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EC04-1571 Pesticide Use on Specialty Crops in Nebraska - 1999

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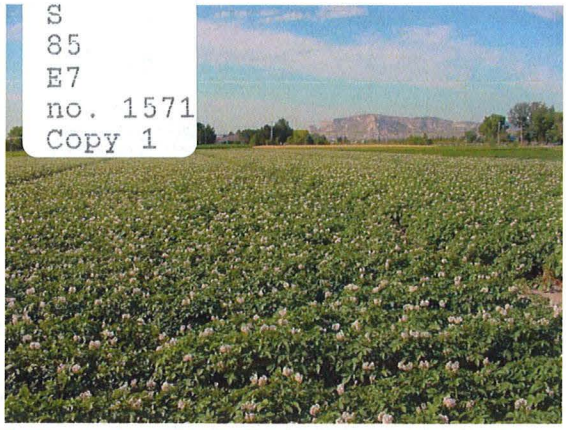

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Pesticide Use on Specialty Crops in Nebraska — 1999[1]

John A. Thomas[2], Gary L. Hein[2], Alexander D. Pavlista[2], Shripat T. Kamble[3]

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 quantities of pesticide are used on the 19.4 million acres of cropland in the state (Nebraska Agri-Facts, 2000). Nebraska's primary agricultural commodities are livestock, corn, wheat, soybeans, grain sorghum and alfalfa. In addition to these, specialty crops also are grown in the state, but these are not concentrated in the areas where most of the corn, soybeans and sorghum are grown. Specialty crops are grown somewhat regionally by a limited number of growers.

Dry beans are grown primarily in the Panhandle and southwest Nebraska. Because processing facilities are in the Panhandle and northeast Colorado, sugarbeets are grown only in the Panhandle and the immediate proximity. Potatoes are grown throughout the state, but acreages are concentrated near several production areas. Sunflowers are grown throughout the state, but larger acreages are located in the western part of the state, close to stable markets (processing facilities) in western Kansas and western Nebraska.

Because of the regionalization of these crops, the limited number of acres 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 these crops. The regionalization of specialty crops and the high value of some of them make these crops very 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). In 1992 a survey of pesticide use on dry beans, onions, potatoes, proso millet, sugarbeets and sunflowers was done by Hein et al. (1994). The 1999 survey was conducted to assess pesticide use patterns and related information on dry beans, potatoes, sugarbeets, and sunflowers.

Materials and Methods

Project Cooperators

This pesticide use survey was a cooperative effort of the University of Nebraska, drawing information from a number of specialists and departments, including Entomology, Agronomy and Horticulture, Agricultural Economics, and Plant Pathology. The USDA Nebraska Agricultural Statistics Service assisted by mailing surveys to selected dry bean and sunflower growers. Western Sugar Company and Holly Sugar Corporation assisted by mailing surveys to selected sugarbeet growers.

Survey Questionnaire (Instrument)

Because many growers raise only one of the specialty crops being surveyed, and the different crops are unique in management practices, a separate survey questionnaire was designed for each crop. Questionnaires included information on total acreage, pesticide use patterns, pest management practices, pesticide use practices, target pests, consulting, scouting, and alternative pest management methods. An example of the questionnaire is shown in *Appendix E.*

Sample Size and Mailing

In cooperation with the USDA Nebraska Agricultural Statistics Service, a stratified random sample of dry bean growers based on production acreage was 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 stratum (342 total). Surveys were sent to 50 percent of the sunflower growers in each stratum with a total mailing of 272. The mailing lists for dry bean and sunflower growers were confidential so the Agricultural Statistics Service did the mailing. Sugarbeet surveys were sent to 66 percent (242 total) of the Holly Sugar Corporation and Western Sugar Company

[1]This study was funded in part by the North Central Region Pest Management Center, Michigan State University, East Lansing, MI, 48824. Project No. NC669-S.
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Table 1. Grower population size and response to the survey: *Pesticide Use on Specialty Crops in Nebraska, 1999.*

Crop	*Population size (approximate)*	*Surveys mailed*	*Number of surveys returned*	*Number of usable surveys*[1]
Dry Bean	977	342	66	52
Potato	16	16	14	14
Sugarbeet	367	242	48	45
Sunflower	544	272	84	42

[1]Some returned surveys were not usable because the grower no longer raised the crop or the landowner did not have the pesticide use information.

growers who produce sugarbeets in Nebraska. Surveys were sent to all significantly sized (50 acres plus) potato growers in the state (16 total).

Surveys were mailed in March and April 2000. Ten to 14 days after the mailing of all surveys, a followup postcard was sent reminding the recipients to complete and return the questionnaire. *Table 1* shows the grower population size and response to the survey.

Data Processing and Reporting

Responses were tallied and averages determined for all pesticides and crops. Expansion factors were determined to provide estimates of total state usage for all pesticides reported from the surveys. From the surveys, percent surveyed acreage treated with a given pesticide was obtained. The total estimated treated acreage for a given pesticide was calculated by multiplying the total state crop acreage (*Table 2*) by the percentage of surveyed acres treated (*Appendices A-D*). The total pounds of each pesticide used in Nebraska was estimated by multiplying the average rate for a pesticide (lbs of active ingredient per acre; *Appendices A-D*) from the survey sample by the total estimated treated acres of the crop in the state.

Results

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 15 percent in dry beans and sunflowers to 88 percent in potatoes. Of all returned surveys combined, 72 percent were usable. Surveys were unusable primarily because the grower did not raise the crop in 1999. Unusable survey responses were higher for sunflowers and dry beans because growers move in and out of these crops and mailing lists are difficult to maintain.

The acreage surveyed in comparison to the total state acreage ranged from 6 percent in dry beans to 81 percent in potatoes (*Table 2*). The survey represents 14 percent of the acreage in these specialty crops in

Table 2. Specialty crop acreage surveyed in Nebraska that was treated with pesticides during 1999.

				Surveyed acres treated					
				Herbicides		*Insecticides*		*Fungicides/nematicides*	
Crops	*Estimated statewide acreage*	*Total acreage surveyed*	*Surveyed acreage treated (%)*	*Treated acres*	*% of total acres*	*Treated acres*	*% of total acres*	*Treated acres*	*% of total acres*
Dry Bean	187,000	11,503	11,354 (99%)	11,304	98%	1,432	12%	1,139	10%
Potato	26,000	21,020	21,020 (100%)	21,020	100%	21,020	100%	21,020	100%
Sugarbeet	66,200	10,417	10,417 (100%)	10,417	100%	6,933	67%	3,009	29%
Sunflower (Total)	97,000	11,030	10,235 (93%)	10,067	91%	4,026	36%	241	2%
Sunflower (Oil)	47,000	5,742	5,491 (96%)	5,323	93%	2,150	37%	241	4%
Sunflower (Confect.)	50,000	5,288	4,744 (90%)	4,744	90%	1,876	35%	0	0%

