall total estimated insecticide usage in 1992 was 103,811 lbs (AI).

Table 6. Fungicides and nematicides applied to major specialty crops in Nebraska-1992.

	Dry Beans	*Onion*	*Potatoes*	*Proso Millet*	*Sugarbeets*	*Sunflowers*
Fungicide			*Pounds of Active Ingredient Applied*			
benomyl Benlate	4,896				19	
chlorothalonil Bravo	29,486	62	568			
coppers	26,056					
ethylene bisdithiocarbamate Maneb Manzate Dithane	2,524	31	3,453 2,405			
iprodione Rovral		28				
metalaxyl Ridomil			1,750			
sulfur	5,998				8,891	
thiophanate methyl Tops Topsin M	2,582		9,669			
TOTAL*	71,542	121	17,845	0	8,910	0
Nematicide						
aldicarb Temik					5,262	
1-3-dichloro-propene Telone II					2,192,237	
TOTAL	0	0	0	0	2,197,499	0

*Overall total estimated fungicide usage in 1992 was 98,418 lbs (AI).

Pesticide Use in Sunflowers

Herbicides (25,904 lbs, AI) were used on 73 percent of the acreage of sunflowers with primarily only one treatment being used. The most used herbicides were pendimethalin (19,000 lbs, AI) and trifluralin (6,223 lbs, AI). Only a small amount of sunflower acreage was treated with insecticides (11 percent), and all of this was treated with esfenvalerate (161 lbs, AI). No fungicides or nematicides were used on sunflowers.

Pesticide Use in Potatoes

Herbicides were applied to 99 percent of the potato acreage with multiple treatments being used on much of this acreage. The total potato acreage treated was nearly 100 percent of the

surveyed acreage with an average of 1.69 treatments per treated acre. Approximately 30,644 lbs (AI) of herbicides were used on the potato acreage in Nebraska. The most used herbicide was metolachlor (18,454 lbs, AI) followed by metribuzin and EPTC. Nearly all of the potato acreage was treated with insecticides with the total treatments averaging 2.29. Phorate made up nearly 80 percent of the total insecticides applied to potatoes with 32,881 lbs out of 41,002 lbs (AI). Thiophanate methyl (9,669 lbs, AI) and ethylene bisdithiocarbamate (5,858 lbs, AI) were the two most used fungicides used on 74 percent of the potato acreage. Some double applications of fungicides were applied on potatoes.

Pesticide Use in Proso Millet

Forty-nine percent of the proso millet acreage was treated with 26,130 lbs (AI) of herbicides. Atrazine (17,018 lbs, AI) and 2,4-D (4,646 lbs, AI) were the most used herbicides. This is expected to be about the last year for atrazine use in millet because of registration cancellation and the depletion of available registered stocks. Numerous growers expressed frustration that few effective herbicide options are available. No insecticides, fungicides or nematicides were applied to proso millet.

Pesticide Use in Onions

Only two commercial onion growers were identified in Nebraska in 1992, representing 41 acres of onions. All pesticide use was very heavy on onions with multiple applications being applied to nearly all the acres. Herbicide use was the greatest, averaging nearly four applications per acre and totaling 347 lbs (AI), on this limited acreage.

Pesticide Application Methods

A breakdown of methods and timings of pesticide applications is given in *Table 7*. Most herbicide application on dry beans, potatoes, proso millet, and sunflowers were ground applied broadcast treatments. In sugarbeets most of the herbicide applications were applied as band treatments. Band and in-furrow treatments were heavily used in sugarbeets for insecticide applications as well. These application methods were also important for insecticide use in dry beans and potatoes. Chemigation use was reported only in dry beans and potatoes. Preplant applications were important for herbicide applications in dry beans and sunflowers, and preemergence and cultivation applications were the most used methods for herbicides in potatoes and sugarbeets, respectively. At planting time, insecticide applications were extensively used in dry beans, potatoes, and sugarbeets. The other major insecticide applications occurred late season, indicating the need for late season insect control. Fungicide/nematicide timing resulted from early season nematode control on sugarbeets and fungicides applied during the late season to dry beans, potatoes and sugarbeets.

Vertebrate Pest Control

Only a few of the respondents indicated problems with vertebrate pests associated with these crops (*Table 8*). Bird problems were identified by 6 percent of the respondents and rodent problems by 17 percent of the respondents. The largest problems were reported on sugarbeets with 19 growers reporting rodent problems. Only 5 percent of the respondents reported using any rodenticides, with no information on specific rates used. Use rates were generally referred to as "low" and use was mostly limited to border areas. Several growers indicated using non-chemical control methods. These were limited mainly to trapping and shooting.

Pesticide Safety

Several questions concerning pesticide safety are summarized in *Tables 9-11*. Ninety-two percent of the respondents were certified pesticide applicators, and 7 percent indicated that they had suffered ill health effects that they thought were due to pesticides. Calibration of pesticide application equipment was done at least regularly during the season by 74 percent of the respondents with only 1 percent indicating that they never calibrate.

The survey indicated that 89 percent of the growers read the label before working with pesticides (*Table 9*). In addition 64 percent indicated that they used the protective equipment as specified on the label, and 76 percent indicated that they used protective equipment that was not specified on the label at least some of the time. A summary of the protective equipment used by the respondents is listed in *Table 10*. A large percentage of growers reported using rubber/neoprene gloves (93 percent), long sleeve shirts and long pants (81 percent) and goggles/face shields (66 percent). These figures represent a dramatic increase over results reported by Wilson (1979). Substantial increases in use of safety equipment were reported for all categories that were included in the Wilson (1979) survey.

Table 7. Percentage of growers using various pesticide application methods and timings: pesticide use on specialty crops in Nebraska-1992.