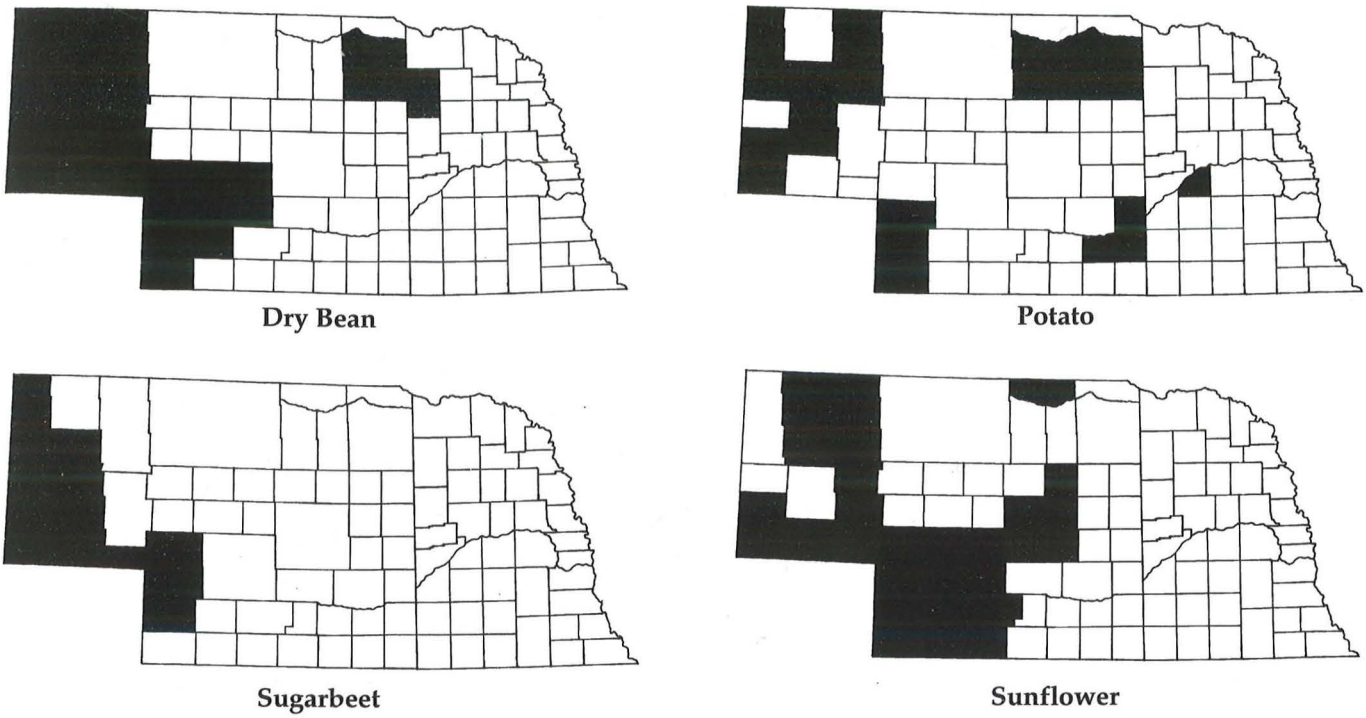

Figure 1. Counties where specialty crops are grown in Nebraska, 1999.

Nebraska. Surveys were randomly sent to growers of the specific crop throughout the state. Since mailing lists were confidential, it is not known where the responses came from. *Figure 1* shows the counties where the different specialty crops are grown in Nebraska.

Total Acres Treated With Pesticides

Table 2 shows the total acreage surveyed in each crop and the percentage of the surveyed acreage that was treated with pesticides. On average, more than 95 percent of all four crops surveyed were treated with some kind of pesticide. Potatoes are the most chemical intensive crop with 100 percent of the surveyed acreage receiving herbicide, insecticide, and fungicide treatments. Herbicides are most extensively used over all 4 crops with an average of 98 percent of total surveyed acres being treated.

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. *Tables 4, 5,* and *6* give an estimate of the pounds of active ingredients (AI) for herbicides, insecticides, and fungicides/nematicides, respectively, used on specialty crops in Nebraska during 1999. These tables are based on the data in *Appendices A-D* which contain the areas treated, percentage of total acreage, and average use rates for the various pesticide formulations.

Pesticide Use in Dry Bean

Nearly all the dry bean acres surveyed were treated with herbicide (98 percent). An estimated 461,440 pounds of herbicide (AI) were applied to dry bean acres in Nebraska in 1999. Over half of the total was EPTC at 243,616 lbs (AI), and nearly a fourth of the total was ethalfluralin at 111,893 lbs (AI). Only 12 percent of dry bean acres were treated with insecticides using 6,428 total lbs (AI). The majority of insecticide applied was phorate (5,012 lbs AI), but esfenvalerate was applied to about five times greater acreage at a much lower rate. A small proportion of dry bean growers (10 percent) treated with fungicides totaling 10,257 lbs (AI), of which copper products were mostly used, totaling 9,397 lbs (AI).

Pesticide Use in Potato

Pesticide use on potatoes was extensive with 100 percent of the acreage being treated with herbicides, insecticides, and fungicides. Multiple treatments per acre were used in all three categories of pesticides. Approximately 68,996 lbs (AI) of herbicide were used on the potato acreage in Nebraska. The most heavily used herbicide was metolachlor at 29,743 lbs (AI) followed by EPTC at 21,271 lbs (AI). The total insecticide use on potatoes for 1999 is estimated at 79,772 lbs (AI) statewide. Phorate was most extensively used at 37,346 lbs (AI) followed by methamidophos at 16,120 lbs (AI) and malathion at 11,334 lbs (AI). All potatoes received multiple treatments of fungicide with

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

Crop	Production acreage categories	Number of surveys	Weeds		Insects		Diseases	
			%	acres	%	acres	%	acres
Dry Bean	0 - 100	13	93	64	31	66	8	85
	101 - 500	34	97	220	6	103	12	264
	501 +	5	100	657	20	925	0	0
Potato	0 - 100	0	0	0	0	0	0	0
	101 - 500	4	100	353	100	353	100	353
	501 +	10	100	1,961	100	1,961	100	1,961
Sunflower Oil	0 - 100	7	57	82	29	83	0	0
	101 - 500	16	88	273	25	346	6	241
	501 +	2	100	584	50	600	0	0
Sunflower Confection	0 - 100	5	100	60	60	54	0	0
	101 - 500	16	75	226	38	286	0	0
	501 +	2	50	750	0	0	0	0
Sugarbeet	0 - 100	12	100	56	58	38	58	53
	101 - 500	28	100	220	75	240	43	168
	501 +	5	100	720	40	815	20	630

Table 4. Herbicides applied to specialty crops in Nebraska, 1999.

Herbicide	Dry bean	Potato	Sugarbeet	Sunflower
	Pounds of active Iigredient applied			
alachlor				
Lasso	11,056			
Partner	17,941			
bentozon				
Basagran	10,729			
clethodim				
Select			276	
clopyralid				
Stinger			1,356	
cycloate				
Ro-neet			20,959	
desmedipham				
Betamix			3,429	
Progress			480	
dimethenamide				
Frontier 6.0	16,383			
diquat				
Diquat		1,024		

Continued on page 5

Herbicide	*Dry bean*	*Potato*	*Sugarbeet*	*Sunflower*
	Pounds of active ingredient applied			
EPTC				
Eptam 7E	222,223	21,271	13,757	
Eptam 20G	21,393			
ethalfluralin				
Sonolan 10G				4,268
Sonolan HFP	111,893			6,875
ethofumesate				
Nortron SC			18,968	
Progress			480	
glyphosate				
Roundup	2,665	494	786	3,044
imazethapyr				
Pursuit DG	1,461			
linuron				
Linex		1,235		
Lorox		1,560		
metolachlor				
Dual II Mag	39,021	28,679		
Turbo		1,064		
metribuzin				
Lexone		1,024		
Sencor		5,774		
Turbo		236		
paraquat				
Gramoxone	351			
pendimethalin				
Prowl	6,219	2,968		51,616
phenmedipham				
Betamix			3,429	
Progress			480	
quizalofop				
Assure II			94	
rimsulfuron				
Matrix		312		
sethoxydim				
Poast	105	2,555	707	486
sulfentrazone				
Spartan (Section 18)				1,272
trifluralin				
Treflan		800		23,371
triflusulfuron				
Upbeet			271	
TOTAL	**461,440**	**68,996**	**65,472**	**90,932**

Table 5. Insecticides applied to specialty crops in Nebraska, 1999.

Insecticide	*Dry bean*	*Potato*	*Sugarbeet*	*Sunflower*
	Pounds of active ingredient applied			
aldicarb Temik 15G			4,963	
carbaryl Sevin	982			
carbofuran Furadan		1,352		
chlorpyrifos Lorsban			637	
dimethoate Dimethoate		4,680		
disulfoton DiSyston		390		
endosulfan Thiodan		5,046		
esfenvalerate Asana	434	165	128	1,134
imidacloprid Admire Provado		1,698 512		
lambda-cyhalothrin Warrior				110
lindane Isotox			15	
malathion Malathion		11,334		
methamidophos Monitor		16,120		
methyl parathion Parathion				606
permethrin Pounce		910		
phorate Thimet 15G Thimet 20G	2,581 2,431	37,346	2,383	
spinosad SpinTor		219		
terbufos Counter 15G Counter 20CR			3,420 36,012	
Total	**6,428**	**79,772**	**47,558**	**1,850**

Table 6. Fungicides and nematicides applied to specialty crops in Nebraska, 1999.

Fungicide/Nematicide	*Dry bean*	*Potato*	*Sugarbeet*	*Sunflower*
	Pounds of active ingredient applied			
aldicarb				
Temik			2,780	
azoxystrobin				
Quadris		3,636	29	
chlorothalonil				
Bravo ZN		37,354		
Bravo WS		47,531		
Ridomil-Gold/Bravo		30,566		
copper-hydroxide				
Champ IV	2,244			
Kocide		1,149		
Nu-Cop	7,153			
cymoxanil				
Curzate		517		
mancozeb				
Dithane DF		83,353	1,658	
Dithane F-45		15,210	199	
Penncozeb			223	
maneb				
Maneb			1,092	
metalaxyl				
Ridomil-Gold/Bravo		1,868		
metiram				
Polyram		3,370		
thiophanate				
Topsin			1,390	
triphenyltin hydroxide				
Supertin		4,630	1,748	
Seed Treatments				
cymoxanil				
Curzate MZ		1,622		
fludioxonil				
Maxim		523		
Maxim/MZ		351		
mancozeb				
Curzate MZ		12,979		
Mancozeb		5,251		
Maxim MZ		6,739		
Tops MZ		356		
thiophanate				
Tops 2.5D		507		
Tops 5D		1,593		
Tops MZ		148		
trichoderma-harzianum				
T-22	860			
Total	**10,257**	**259,253**	**9,119**	**0**
Nematicide	*Dry bean*	*Potato*	*Sugarbeet*	*Sunflower*
1,3 dichloro-propene				
Telone II			502,629	
Total			**502,629**	

259,253 lbs (AI) used in Nebraska in 1999. Total usage of chlorothalonil is estimated at 115,451 lbs (AI), followed by mancozeb at 98,563 lbs (AI) statewide.

Pesticide Use in Sugarbeet

Herbicides were used on 100 percent of sugarbeet acres with many of the acres receiving more than one application. The total herbicide use for Nebraska sugarbeets in 1999 is estimated at 65,472 lbs (AI). The herbicide most often used on sugarbeets was cycloate (20,959 lbs AI), followed by ethofumesate estimated at 19,448 lbs (AI) statewide. Insecticides were applied to 67 percent of sugarbeet acres totaling 47,558 lbs (AI) in 1999. Terbufos was used most extensively for a total of 39,432 lbs (AI), followed by aldicarb with 4,963 lbs (AI). Only 29 percent of sugarbeet acres received fungicide/nematicide applications with the total being approximately 511,748 lbs (AI). Of this total, 98 percent of the chemical load was the nematicide, 1,3 dichloropropene (Telone II) with 502,629 lbs (AI) being used statewide in 1999.

Pesticide Use in Sunflower

Herbicides (90,932 lbs AI) were used on 91 percent of Nebraska sunflower acres in 1999. The most heavily used herbicide was pendimethalin (51,616 lbs AI), followed by trifluralin (23,371 lbs AI). Approximately 36 percent of sunflower acres were treated with insecticides in 1999 totaling 1,850 lbs (AI). The most commonly used insecticide was esfenvalerate (1,134 lbs AI). No significant use of fungicides was reported on sunflowers in 1999.

Pesticide Application Methods

A breakdown of methods and timings of pesticide applications is given in *Table 7*. Most herbicide applications on dry beans, potatoes, 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 on sugarbeets for insecticide applications as well. These application methods also were important for insecticide use in dry beans and potatoes. Chemigation was used for fungicide applications on dry beans and to a small extent in potatoes and sugarbeets. Aerial applications were used in all the specialty crops in some aspect of pesticide application.

Preplant applications were important for herbicides used in dry beans and sunflowers, and preemergence applications were the most used method for herbicides in potatoes. Postemergence herbicides were the most used in sugarbeets, and also were used in potatoes. Planting time insecticide applications were used extensively in sugarbeets and some in potatoes. Late season applications were common in beans, sunflowers and some in potatoes. Fungicides went on from early postemergence throughout the growing season with a significant amount applied from mid to late season. Significant fungicide applications were not reported on sunflowers in 1999.

Table 7. Percentage[1] of pesticide applications using various methods and timing on specialty crops in Nebraska, 1999.

	Dry bean			*Potato*			*Sugarbeet*			*Sunflower*	
	Herb.	*Insect.*	*Fung.*	*Herb.*	*Insect.*	*Fung.*	*Herb.*	*Insect.*	*Fung.*	*Herb.*	*Insect.*
Application Method											
Broadcast-ground	77.9	14.3	—	80.8	30	16.9	12.7	—	14.7	84	11.1
Band	17.3	28.6	—	4.3	12	3.9	83.1	75	8.8	2	—
In-furrow	—	—	—	—	20	1.3	—	21.9	11.8	—	—
Aerial	1.9	42.9	20	4.3	38	32.5	1.4	3.1	61.8	4	83.3
Chemigation	—	—	40	6.4	—	6.5	1.4	—	—	—	—
Ropewick	—	—	—	—	—	—	1.4	—	—	—	—
Seed treatment	—	—	40	—	—	35	—	—	—	—	—
No information	2.9	14.3	—	4.3	—	3.9	—	—	2.9	10	5.6
Application Timing											
Pre-plant incorporate	64.4	—	—	2.1	—	—	16.2	—	—	59.6	—
Pre-plant	2.9	—	—	2.1	—	1.8	2.1	9.4	18.9	19.2	5.6
At planting	—	—	40	—	28.8	22.7	—	65.6	5.4	—	—
Preemergence	8.7	—	—	57.4	—	—	9.9	—	—	11.5	—
Postemergence	12.5	—	—	36.2	—	—	63.4	—	—	7.7	—
Cult. (or early postemerg)	—	14.3	20	—	3.8	40	—	21.9	24.3	—	—
Layby (or midseason)	2.9	—	—	—	32.7	—	2.8	—	—	—	—
Late season	—	42.9	40	—	21.2	32	—	3.1	51.4	—	88.9
No information	8.6	42.9	—	2.1	13.5	3.6	5.6	—	—	1.9	5.6

[1]Not all columns add to exactly 100% due to rounding some figures to one decimal place.