	Dry Beans			*Potatoes*			*Proso Millet*	*Sugarbeets*			*Sunflowers*	
	Herb.	*Ins.*	*Fung.*	*Herb.*	*Ins.*	*Fung.*	*Herb.*	*Herb.*	*Ins.*	*Fung/Nem*	*Herb.*	*Ins.*
Application Method												
Broadcast-ground	95%	7%	0	67%	0%	25%	84%	26%	5%	80%	91%	0%
Band	1%	21%	0	0%	18%	0%	0%	73%	85%	13%	9%	0%
In-furrow	0%	7%	0	0%	29%	0%	0%	0	8%	0%	0%	0%
Aerial	3%	57%	100%	0%	41%	50%	16%	0	3%	7%	0%	100%
Chemigation	1%	7%	0	33%	12%	25%	0%	0	0%	0%	0%	0%
	n=76	n=14	n=12	n=9	n=17	n=4	n=19	n=121	n=39	n=30	n=23	n=5
Application Timing												
Pre-plant	75%	0%	0	10%	0%	0%	35%	19%	7%	80%	70%	0%
At-plant	9%	31%	0	0%	33%	0%	0%	25%	86%	13%	8%	0%
Pre-emergence	12%	0%	0	40%	0%	0%	12%	7%	0%	0%	8%	0%
Cultivation (or early postemerg.)	4%	0%	0	20%	7%	25%	41%	50%	7%	0%	4%	0%
Late season	0%	69%	100%	30%	60%	75%	12%	0%	0%	7%	0%	100%
	n=68	n=13	n=12	n=10	n=15	n=4	n=17	n=118	n=46	n=30	n=24	n=5

Questions concerning pesticide storage revealed that only 21 percent of the respondents said they used locked "pesticide only" storage facilities. Disposal methods have also changed a lot from those reported by Wilson (1979). Increases in burning, returning containers to dealers and recycling were noted in comparison to Wilson (1979) (*Table 11*). The primary method of pesticide container disposal was burning (57 percent) followed by returning the container to the dealer and hauling them to the landfill. A noticeable increase in recycling was noticed with 11 percent of the growers indicating that they recycle. Also, a substantial decrease in burying of the containers was noted as compared to Wilson (1979).

Table 8. Vertebrate pest problems and rodenticides used on specialty crops in Nebraska-1992.

	Dry Beans	*Potatoes*	*Proso Millet*	*Sugarbeets*	*Sunflowers*	*Total*
Problems with birds	3	0	0	5	2	10 (6%)
Problems with rodents	5	0	2	19	1	27 (17%)
Number of growers reporting use of rodenticides	2	0	1	6	0	9 (5%)
Non-chemical control methods used						
Trapping						
-rodents	5	0	0	7	0	
Shooting						
-birds	1	0	0	2	0	
-rodents	2	0	0	1	0	
Other						
-birds	2	0	0	0	0	
-rodents	2	0	2	1	0	

Table 9. Specialty crop producers use of pesticide label for safety information in Nebraska-1992.

	Percentage of responses (n=150)		
	Always	*Sometimes*	*Never*
Read pesticide label before handling, mixing, applying	89%	11%	0%
Use protective equipment as specified on label	64%	36%	0%
Use protective equipment not specified on label	10%	66%	24%

Table 10. Protective equipment used when handling, mixing or applying pesticides by specialty crop growers in Nebraska-1992 (n=152).

	Percentage of growers using protective equipment	
Protective equipment	*Current Survey*	*Wilson 1979 Survey*
Rubber/neoprene gloves	93%	5%
Long-sleeve shirt, long-legged pants	81%	*
Goggles/face shield	66%	25%
Rubber/plastic apron	28%	8%
Rubber/neoprene boots	27%	9%
Respirator	26%	*
Hard hat	5%	*

*Not a specific category in Wilson 1979 survey.

Table 11. Disposal of empty pesticide containers by specialty crop growers in Nebraska-1992 (n=152).

	Percentage of growers using method	
Method	*Current Survey*	*Wilson 1979 Survey*
Burned	57%	4%
Returned to dealer	38%	13%
Hauled to landfill	32%	40%
Recycled	11%	1%
Reused on farm	5%	6%
Stored on farm	5%	9%
Buried	3%	27%

Table 12. Usage of cultivation and rotary hoe on specialty crops in Nebraska-1992.

	Dry Beans	*Potatoes*	*Sugarbeets*	*Sunflowers*
Cultivating	92%	80%	100%	62%
Avg. cultivations	1.5	1.9	2.6	1.5
Rotary hoe	28%	0%	17%	8%

Alternative Pest Control Measures

Cultivation: Cultivation of the four row crops was a major weed control practice (*Table 12*). All of the sugarbeet growers reported that they used an average of 2.6 cultivations. The least cultivations were reported for sunflowers, with 62 percent reporting that they cultivated. Rotary hoeing was used in dry beans, sugarbeets and sunflowers, but to a much lesser extent than cultivation, with the highest percentage of growers reporting that they rotary hoed dry beans (28 percent).

Other alternatives: *Table 13* contains growers' responses about non-chemical control methods. Because of the incomplete and variable quality of responses, these data are presented only as the number of respondents that reported using a particular technique. Many respondents did not report crop acreage involved and few reported any estimate of yield gain or loss. The greatest number and variety of alternative methods were listed for sugarbeets and dry beans. This was expected because of the problems, particularly nematodes (sugarbeets) and diseases (dry beans), associated with production of these crops.

Crop rotation was the most mentioned alternative method for controlling weeds for all the crops surveyed. Disease management practices included more options than weeds or insects. Crop rotation was the most mentioned practice for disease control, especially for dry beans and sugarbeets. Sanitation was mentioned as a major method for managing dry bean diseases. Variety selection was also mentioned by several growers for managing diseases in sugarbeets. Alternative methods for managing insect problems were mentioned only a few times, with the planting date in sunflower and dry beans mentioned most often.

Based on the low number of responses and the variability in the quality of responses, this survey did not adequately evaluate the use of alternative pest control methods. While the importance of the different techniques mentioned by the respondents was appropriate, it would seem that this area is not well understood by the growers. For example, tillage and row spacing are major factors in weed control in most crops; however, only a small portion of those filling out this survey recognized the importance of these practices. This is also true of the effect of date of planting on insects for dry beans and sunflowers. These practices are used by many growers but their importance is not demonstrated by the responses in this survey. Perhaps a survey of crop production specialists would better assess the true value of the many alternative methods that are used.