Table 8. Percentage of growers using listed practices in specialty crops in Nebraska, 1999.

	Dry bean (N=52)	*Potato (N=14)*	*Sugarbeet (N=45)*	*Sunflower (N=42)*
General Pesticide Usage				
More pesticide use than average	7.7	21.4	26.7	12
Same pesticide use as average	71.2	42.8	55.6	47.6
Less pesticide use than average	9.6	21.4	8.9	19
Calibration				
Calibrate equipment each application	40.4	57.1	37.8	22
Calibrate equipment multiple times/year	26.9	42.8	46.7	16.7
Calibrate equipment one time/year	13.5	0	13.3	22
Calibrate equipment rarely	0	0	0	5.6
Vertebrate Pests				
Noted vertebrate pest problems	0	7	2.2	28.6
Scouting Practices				
Personal scouting regularly	57.7	93	84.4	52.4
Personal scouting occasionally	25	0	13.3	31
Personal scouting when problems	9.6	0	2.2	9.5
Never do personal scouting	3.8	7	0	4.8
Regular consultant scouting	13.5	28.6	22.2	4.8
Limited consultant scouting	17.3	14.3	13.3	21.4
No consultant scouting	65.4	50	62.2	71.4
Special Management Practices				
Pheromone traps (WBC*, SHM)	7.7	—	—	4.8
Egg mass sampling (MBB*)	23.1	—	—	—
Use economic thresholds for treatment	21.2	—	—	—
Seed weevil monitoring	—**	—	—	33.3
Stem weevil monitoring	—	—	—	14.3

*MBB = Mexican bean beetle, WBC = western bean cutworm, SHM = sunflower head moth
**Dash (—) means question not asked on survey or not applicable

Grower Practices in Specialty Crops

Table 8 reflects some general grower practices in specialty crop production. For a general pesticide use trend, 54 percent of all the growers surveyed indicated using the same amount of pesticide in 1999 as in an average year while 17 percent indicated an increase and 15 percent indicated a decrease in pesticide use. The survey indicated that 39 percent of growers calibrate their equipment each application and 33 percent of growers calibrate their equipment multiple times per year. Vertebrate pest problems were noted most significantly in sunflowers with 29 percent of growers having problems with birds. Personal scouting was more common than consultant scouting and in general more intense scouting occurred on the higher valued potato and sugarbeet crops. Monitoring for seed weevil in sunflowers and egg mass sampling for Mexican bean beetle in dry beans were some of the special management practices implemented by growers in managing insects. Practices implemented by growers to manage insects included: pheromone trapping for western bean cutworm and sunflower head moth, egg-mass sampling for Mexican bean beetle, use of economic thresholds, and monitoring for seed weevil and stem weevil in sunflowers.

Consultant Scouting in Specialty Crops

The highest percentages of acreage scouted by consultants were for potatoes (68 percent) and sugarbeets (34 percent). On average across the specialty crops 55 percent of the consultants used were paid with the average cost ranging from $3.85/ac for sunflowers to $7.59/ac for sugarbeets. Consultants who were regularly used by a grower, were involved in making recommendations for nearly all management decisions for the different specialty crops. For growers using consultants on a limited basis, the services used were primarily scouting, pesticide recommendations, soil sampling and fertility recommendations. *Table 9* contains information on consultant scouting.

Alternate (Nonchemical) Pest Reduction Methods

Tables 10-12 list percentage of acres managed by alternative methods for weeds, insects, and diseases in specialty crops in Nebraska. *Table 13* shows the percentage of growers using alternative disease reduction methods in potatoes. It is interesting to note that growers are becoming more aware of alternative pest control practices in addition to the traditional chemical practices as they manage various pest problems.

Table 9. Consultant scouting and percentage of growers using various services on specialty crops in Nebraska, 1999.

	Dry bean	*Potato*	*Sugarbeet*	*Sunflower*
General Consulting				
% total acres scouted by consult.	16.1	68	33.7	8.4
% paid consultants	50	83	50	36
Average cost for paid consultants	$5.53/ac	$5.09/ac	$7.59/ac	$3.85/ac
Consulting Services				
Growers using consultants on regular basis (percent using listed services)				
Scouting every 1-2 weeks	100	100	90	100
Occasional scouting (1/month)	0	25	0	0
Pesticide recommendations	85.7	100	90	50
Variety selection	14.3	0	70	0
Irrigation scheduling	85.7	75	80	100
Soil sampling	71.4	75	90	50
Fertility recommendations	71.4	75	90	50
Equipment calibration	57.1	0	60	0
Growers using consultants on limited basis (percent using listed services)				
Scouting every 1-2 weeks	11.1	50	17	33
Occasional scouting (1/month)	22.2	50	33	22
Pesticide recommendations	22.2	50	33	33
Variety selection	11.1	0	0	0
Irrigation scheduling	22.2	0	0	0
Soil sampling	0	0	33	11
Fertility recommendations	11.1	50	33	11
Equipment calibration	0	50	0	0

Table 10. Percentage of acres using alternate weed reduction methods (nonchemical) on specialty crops, Nebraska, 1999.

	Dry bean	*Potato*	*Sugarbeet*	*Sunflower*
Weed Management				
Delay planting	—	—	—	46
Preplant tillage	96	95	93	48
Row spacing < 30 inches	24	—	33	9
Increasing plant population	21	—	26	11
Variety selection	26	—	—	—
1 cultivation	48	64	1	19
2 cultivations	45	17	98	4
3 cultivations	2	19	1	0
Hand weeding	—	—	15	—
Micro-rate herbicide application*	—	—	25	—
2-year crop rotation	—	19	—	—
3-year crop rotation	—	38	—	—
4-year crop rotation	—	35	—	—
5-year (+) crop rotation	—	9	—	—

* This is not a nonchemical method, but it does greatly reduce the normal chemical rate

Table 11. **Percentage of acres using alternate insect reduction methods (nonchemical) on specialty crops, Nebraska, 1999.**

Insect Management	Crop
Sugarbeet root aphid	**Sugarbeet**
Resistant varieties	44
Irrigation management	30
Sugarbeet root maggot	
Maximize plant vigor	29
3-year crop rotation	31
4-year crop rotation	30
5-year crop rotation	5
Sunflower head moth	**Sunflower**
Delay planting	48
Red seed weevil	
Trap crop	3
Delay planting	14
Stem weevil	
Harvest early	3
Mexican bean beetle	**Dry Bean**
Avoid early planting	23
Seed corn maggot	
Reduce organic residue	5
Aphids	**Potato**
Field location	19
Colorado potato beetle	
Avoid close rotation	50
Enhance natural enemies	27
Wireworm	
Monitor prior infestations	37
Resistant varieties	26
Secondary pests	
Reduce insecticide use	13
Use economic thresholds	86

Table 12. **Percentage of acres using alternate disease reduction methods (nonchemical) on specialty crops, Nebraska, 1999.**

Disease Management	Crop
Nematode	**Sugarbeet**
3-year rotation	32
4-year rotation	31
5-year rotation	5
Host weed control	46
Tare dirt disposal	46
Rhizoctonia	
3-year rotation	26
4-year rotation	30
5-year rotation	10
Resistant varieties	48
Irrigation management	51
Tare dirt disposal	70
Rhizomania	
3-year rotation	17
4-year rotation	10
5-year rotation	5
Resistant varieties	8
Sclerotina	**Sunflower**
2-year rotation	1
3-year rotation	29
4-year rotation	26
Bacterial diseases	
Crop residue management	6
White Mold	**Dry Bean**
Row spacing	44
Irrigation management	72
Resistant varieties	40
2-year rotation	20
3-year rotation	54
4-year rotation	13
Fusarium root rot	
Reduce soil compaction	43
Improve drainage	24
Resistant varieties	20
2-year rotation	12
3-year rotation	35
4-year rotation	11
Rust	
Resistant varieties	55
Control volunteer beans	32
2-year rotation	14
3-year rotation	34
4-year rotation	11
Blights and Wilts	
Resistant varieties	58
Certified seed	61
Cleaning planter	29
2-ear rotation	18
3-year rotation	48
4-year rotation	14

Table 13. Percentage of growers using alternate disease reduction methods (nonchemical) on potatoes, Nebraska, 1999.

Management practice	*Seed decay*	*Early * late blight*	*Wilts*	*Storage rots*	*Tuber blight*	*Common scab*
Healing cut pieces	79	—	—	—	—	—
Plant in warm soil	43	—	21	—	—	—
Warming seed	71	—	21	—	—	—
Avoid low spots	57	86	57	64	43	—
Crop rotation	21	21	50	14	14	36
Cool temperatures at harvest	—	14	—	86	36	—
Vine kill	—	57	7	50	71	—
Resistant varieties	—	21	—	14	14	57
Irrigation management	—	93	50	86	50	29
Storage management	—	14	—	79	57	—

Many of these alternative practices, such as preplant tillage, cultivation, or crop rotation are not new, but growers are specifically mentioning them as tools used to deal with pests.

Preplant tillage and cultivation were the main alternative practices used to manage weeds although row spacing, plant population, variety, micro-rate herbicide, and crop rotation were used on significant numbers of acres. For insect management, growers used resistant varieties, crop rotation, planting date, irrigation management, natural enemies, and economic thresholds as alternative methods to manage insects. Disease management in the specialty crops included a number of alternative practices including crop rotation, irrigation management, resistant varieties, host weed control, beet tare dirt disposal, soil compaction and others. Potato disease management included a number of nonchemical practices including irrigation management, crop rotation, storage management, resistant varieties, and seed piece management.

Discussion

Several specialty crops are grown regionally within Nebraska. These crops have become major production commodities within these regions and are vital to Nebraska's agricultural economy. Production of these specialty crops relies heavily on the use of pesticides to maintain economic production. The 1999 survey indicated that nearly all the acreage of dry beans, potatoes, sugarbeets, and sunflowers were treated with pesticides.

In comparison with 1992, the 1999 survey indicates that growers have a higher awareness of alternative methods for dealing with pests and are recognizing the value of nonchemical alternatives in dealing with pests. Growers consistently completed the portion of the survey dealing with alternative control measures, which is a change from the 1992 survey.

Figure 2 compares the acres of crop grown in 1992 with the acreage in 1999. Dry beans, potatoes, and sunflowers have increased while sugarbeet acres have decreased. *Figures 3-6* compare pesticide use in 1992 with use in 1999 on the basis of total pounds active ingredient used in the state. The figures represent each crop separately and look at total pounds active ingredient by insecticide type (herbicide, insecticide, fungicide). Noteworthy trends include a significant decrease in fungicides on dry beans even though bean acres increased. Fungicide use on potatoes went up over 14 times while the acres grown only doubled. This was largely due to the new strain of late blight that occurred in 1994 in Nebraska and other parts of the country (Wiese et al. 1998). Nematicide use on sugarbeets was less than one fourth that of 1992 because of decreased use of Telone II driven by high chemical costs and declining crop returns. Herbicide use in sunflowers went up 3.5 times while the number of acres grown was a little more than doubled. *Figure 7* compares the total pesticide use on individual crops in 1992 and 1999. All crops increased in pesticide use except sugarbeets, which decreased due to less nematicide use.

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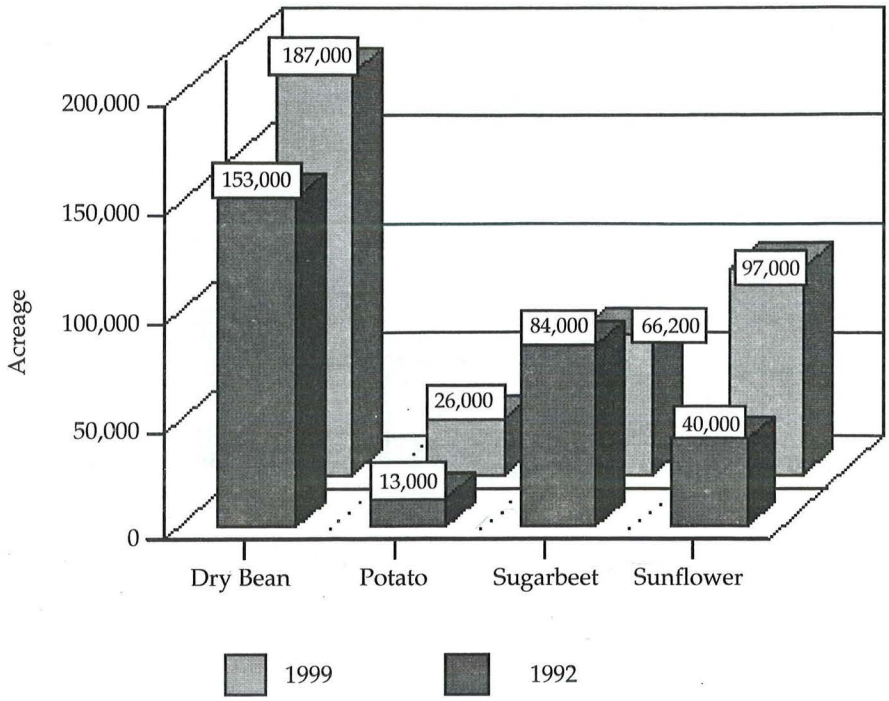

Figure 2. Total acres of crop grown in Nebraska, 1992 and 1999.

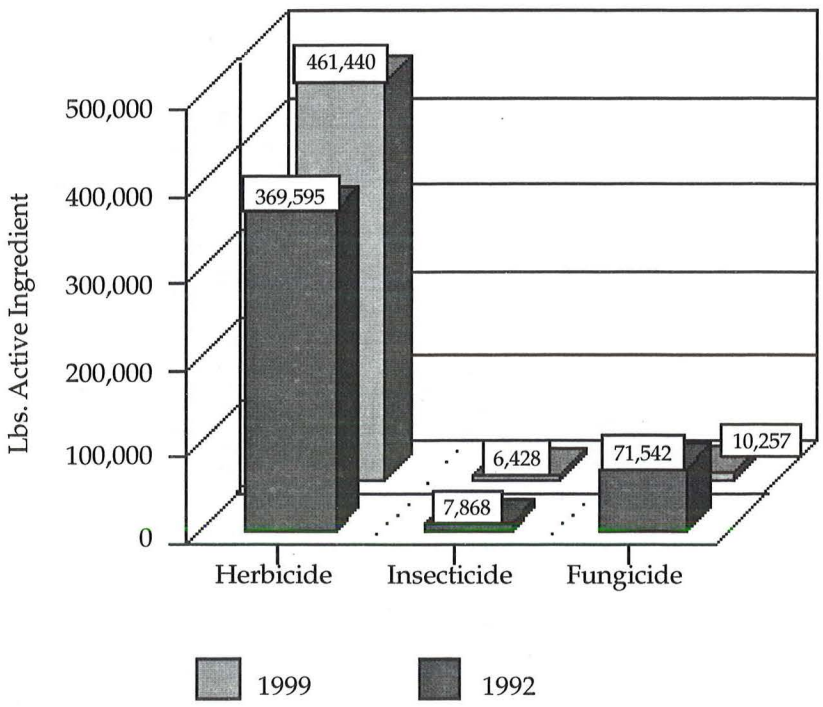

Figure 3. Total dry bean pesticide use in Nebraska, 1992 and 1999.