Pest Scouting Practices

The number of growers that reported regularly scouting their fields varied a great deal from crop to crop (*Table 14*). This likely relates to the value of the crop and the presence of serious pests. All of the potato growers and 67 percent of the sugarbeet growers reported regularly scouting their fields. There are several insect and disease pests that cause problems in potatoes and sugarbeets and it is important that growers stay on top of these pest problems. The highest percentage of growers used scouting services on potatoes and dry beans, 20 percent and 21 percent respectively. The higher percentage for potatoes was due to the low number of growers involved, with only two growers indicating they used consultants. The higher percentage obtained for dry beans represents a number of growers from areas of center pivots where corn and beans are grown more intensively. These growers tend to rely more heavily on consultants.

The average cost of consulting services was $5.28, with a range of $3.00 to $8.50. Several growers reported that they were not charged for their consulting services, and this was usually in situations where few or very limited services were offered. These data indicate that the consulting services used in these specialty crops is quite limited. This is surprising in light of the overall value of dry beans, sugarbeets, and potatoes. The use of consultants and an increase in field scouting are areas that need to be expanded in the future, especially if management is to be optimized.

Summary and Conclusions

Several specialty crops are grown in specific regions within Nebraska. These crops have become major production commodities within these regions. Production of these specialty crops relies quite heavily on the use of pesticides to maintain economic production. This survey indicated that nearly all the acreage of sugarbeets, dry beans, potatoes and onions were treated with pesticides. The lower value crops of proso millet (49 percent treated) and sunflowers (73 percent treated) required fewer pesticide treatments.

Pesticide usage for the highest value crops was the greatest. The results from this survey indicate the amount of all pesticides used per acre averaged over the entire Nebraska acreage for these specialty crops was 27.9 lbs (AI) for sugarbeets, 11.9 lbs (AI) for onions, 6.9 lbs (AI) for potatoes, 2.9 lbs (AI) for dry beans, 0.65 lb (AI) for sunflowers, and 0.4 lb (AI) for proso millet. Pesticide use per acre was the heaviest on sugarbeets, because of the heavy use of soil fumigant to control nematode problems. The use of the soil fumigant accounted for 93 percent of pounds of pesticide used on sugarbeets.

The survey also addressed pesticide safety issues and alternative pest control methods. Information gathered in this survey indicates that growers are much more safety conscious with regard to pesticides than in a similar survey conducted in 1979. Pesticide safety practices have improved dramatically. The information on alternative pesticide practices indicated that a number of growers used alternative practices, but the lack of responses with regard to benefits of these practices and the extent of use of these practices indicates that this survey did not adequately evaluate the value of these alternative pest control methods.

Table 13. Alternative pest control methods reported by specialty crop growers in Nebraska-1992.

	Dry Beans			*Potatoes*			*Proso Millet*	*Sugarbeets*			*Sunflowers*		
	Weeds	*Insects*	*Disease*	*Weeds*	*Insects*	*Disease*	*Weeds*	*Weeds*	*Insects*	*Disease*	*Weeds*	*Insects*	*Disease*
Crop rotation	15	1	24	1	1	2	16	5	2	31	9	0	1
Variety selection	0	0	4	0	0	4	0	2	0	12	0	0	0
Adjust planting date	0	4	2	0	0	0	1	2	0	2	0	3	0
Tillage	2	0	3	1	0	0	3	5	0	2	2	0	0
Sanitation	4	0	23	0	0	1	0	1	1	3	0	0	0
Row spacing	2	0	0	0	0	0	0	0	0	0	0	0	0
Irrigation man.	0	0	1	0	0	0	0	0	0	0	0	0	0

Table 14. Pest scouting practices for specialty crop growers in Nebraska-1992.

	Percentage of responses					
Scouting	*Dry Beans*	*Potatoes*	*Proso Millet*	*Sugarbeets*	*Sunflowers*	*Total*
Regularly	49	100	31	67	50	55
Occasionally	46	0	48	28	38	37
When pests obvious	2	0	10	6	8	5
Never scout	3	0	10	0	4	3
	n=59	n=10	n=29	n=54	n=24	n=176

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Baker, M., N. Peterson, S. T. Kamble. 1990. Pesticide use on crops in Nebraska-1987. Res. Bull. 311. Institute of Agriculture & Natural Resources, University of Nebraska, Lincoln, 68583. 34 pp.

Johnson, B. B. and S. T. Kamble. 1984. Pesticide use on major crops in Nebraska - 1982. Environmental Programs Dept. Report No. 10. Institute of Agriculture & Natural Resources, University of Nebraska, Lincoln, 68583. 29 pp.

Wilson, R. G. 1979. Survey of pesticide use in irrigated regions of the Nebraska panhandle. SB 544. Institute of Agriculture & Natural Resources, University of Nebraska, Lincoln, 68583. 19 pp.

APPENDICES

Appendix A. Survey summary of pesticides used on dry beans in Nebraska — 1992.