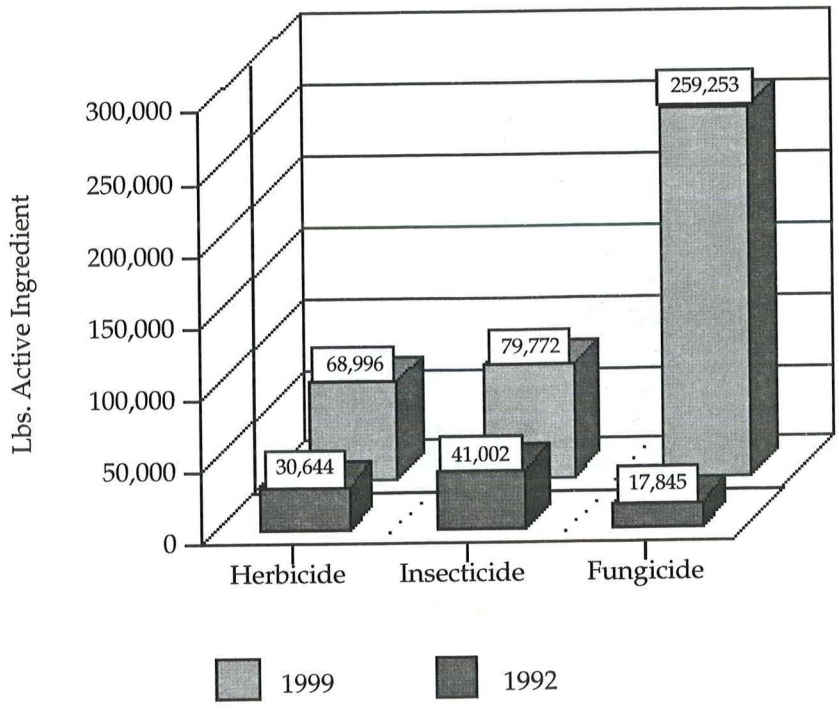

Figure 4. Total potato pesticide use in Nebraska, 1992 and 1999.

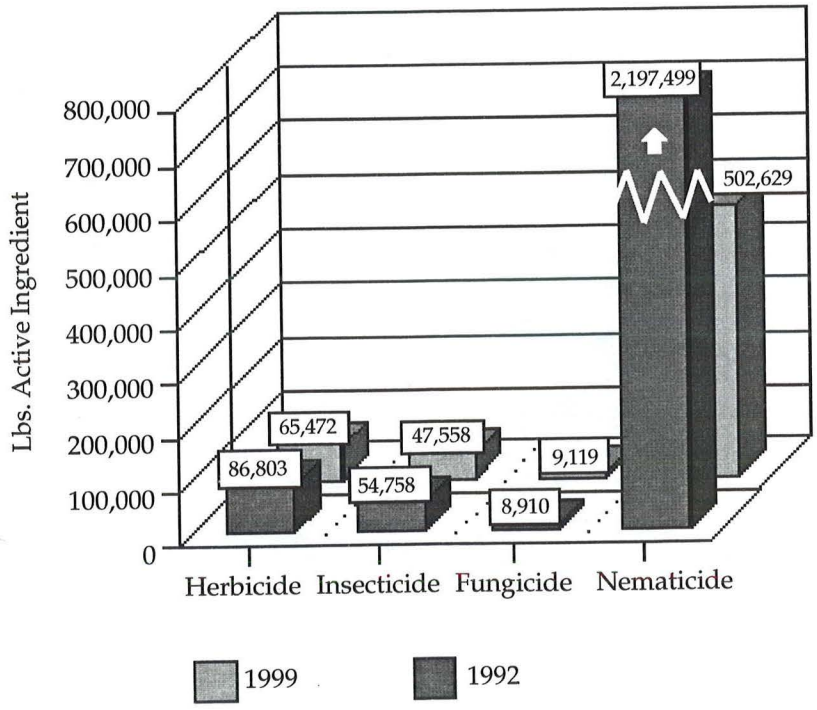

Figure 5. Total sugarbeet pesticide use in Nebraska, 1992 and 1999.

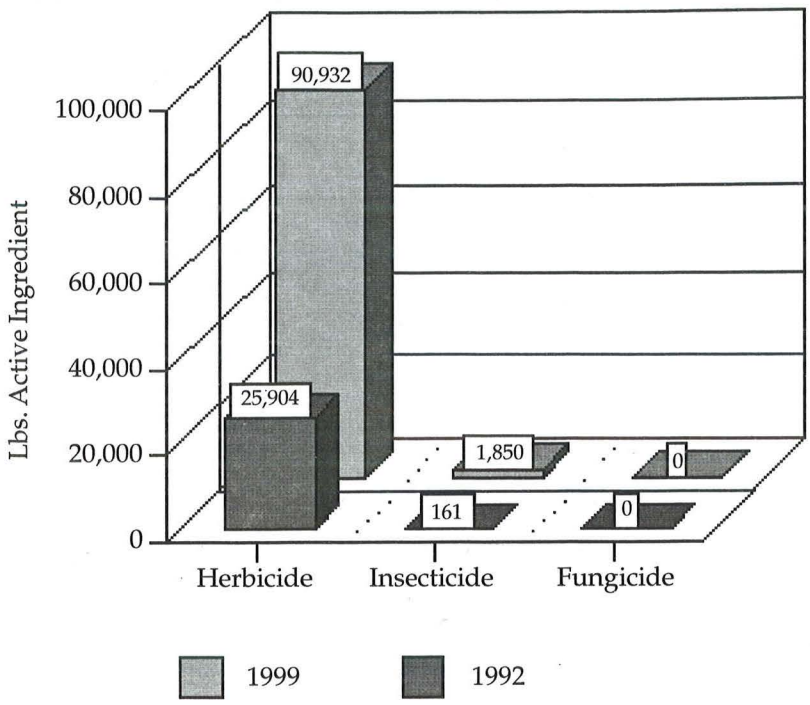

Figure 6. Total sunflower pesticide use in Nebraska, 1992 and 1999.