Herbicides	*No. of Growers Using Pesticide*	*% of Total Acreage Treated*	*Acres Treated*		*Average Application Rate*	
			Self Applied	*Custom Applied*	*Dry (lbs/A)*	*Liquid (qt/A)*
Sonalan/Lasso	1	3.5	320	—	—	1.00/2.00
Eptam/Sonalan/ Partner	1	1.5	—	139	2.0	0.62/0.50
Eptam	2	2.3	120	93	—	1.88
Sonalan	6	9.7	895	—	—	1.00
Pursuit	1	4.9	450	—	—	0.09
Partner	4	5.2	482	—	3.1	—
Eptam/Dual	1	1.4	130	—	—	1.25/0.60
Cannon/Lasso	1	1.4	130	—	—	0.75/1.25
Lasso	2	6.7	420	195	—	1.38
Poast	1	0.5	—	50	—	0.75
Treflan	1	0.2	20	—	—	0.50
Lasso II	1	4.9	450	—	7.0	—
Eptam/Sonalan	24	37.8	2463	1027	—	1.24/0.94
Eptam/Treflan	10	12.4	631	515	—	1.10/0.50
Sonalan/Dual	2	2.1	192	—	—	1.00/0.63
Eptam/Prowl	1	1.4	130	—	—	1.00/0.50
Eptam/Lasso	4	5.7	305	225	—	1.06/1.53
Eptam/Tri-4	1	1.7	160	—	—	0.88/0.38
Eptam/Partner	2	2.9	110	160	3.0	1.00
Pursuit +	2	1.1	102	—	—	1.25
Total Acres			**7510**	**2404**		
Insecticides						
Asana XL	8	12.2	130	995	—	0.15
Penncap-M	1	1.5	—	139	—	1.00
Di-Syston 15G	3	2.6	242	—	6.5	—
Sevin	2	0.4	—	37	—	1.00
Thimet 15G	1	1.1	100	—	7.0	—
Total Acres			**472**	**1171**		
Fungicides						
Copper	9	25.1	126	2194	—	1.18
Bravo	3	14.6	—	1349	—	0.88
Benlate	1	3.2	—	300	2.0	—
Manex	1	1.1	—	98	—	1.50
Sulfur	1	0.2	—	15	20.0	—
Topsin M	1	1.5	—	136	—	1.00
Total Acres			**126**	**4092**		

Appendix B. Survey summary of pesticides used on onions in Nebraska — 1992.

Herbicides	No. of Growers Using Pesticide	% of Total Acreage Treated	Acres Treated		Average Application Rate	
			Self Applied	Custom Applied	Dry (lbs/A)	Liquid (qt/A)
Dacthal W-75	1	32	13	—	12.0	—
Goal	2	168[a]	69	—	—	0.32
Poast	2	100	41	—	—	0.67
Prowl	1	68	28	—	—	2.00
Total Acres			**151**			
Insecticides						
Ambush	2	100	41	—	—	0.53
Penncap-M	1	68	28	—	—	0.75
Total Acres			**69**			
Fungicides						
Bravo	2	100	41	—	—	1.00
Dithane	1	32	13	—	—	2.40
Rovral	1	68	28	—	2.0	—
Total Acres			**82**			

[a] Exceeds 100 because of multiple treatments.

Appendix C. Survey summary of pesticides used on potatoes in Nebraska — 1992.

Herbicides	*No. of Growers Using Pesticide*	*% of Total Acreage Treated*	*Acres Treated*		*Average Application Rate*	
			Self Applied	*Custom Applied*	*Dry (lbs/A)*	*Liquid (qt/A)*
Diquat	1	23.6	1500	—	—	0.50
Dual	2	12.0	600	195	—	0.88
Eptam	4	9.7	640	—	—	1.57
Gramoxone	1	14.7	—	976	—	1.00
Lorox	1	2.9	—	195	—	0.50
Poast	1	2.9	195	—	—	0.50
Prowl	2	8.5	560	—	—	0.75
Roundup	1	8.3	550	—	—	1.00
Sencor	3	11.2	745	—	—	0.38
Sencor/Dual	1	14.7	976	—	—	0.75/1.00
Treflan	1	0.2	—	10	—	0.50
Turbo	5	59.4	3935	—	—	0.94
Total Acres			**9701**	**1376**		
Insecticides						
Ambush	2	23.9	—	1585	—	0.20
Asana XL	3	5.6	362	8	—	0.18
Di-Syston 15G	1	0.8	53	—	14.0	—
Monitor	2	21.4	—	1420	—	0.88
Pounce	2	30.9	195	1850	—	0.16
Sevin	1	0.03	2	—	—	1.50
Thimet 20G	6	98.8	6546	—	12.8	—
Thiodan	3	47.2	—	3125	—	1.00
Total Acres			**7158**	**7988**		
Fungicides						
Bravo	1	5.4	360	—	—	0.75
Maneb	1	16.6	—	1100	2.00	—
Manzate	1	18.5	—	1225	—	1.00
Micro F	1	0.2	16	—	—	0
Ridomil 2E	1	18.5	—	1225	—	0.38
Ridomil MZ 58	2	24.0	—	1588	1.75	1.00
Ridomil/Bravo 8/W	1	0.1	—	8	2.00	—
Tops	2	17.0	1126	—	17.50	—
Total Acres			**1502**	**5146**		

Appendix D. Survey summary of pesticides used on proso millet in Nebraska — 1992.

Herbicides	*No. of Growers Using Pesticide*	*$ of Total Acreage Treated*	*Acres Treated*		*Average Application Rate*	
			Self Applied	*Custom Applied*	*Dry (lbs/A)*	*Liquid (qt/A)*
Aatrex 90/Cyclone	1	11.2	881	—	1.4	0.63
Aatrex 90/Roundup	1	2.6	200	—	0.5	0.38
Atrazine	2	13.6	—	1070	—	0.75
Atrazine/Cyclone	1	0.7	—	52	—	1.00/0.75
Banvel	1	1.3	100	—	—	0.25
2,4-D Amine	4	8.0	—	629	—	0.44
2,4-D Amine/Banvel	6	10.4	703	110	—	0.32/0.17
2,4-D Ester	1	2.7	210	—	—	0.25
Total Acres			**2094**	**1861**		

Appendix E. Survey summary of pesticides used on sugarbeets in Nebraska — 1992.

Herbicides	*No. of Growers Using Pesticide*	*% of Total Acreage Treated*	*Acres Treated*		*Average Application Rate*	
			Self Applied	*Custom Applied*	*Dry (lbs/A)*	*Liquid (qt/A)*
Antor	1	3.9	440	—	—	0.33
Betamix	34	43.4	4,884	—	—	0.39
Betamix/Stinger	5	11.4	1,277	—	—	0.37/0.07
Eptam 7E	1	0.4	50	—	—	1.50
Eptam 10G	2	3.3	370	—	8.5	—
Eptam/Treflan	1	1.3	144	—	—	1.00/0.50
Nortron	4	6.8	765	—	—	2.20
Nortron (banded)	21	43.3	4,874	—	—	1.28
Nortron/Antor	8	8.3	937	—	—	1.19/0.45
Poast	2	0.3	37	—	—	0.75
Poast (banded)	9	8.6	963	—	—	0.20
Poast/Stinger	1	4.3	485	—	—	0.20/0.05
Ro-Neet	23	26.5	2,978	246	—	1.17
Ro-Neet (banded)	2	0.8	85	—	—	0.28
Ro-Neet/Antor	2	1.6	175	—	—	0.58/0.69
Roundup	2	1.4	161	—	—	0.50
Stinger	6	5.5	615	—	—	0.058
Treflan	4	6.1	683	—	—	0.41
Total Acres			**19,923**	**246**		
Insecticides						
Counter 15G	4	9.8	1099	—	7.0	—
Counter 20 CR	2	3.3	372	—	6.0	—
Furadan 15G	18	22.6	2547	—	6.4	—
Lorsban 15G	5	5.1	577	—	9.1	—
Lorsban 4E	2	4.4	10	485	—	1.0
Temik 15G	11	14.9	1671	—	8.0	—
Total Acres			**6276**	**485**		
Fungicides						
Sulfur	2	2.7	—	299	4.0	—
Benlate	1	0.9	—	100	0.5	—
Total Acres				**399**		
Nematicides						
Telone II	26	23.1	1317	1285	—	47.6
Temik 15G	4	1.8	204	—	23.2	
Total Acres			**1521**	**1285**		

Appendix F. Survey summary of pesticides used on sunflowers in Nebraska — 1992.

Herbicides	No. of Growers Using Pesticide	% of Total Acreage Treated	Acres Treated: Self Applied: Oil	Acres Treated: Self Applied: Conf.	Acres Treated: Custom Applied: Oil	Acres Treated: Custom Applied: Conf.	Average Application Rate: Dry (lbs/A)	Average Application Rate: Liquid (qt/A)
Lasso	1	1.3	80	—	—	—	—	1.00
Prowl	13	47.5	1308	165	699	830	—	1.00
Roundup	1	1.3	80	—	—	—	—	0.31
Treflan	6	21.4	1020	—	332	—	—	0.65
Tri-4	2	2.7	—	70	100	—	—	0.63
		Total Acres	**2488**	**235**	**1131**	**830**		
Insecticides								
Asana XL	3	11.1	—	—	—	700	—	0.22

Appendix G

University of Nebraska Lincoln
Institute of Agriculture and Natural Resources

Panhandle Research
& Extension Center
4502 Avenue I
Scottsbluff, NE 69361-4939
Phone: (308) 632-1230
Fax: (308) 632-1365

SURVEY OF DRY BEAN PESTICIDE USE IN 1992

Dear Dry bean grower,

The University of Nebraska Institute of Agriculture and Natural Resources, under funding from USDA - NAPIAP (National Agriculture Pesticide Impact Assessment Program), is conducting a survey to determine the types and amounts of pesticides which are currently used in the production of dry beans in the state of Nebraska. The purposes of this survey are two fold:

(1) To gather current information that can be used to assess the impact of possible pesticide cancellations/restrictions on Nebraska agriculture and its economy. The information gathered from this survey is needed to accurately reflect the use of pesticides in Nebraska. Survey data will be used by USDA and EPA when reviewing pesticide usage and in developing regulatory policies. This review affects everyone!

(2) To identify trends in pest control which, in turn, will be used to direct research efforts by University of Nebraska specialists.

You have been randomly selected to contribute to a representative sample of the states dry bean growers. Your input is essential if accurate and reliable use data is to be obtained.

All information that you provide will be strictly confidential, and will only be used in determining survey summaries.

Please return your completed questionnaire in the enclosed pre-addressed, postage-paid envelope by **March 25, 1993**. Your prompt reply will assist us in accurately processing this important information. Should you have any questions or need more information, please do not hesitate to contact Dr. Gary Hein at (308) 632 - 1230. Thank you for your cooperation.

Sincerely,

Gary L. Hein

Dr. Gary L. Hein,
Entomologist,
University of Nebraska,
Panhandle Research and Extension Center

If the individual, farm, corporation, partnership, etc. addressed on the survey label did not grow dry beans or did not perform the day to day farm operations in 1992, please return this survey un-marked in the enclosed self addressed envelope.

University of Nebraska–Lincoln University of Nebraska Medical Center University of Nebraska at Omaha University of Nebraska at Kearney

Part I: Pest Management

1. List the total acres on which you produced dry beans in 1992 (including land rented from others). 1._____.

2. Of the total acres listed in #1, list the number of acres receiving one or more pesticide applications (including herbicide, insecticide, fungicide, and rodenticide/avicide applications). 2._____.

For each of the following questions circle the appropriate response.

3. Describe your pesticide use in 1992:
   a. more than previous years b. less than previous years c. about the same as previous years

4. If you answered less or more for question 3, please estimate the percent of increase or decrease for herbicides, insecticides, and nematicides/fungicides in the table below.

HERBICIDE (+ or - %)	INSECTICIDE (+ or - %)	NEMATICIDE/FUNGICIDE (+ or - %)

5. If you used less pesticides in 1992, indicate any of the contributing factors (circle all that apply).
   a. fewer pests b. better application techniques c. better scouting for timely application
   d. use of different chemical with lower application rates e. not economically feasible
   f. use of alternative control practices g. favorable application/weather conditions

6. Were any agricultural consulting or scouting services used for pest management in 1992? 6. **yes** **no**

If you answered no to question 6 skip questions 7-12 and proceed to question 13.