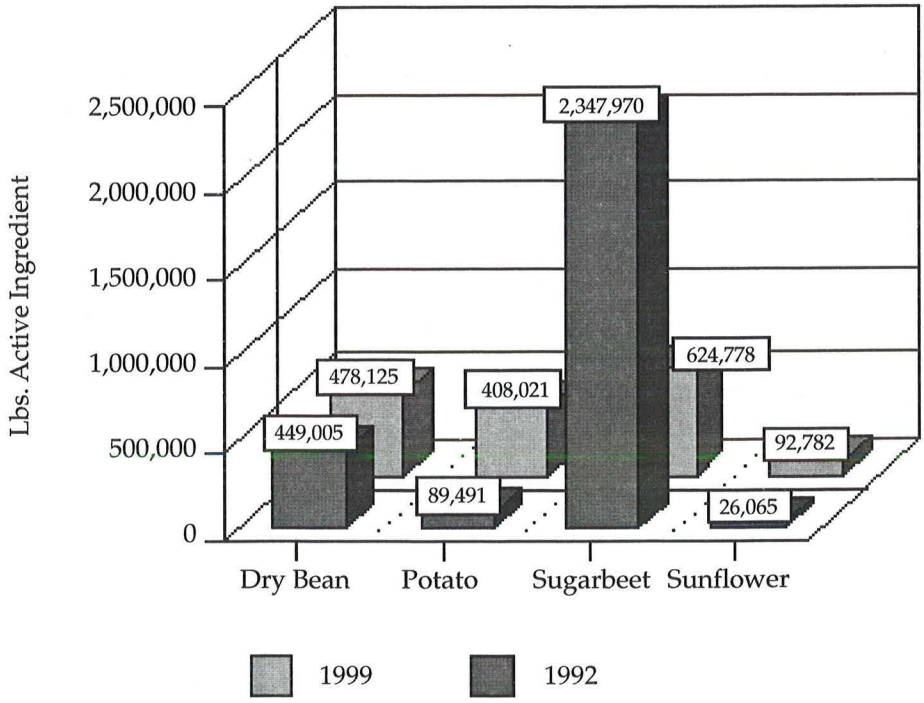

Figure 7. Total pounds of pesticide used on specialty crops in Nebraska, 1992 and 1999.

Appendix A. Survey summary of pesticides used on dry bean in Nebraska, 1999.

	No. of growers using pesticide	*% of Total acreage treated*	*Acres treated**		*Average application rate*	
			Self-applied	*Custom-applied*	*Dry (lbs/ac)*	*Liquid (oz/ac)*
Herbicide						
Basagran	8	10.2	430	742	—	18
Dual II Mag	8	18.4	1,582	540	—	19
Eptam 7E	28	53	4,669	1,407	—	41
Eptam 20G	1	5.2	600	0	11	—
Frontier	3	8.9	0	1,020	—	21
Gramoxone	1	0.4	50	0	—	24
Lasso	5	4.3	462	37	—	44
Partner	2	4.1	150	325	3.6	—
Poast	1	0.3	0	30	—	16
Prowl	2	3.0	0	350	—	43
Pursuit	8	18	1,295	772	0.062	—
Roundup	2	1.9	0	215	—	24
Sonolan	33	69	5,278	2,681	—	37
Total Acres			**14,516**	**8,119**		
Insecticides						
Asana	3	10	0	1,152	—	4.5
Sevin	1	0.7	75	0	—	24
Thimet 15G	2	0.8	48	42	11.5	—
Thimet 20G	1	1.0	115	0	6.5	—
Total Acres			**238**	**1,194**		
Fungicides						
Champ 4	1	1.2	135	0	—	32
Nu-Cop	1	3.4	390	0	—	48
T-22	2	4.6	529	0	0.1	—
Tilt	1	0.74	0	85	—	—
Total Acres			**1,054**	**85**		

* Acres treated = cumulative acres treated; some acres treated more than once.

Appendix B. Survey summary of pesticides used on potato in Nebraska, 1999.

	No. of growers using pesticide	*% of Total acreage treated*	*Acres treated**		*Average application rate*	
			Self-applied	*Custom-applied*	*Dry (lbs/ac)*	*Liquid (oz/ac)*
Herbicide						
Diquat	2	10.5	570	1,645	—	24
Dual II Mag	8	77	15,035	1,090	—	24
Eptam 7E	2	22	4,570	0	—	68
Lexone	1	10.5	2,200	0	0.5	—
Linex	1	9.5	2,000	0	1.0	—
Lorox	1	12.2	2,570	0	1.0	—
Matrix	10	48.2	9,320	818	0.1	—
Poast	8	39.3	2,160	6,105	—	21.5
Prowl	4	16.4	2,875	570	—	27
Roundup	1	1.9	400	0	—	32
Sencor	6	63	12,680	520	0.47	—
Treflan	1	4.1	860	0	—	24
Turbo	2	2	300	128	—	40
Total Acres			**55,540**	**10,876**		
Insecticides						
Admire	3	22	4,630	0	—	19
Asana	2	16.4	0	3,450	—	7.5
Dimethoate	5	36	400	7,120	—	16
DiSyston	1	1	210	0	10	—
Furadan	1	5.2	1,102	0	—	32
Malathion	2	31	0	6,420	—	36
Monitor	9	62	1,400	11,553	—	32
Pounce	2	20	0	4,238	—	7
Provado	6	42	300	8,500	—	3.75
SpinTor	2	9	300	1,600	—	6
Thimet	11	57	12,075	0	12.6	—
Thiodan	5	23	113	4,644	—	36
Total Acres			**20,530**	**47,525**		
Fungicides						
Bravo	8	75	11,770	3,970	—	52
Bravo ZN	6	70	8,735	5,980	—	63
Curzate	2	10.7	0	2,260	0.31	—
Curzate MZ	2	12	2,540	0	6.5	—
Dithane	10	83	4,300	13,140	5.15	—
Kocide	1	2.4	0	500	3	—
Mancozeb	7	18	3,740	0	18.7	—
Maxim	8	30	6,330	0	13.4	—
Maxim MZ	4	27	5,735	0	10	—
Penncozeb	1	39	0	8,225	2	—
Polygram	1	2.7	0	570	6	—
Quadris	7	57	0	11,903	—	15.1
Ridomil Gold/Bravo	7	52	3,255	7,760	3.14	—
Supertin	4	42	5,645	3,200	0.53	—
Tops 2.5D	2	12	2,540	0	6.5	—
Tops 5D	2	4.9	500	520	25	—
Tops MZ	1	1.9	0	400	12	—
Total Acres			**55,090**	**58,428**		

* Acres treated = cumulative acres treated; some acres treated more than once.

Appendix C. Survey summary of pesticides used on sugarbeet in Nebraska, 1999.

	No. of Growers using pesticide	*% of Total acreage treated*	*Acres treated**		*Average application rate*	
			Self-applied	*Custom-applied*	*Dry (lbs/ac)*	*Liquid (oz/ac)*
Herbicide						
Assure	2	4.2	440	0	—	4.9
Betamix	28	75	7,540	320	—	13.6
Eptam	3	7.6	788	0	—	50
Nortron	17	52.5	5,486	0	—	17.3
Poast	6	9.4	925	59	—	9.7
Progress	13	13.8	1,437	0	—	11.2
Ro-Neet	21	22.2	1,912	405	—	30.7
Roundup	4	3.8	339	55	—	10
Select	6	8.9	815	111	—	3
Stinger	20	45.8	4,455	320	—	1.9
Upbeet	22	62.6	6,199	320	.013	—
Total Acres			**30,336**	**1,590**		
Insecticides						
Asana	1	4.7	0	485	—	8
Counter15G	3	4.2	434	0	6.8	—
Counter20G	17	40	4,180	0	8.2	—
Isotox	1	2.3	240	0	.04	—
Lorsban	2	2.2	231	0	—	14
Temik	5	3.4	354	0	14.7	—
Thimet	3	2	211	0	9	—
Total Acres			**5,650**	**485**		
Fungicides/Nematicides						
DithaneF45	1	0.4	0	45	—	24
Dithane DF	3	2	0	205	1.7	—
Maneb	1	1.1	0	111	2	—
Penncozeb	1	0.3	0	35	1.5	—
Quadris	1	0.3	0	35	—	9
Supertin	9	11	0	1,112	0.3	—
Telone II	7	6.6	332	356	—	1,550
Temik	2	1.4	153	0	20	—
Topsin	9	8	0	826	.38	—
Total Acres			**485**	**2,725**		

* Acres treated = cumulative acres treated; some acres treated more than once.