7. List the number of acres scouted for each type of pest (weeds, insects, disease) in the appropriate spaces below:
   WEEDS:_____ INSECTS:_____ DISEASE:_____

8. Did consultants regularly scout your fields for pests (i.e. on a scheduled basis)? 8. **yes** **no**

9. Did consultants scout your fields on a limited basis? 9. **yes** **no**

10. If you used consultants in any other manner, please describe their use_____
    _____.

11. For the fields scouted, please list the consulting costs (per acre). 11. $_____/acre.

12. List all services included in this cost (refer to question 11):_____
    _____

13. Did you scout your own fields for pests?
    a. regularly. b. occasionally. c. only checked when problems became obvious. d. never checked.

Special Instructions For Pesticide Use Tables (See pg. 4 - 8):

The questions contained in the tables on pages 4-8 refer to pesticides used in your dry bean farming operation. If you used pesticides in 1992 please report for the farm(s) you operate (include land rented from others, exclude land rented out to others).

(1) Use a different line for each pesticide application and fill in the required information for each table column (**SEE EXAMPLES**).

(2) If two or more chemicals were combined during one application, list one chemical per line and record the quantity of each chemical used. Use brackets [ ] around chemical combinations to identify the specific combinations (**SEE EXAMPLES**).

(3) If "Band" is circled for **METHOD OF APPLICATION**, please give the band width used (**SEE EXAMPLES**).

(4) Tables listing the trade names of commonly used dry bean pesticides, and typical dry bean pesticide treatments are provided below. These tables are provided to facilitate your completion of this questionnaire and are not recommendations of specific treatments nor endorsements of any pesticide brand or product. If you used a product, or product combination, indicate the product and formulation (i.e. Diazinon 50 % wettable powder is Diazinon 50WP). If you used a product not found below, indicate both the product and formulation.

COMMONLY USED HERBICIDE TREATMENTS		
PREPLANT INCORPORATED (PPI) or PREEMERGENCE (PRE)	POSTEMERGENCE	HARVEST AID
EPTAM 10G or 7E CANNON LASSO DUAL 8E PARTNER PROWL ROUNDUP SONALAN--10G or 3E.C. TRI-4 4E.C., TREFLAN 4E.C., TR-10, M.T.F., 5, or 80 D.C. EPTAM 7E + SONLAN or PROWL EPTAM 7E + DUAL 8E or LASSO EPTAM 7E + TRI-4 4EC EPTAM 7E + TREFLAN -- 4E.C, M.T.F., 5, or 80D.C. SONALAN + DUAL 8E or LASSO TREFLAN 4EC + DUAL 8E or LASSO CANNON + LASSO	BASAGRAN POAST PURSUIT	GRAMOXONE - EXTRA

COMMONLY USED INSECTICIDES	
PREPLANT OR AT PLANTING	POSTEMERGENCE
DI-SYSTON 8EC, or 15G THIMET 15G or 20G TEMIK 15G DYFONATE 4EC DYFONATE II 10G	ASANA XL 0.66EC BIOBIT 1.6FC, or 3.2WP CYGON 400 CYTHION/MALATHION 9.33 ULV, or 57 EC DIBROM 8EC DIPEL ES, 2X, or 4L DI-SYSTON 8EC, or 15G JAVELIN WG KOOLSPRAY LANNATE L, or LV PENNCAP-M PYDRIN 2.4EC ORTHENE 75S SEVIN XLR Plus, 80S, 50W, or 4F TEMIK 15G THIODAN 2C.O. EC, 3EC, or 50 WP MITICIDES -- COMITE, CYGON 400, KELTHANE, TEMIK 15G, AND SULFUR (SIGNAL, OR SPECIAL ELECTRIC)

COMMONLY USED FUNGICIDE/NEAMTICIDE TREATMENTS		
SEED TREATMENTS	PRE PLANT OR AT PLANTING	POSTEMERGENCE
COMMERCIAL CAPTAN 30-DD,300,400,or 400-D RIVAL RTU - VITAVAX-THIRAM THIRAM 30, 42-S, 50WP DYED SELF APPLIED VITAVAX POUR ON YIELD SHIELD	TELONE II or TELONE C-17 TEMIK 15G VAPAM VORLEX TERRACLOR 2EC, 10%G, or 75%WP	THIOLUX(FLOWABLE SULFUR) MICROTHIL SPECIAL(WETTABLE SULFUR) DUSTING SULFURS -- SIGNAL, SPECIAL ELECTRIC, or MAGNETIC 6 BENLATE 50WP BRAVO 500, or 720 BRAVO 90DG TOPSIN M - 70WP, 4.5F, or 85WDG

Part II: Dry Bean Herbicide Use In 1992

For each 1992 dry bean herbicide application, please provide the information requested in this table.

NAME OF HERBICIDE List herbicide applications. For help refer to the list on pg. 3. LIST PRODUCT AND FORMULATION!	QUANTITY OF UNDILUTED PRODUCT USED PER ACRE FOR EACH APPLICATION SPECIFY AMOUNT/ACRE! Dry (lbs./acre, ozs./acre)	Liquid (gal./acre, qts./acre, pts./acre, fl. ozs./acre)	Other (Specify units/acre)	ACRES	APPLICATION METHOD 1. Broadcast - surface 2. Broadcast - incorporate 3. Band 4. Aerial 5. Via irrigation 6. Spot Application 7. Pipe wick 8. Other (list) Self Applied Circle One	Custom Applied Circle One	BAND WIDTH Inches	ROW SPACING Inches
EXAMPLE Eptam 7E+		2.25 pt./A		80	1 (2) 3 4 5 6 7 8	1 2 3 4 5 6 7 8		22"
Treflan 4EC		1 pt./A			1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8		
EXAMPLE Poast		1.5 pt./A		80	(1) 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8		22"
					1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8		
					1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8		
					1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8		
					1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8		
					1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8		

Part III: Dry Bean Insecticide Use In 1992

For each 1992 dry bean insecticide application, please provide the information requested in this table.

NAME OF INSECTICIDE List insecticide applications. For help refer to the list on pg. 3. LIST PRODUCT AND FORMULATION!	QUANTITY OF UNDILUTED PRODUCT USED PER ACRE FOR EACH APPLICATION SPECIFY AMOUNT/ACRE! Dry (lbs./acre, ozs./acre)	Liquid (gal./acre, qts./acre, pts./acre, fl. ozs./acre)	Other e.g. planter box (Specify units/acre)	ACRES	APPLICATION METHOD 1. Broadcast ground rig 2. Broadcast aerial 3. Band 4. Via irrigation 5. In seed furrow 6. Spot application 7. Other (list) Self Applied Circle One	Custom Applied Circle One	BAND WIDTH Inches	ROW SPACING Inches
EXAMPLE Asana XL 0.66 EC		5.8 fl oz/A		80	1 2 3 4 5 6 7	1 (2) 3 4 5 6 7		22"
					1 2 3 4 5 6 7	1 2 3 4 5 6 7		
					1 2 3 4 5 6 7	1 2 3 4 5 6 7		
					1 2 3 4 5 6 7	1 2 3 4 5 6 7		
					1 2 3 4 5 6 7	1 2 3 4 5 6 7		
					1 2 3 4 5 6 7	1 2 3 4 5 6 7		
					1 2 3 4 5 6 7	1 2 3 4 5 6 7		

Part II: Dry Bean Herbicide Use In 1992 (Cont.)

For each herbicide application, circle the appropriate responses below.

WHEN APPLIED 1. Preplant 2. At planting 3. Preemergence Postemergence - 4. Early (at cultivation) 5. Late season Circle One	WEEDS TO BE CONTROLLED 1. Cocklebur 2. Foxtail 3. Kochia 4. Lambsquarters 5. Nightshade 6. Pigweed 7. Sandbur 8. Sunflower 9. Other (list) Circle All That Apply	CONTROL RATING 1. Excellent 2. Good 3. Fair 4. Poor Circle One	TILLAGE SYSTEM 1. Plowing + seed bed preparation 2. Rotary tiller 3. Three or more operations with plow, disc, or field cultivator 4. Two passes with plow, disc, or field cultivator 5. One pass with disc or field cultivator 6. No till 7. Other (list) Circle One	CULTIVATIONS 1. Once 2. Twice 3. Three times 4. Rotary hoe Note: Do not count ditching for furrow irrigation Circle All Used
1 2 3 4 5	1 2 3 4 5 6 7 8 9 Barnyard grass	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9	1 2 3 4	1 2 3 4 5 6. 7	1 2 3 4

Part III: Dry Bean Insecticide Use In 1992 (Cont.)

For each insecticide application, circle the appropriate responses below.

WHEN APPLIED 1. Seed treatment 2. Preplant 3. At planting Postemergence - 4. Early (at cultivation) 5. Late season Circle One	INSECTS TO BE CONTROLLED 1. Mexican bean beetle 2. Western bean cutworm 3. Thrips 4. Leafhoppers 5. Grasshoppers 6. Seedcorn maggot 7. Cutworms 8. Flea beetle 9. Aphids 10. Mites 11. Other (list) Circle All That Apply	CONTROL RATING 1. Excellent 2. Good 3. Fair 4. Poor Circle One	TILLAGE SYSTEM 1. Plowing + seed bed preparation 2. Rotary tiller 3. Three or more operations with plow, disc, or field cultivator 4. Two passes with plow, disc, or field cultivator 5. One pass with disc or field cultivator, 6. No till, 7. Other (list) Circle One	CULTIVATIONS 1. Once 2. Twice 3. Three times 4. Rotary hoe Note: Do not count ditching for furrow irrigation Circle All Used
1 2 3 4 5	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4

Part IV: Dry Bean Fungicide/Nematicide Use In 1992

For each 1992 dry bean fungicide/nematicide application, please provide the information requested in this table.

NAME OF FUNGICIDE/NEMATICIDE List fungicide/nematicide applications. For help refer to the list on pg. 3. LIST PRODUCT AND FORMULATION!	QUANTITY OF UNDILUTED PRODUCT USED PER ACRE FOR EACH APPLICATION SPECIFY AMOUNT/ACRE!			ACRES	APPLICATION METHOD 1. Seed treatment 2. In seed furrow 3. Broadcast ground rig 4. Broadcast aerial 5. Band 6. Aerial 7. Via irrigation 8. Spot application 9. Other (list)		BAND WIDTH	ROW SPACING
	Dry (lbs./acre, ozs./acre)	Liquid (gal./acre, qts./acre, pts./acre, fl. ozs./acre)	Other (Specify units/acre)		Self Applied Circle One	Custom Applied Circle One	Inches	Inches
EXAMPLE Rival	Seeding rate = 60 lb/A			80	12345678	(1)23456789		22"
EXAMPLE TOPSIN-M 70WP	1½ lb/A			80	12345678	123(4)56789		22"
					12345678	123456789		
					12345678	123456789		
					12345678	123456789		
					12345678	123456789		

Part V: Pesticide Safety

1. Before handling, mixing, or applying pesticides, do you read the pesticide label?
   a. always b. sometimes c. never

2. When handling, mixing, and applying pesticides, do you use protective equipment as specified on the label?
   a. always b. sometimes c. never

3. When handling, mixing, or applying pesticides, do you use any protective equipment not specified on the label?
   a. always b. sometimes c. never

4. a. Underline all the protective equipment you wear when handling and mixing pesticides.
   b. **Circle** all the protective equipment you wear when applying pesticides.
   a. rubber or plastic apron b. rubber or neoprene gloves c. goggles/face shield d. hard hat
   e. respirator f. rubber or neoprene boots g. cotton coveralls h. ball cap
   i. long sleeve shirt and long legged pants

5. What practices do you use when storing pesticides?
   a. stored with non-pesticide materials b. locked up in a separate "pesticide only" location
   c. stored only in original containers d. other (please specify)_____

6. How do you dispose of empty pesticide containers?
   a. buried b. hauled to a landfill c. returned to a dealer d. burned e. reused on farm
   f. recycled g. stored on farm h. other (please specify)_____

7. Over the last five years have you had any ill health effects which you feel were the result of pesticide contact? 7. **yes no**

Part IV: Dry Bean Fungicide/Nematicide use in 1992 (Cont.)

For each fungicide/nematicide application, circle the appropriate responses below.

WHEN APPLIED 1. Seed treatment 2. Preplant 3. At planting 4. Early cultivation 5. Postemergence 6. Late season Circle One	DISEASES TO BE CONTROLLED Rhizoctonia - 1. Root rot, 2. Stem rot 3. Gray mold 4. White mold 5. Powdery mildew 6. Bacterial blights 7. Rust 8. Other (list) Circle All That Apply	CONTROL RATING 1. Excellent 2. Good 3. Fair 4. Poor Circle One	TILLAGE SYSTEM 1. Plowing + seed bed preparation 2. Rotary tiller, 3. Three or more operations with plow, disc, or field cultivator 4. Two passes with plow, disc, or field cultivator 5. One pass with disc or field cultivator, 6. No Till, 7. Other (list) Circle One	CULTIVATIONS 1. Once 2. Twice 3. Three times 4. Rotary hoe Note: Do not count ditching for furrow irrigation Circle All Used
1 2 3 4 5 6	1 2 3 4 5 6 7 8	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5 6	1 2 3 4 5 6 7 8	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5 6	1 2 3 4 5 6 7 8	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5 6	1 2 3 4 5 6 7 8	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5 6	1 2 3 4 5 6 7 8	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4
1 2 3 4 5 6	1 2 3 4 5 6 7 8	1 2 3 4	1 2 3 4 5 6 7	1 2 3 4

Part V: Pesticide Safety (Cont.)

8. Are you or any person(s) who are involved in your farm operation a certified pesticide applicator? 8. **yes no**

9. How often do you calibrate your pesticide application equipment?
   a. once each season b. regularly during each season c. before first application
   d. before each application e. non - seasonally f. never

Part VI: Vertebrate Pest Control In Dry Bean Fields In 1992

10. Did you have a problem with **BIRDS** (common examples of pests include pigeons, starlings, sparrows, etc.) in 1992? 10. **yes no**

11. Did you have a problem with **RODENTS** (common examples of pests include gophers, mice, prairie dogs, etc.) in 1992? 11. **yes no**

If non - chemical methods or pesticides were not used to control vertebrate pests in your dry bean fields, proceed to Part VII.

If you used a non - chemical method to control **BIRDS** or **RODENTS**, please place a "B" for bird control and/or a "R" for rodent control in the appropriate spaces below:

__a. Netting
__b. Trapping
__c. Removing shelters/nests
__d. Food removal (sanitation)
__e. Frightening devices
__f. Shooting
__g. Wire prongs or porcupine wires
__h. Electronic sonic or vibrational devices
__i. Excluding from structures (feeders, perches,etc.)
__j. Tactile repellents
__k. Other (specify) _____

Part VI: Vertebrate Pest Control (Cont.)

If avicides/repellents or rodenticides were used to control **BIRDS** or **RODENTS**, please complete the table below:

NAME OF BIRD OR RODENT TO BE CONTROLLED (list each separately)	NAME OF PESTICIDE USED	AMOUNT USED (specify units i.e., gals., pts., lbs., etc.)	EFFECTIVENESS 1. none, 2. little, 3. some what, 4. very, 5. extremely
			1 2 3 4 5
			1 2 3 4 5
			1 2 3 4 5

COMMON RODENTICIDES

WARFARIN (.025%)– d-CON (CONCENTRATE, MOUSE PRUF, or READY-MIXED) PROLINE HAVOC, or TALON-G MAKI, or CONTRAC ROZOI RAMIK, or BAIT BLOCKS PIVAL, or PIVALYN PITCH PACK TAG M PURINA: PLACE PACK, RAT CONTROL PELLETS, or RAT KILL SOLUBLE STRYCHNINE 0.35% or 0.50% FUMITOXIN GAS CARTRIDGES PHOSTOXIN ROTOX (DELTIA) 2% ZINC PHOSPHIDE, ZINC PHOSPHIDE CONCENTRATE, or ZP ASSUALT or TROUNCE QUINTOX or RAMPAGE

COMMON AVICIDES/REPELLENTS

AVITROL: CORN CHOPS-99, DOUBLE STRENGTH, MIXED GRAIN, or PELLETIZED FEED ENDRIN RID-A-BIRD PERCH SOLUTION ENTHION RID-A-BIRD PERCH SOLUTION MESUROL PIGEON-9 ROOST NO MORE SPARROW-CRACKS STARLICIDE COMPLETE

Part VII: Alternate Pest Reduction Methods In 1992

Indicate which cultural practices or non-chemical tactics you used to avoid weed, insect, or disease problems. Indicate the number of acres involved, and the weeds, insects, or diseases controlled. Estimate any loss or gain in yield. (**SEE EXAMPLES**: A three year crop rotation helps to control bacterial blights. Sanitation methods which help control bacterial blights include; using certified blight free seed, avoid moving through fields with wet bean plants, and avoid putting old bean straw back into the next years bean fields.)

CONTROL METHOD	WEED CONTROL			INSECT CONTROL			DISEASE CONTROL		
CONTROL METHOD	ACRES	WEEDS TARGETED (List)	ESTIMATED % YIELD GAIN OR LOSS	ACRES	INSECTS TARGETED (List)	ESTIMATED % YIELD GAIN OR LOSS	ACRES	DISEASES TARGETED (List)	ESTIMATED % YIELD GAIN OR LOSS
EXAMPLE Crop rotation 3-year rotation							80	Bacterial Blight	10%
EXAMPLE Sanitation cert. seed straw man.							80	Bacterial Blight	5%
Crop rotation									
Variety selection									
Adjust planting date									
Tillage practice									
Row spacing									
Crop residue removal									
Natural enemies (pathogens, parasites, predatory insects, etc.)									
Trap cropping									
Sanitation									
Other (list)									
Other (list)									