Appendix D. Survey summary of pesticides used on sunflower in Nebraska, 1999.

	No. of growers using pesticide	*% of Total acreage treated*	*Acres treated**				*Average application rate*	
			Self-applied		*Custom-applied*		*Dry (lbs/ac)*	*Liquid (oz/ac)*
			Oil	*Conf.*	*Oil*	*Conf.*		
Herbicide								
Poast	2	1.78	0	0	75	121	—	24
Prowl	21	43	990	1,121	1,664	944	—	48
Roundup	5	5.2	—	—	295	282	—	19.2
Sonolan HFP	5	9	525	100	240	128	—	33.6
Sonolan 10G	2	4.4	0	0	332	157	10	—
Spartan	2	5.3	80	500	0	0	0.33	—
Treflan	12	30	825	760	1,193	502	—	25.7
Total Acres			**2,420**	**2,481**	**3,799**	**2,134**		
Insecticide								
Asana	11	31.5	0	0	1,720	1,754	—	7.2
Parathion	2	1	0	0	65	51	—	20
Warrior	4	4.4	0	0	365	122	—	3.3
Total Acres					**2,150**	**1,927**		

Appendix E. Survey of Pesticide Use on Dry Beans for 1999.

Dry Bean Production and Pesticide Use

1. **Total dry bean acres produced, 1999:** _____ acres

2. **Dry bean acres receiving one or more pesticide applications:**
   ("pesticide" includes all herbicides, insecticides, fungicides, etc.) _____ acres

3. (Circle one answer) **Dry bean pesticide use in 1999 was: a) less than, b) the same as, c) more than my average yearly use.**

   If pesticide use in 1999 was less or more than your average, indicate the % increase or decrease in 1999.

Herbicides	Insecticides	Fungicides
_____% increase	_____% increase	_____% increase
_____% decrease	_____% decrease	_____% decrease

4. **How often do you calibrate pesticide application equipment?** (check one)

   ____ before each application

   ____ multiple times a year

   ____ once a year

   ____ rarely

Vertebrate Pest Control on Dry Beans

1. **Did you have a problem with birds?** (____Yes) (____No)

   If yes, list method of control (include nonchemical methods) _____

2. **Did you have a problem with rodents?** (____Yes) (____No)

   If yes, list method of control (include nonchemical methods) _____

   If repellent, avicide, or rodenticide used, complete the following table:

Target Pest	Name of Pesticide	Amount used (e.g. gals, lbs, etc.)

Agricultural Consulting/Scouting

1. **How often did you scout your own dry bean fields for pests (includes weeds, insects, diseases)** (check one):

   ____ never

   ____ only when problems obvious

   ____ occasionally (1/month)

   ____ regularly (every 1-2 weeks)

2. **Were ag consultants or scouting services used for dry bean pest management in 1999?** (check one)

_____ none

_____ limited basis

_____ regular basis

3. **Did you or your consultant use the following pest management practices:** (check all that apply)

_____ phermone trapping for western bean cutworm

_____ egg mass sampling for Mexican bean beetle

_____ economic thresholds for pesticide treatments

Skip to next section if no consultants used.

4. **List number of dry bean acres scouted by consultants:** _____acres

5. **For fields scouted, consulting costs were: $_____/acre.**

6. **Check services included in consulting cost noted in #5:**

___ regular pest scouting (every 1-2 weeks)

___ occasional pest scouting (1/month)

___ pesticide recommendations

___ variety selection

___ irrigation scheduling

___ soil sampling

___ fertility recommendations

___ equipment calibration

___ other (list)

Alternate Pest Reduction Methods

A number of practices are used to help reduce pressure from weeds, insects, and disease including crop rotation, altering planting dates, varietal resistance, tillage/cultivation, row spacing, crop residue management, trap crops, natural enemies, etc.

Please estimate the number of acres that you used the following methods on to *reduce pest pressure* on your dry beans in 1999.

Target Pest	*Weed Management*		*Acres*
Early season weeds	Preplant tillage		_____
All weeds (better competition)	Row spacing < 30"		_____
	Increased plant pop.		_____
	Variety selection		_____
All weeds	Cultivation	1 time/yr	_____
		2 times/yr	_____
List any other methods used:			
_____	_____		_____

Target Pest	*Insect Management*	*Acres*
Mexican bean beetle	Avoid early planting	_____
Seed corn maggot	Minimize organic residue	_____
List any other methods used:		
_____	_____	_____

Target Pest	*Disease Management*	*Acres*
White mold	Row spacing	_____
	Irrigation management	_____
	Variety selection	_____
	Crop rotation	
	2 yr_____ 3 yr_____ 4 yr_____	
Fusarium root rot	Minimize soil compaction	_____
	Improve drainage	_____
	Resistant varieties	_____
	Crop rotation	
	2 yr_____ 3 yr_____ 4 yr_____	
Rust	Resistant varieties	_____
	Control volunteer beans	_____
	Crop rotation	
	2 yr_____ 3 yr_____ 4 yr _____	
Blights and wilts	Resistant varieties	_____
	Certified seed	_____
	Cleaning planters	_____
	Crop rotation	
	2 yr_____ 3 yr_____ 4 yr _____	
List any other methods used:		
_____	_____	_____

Dry Bean Herbicide Use, 1999

*Name of Herbicide (Product and formulation)	Rate of undiluted product per acre Dry (lbs/ac, oz/ac)	 Liquid (gal/ac, qts/ac, oz/ac, etc.)	Acres	Application method 1. broadcast 2. band 3. aerial 4. chemigation 5. spot applic. 6. rope wick	Applied 1. self 2. custom	Band width (inches)	Row spacing (inches)	Control rating 1. excellent 2. good 3. fair 4. poor	Timing 1. preplant inc. 2. early preplant 3. preemerg 4. postemerg 5. layby	Weeds 1. kochia 2. nightshade 3. foxtail 4. lambsquarter 5. pigweed 6. other (list)
				1 2 3 4 5 6	1 2			1 2 3 4	1 2 3 4 5	1 2 3 4 5 6
				1 2 3 4 5 6	1 2			1 2 3 4	1 2 3 4 5	1 2 3 4 5 6
				1 2 3 4 5 6	1 2			1 2 3 4	1 2 3 4 5	1 2 3 4 5 6
				1 2 3 4 5 6	1 2			1 2 3 4	1 2 3 4 5	1 2 3 4 5 6
				1 2 3 4 5 6	1 2			1 2 3 4	1 2 3 4 5	1 2 3 4 5 6
				1 2 3 4 5 6	1 2			1 2 3 4	1 2 3 4 5	1 2 3 4 5 6

*Herbicide names: Preplant incorporated or Preemergence: Dual II Magnum, Eptam 20G or 7E, Frontier, Eptam 7E + Sonolan or Prowl or Treflan, Eptam 7E + Dual II Magnum or Lasso, Lasso, Partner, Partner + Eptam 7E or Treflan, Treflan 4EC + Dual II Magnum or Lasso; Postemergence: Assure II + COC, Basagran + COC, Pursuit DG, Pursuit DG + Basagran, Poast + COC, Select 2EC; Harvest aid: Gramoxone Extra.

Dry Bean Insecticide Use, 1999

*Name of Insecticide **(Product and formulation)**	Rate of undiluted product per acre **Dry (lbs/ac, oz/ac)**	 **Liquid (gal/ac, qts/ac, oz/ac, etc.)**	Acres	Application method **1. broadcast** **2. band** **3. aerial** **4. chemigation** **5. in-furrow** **6. seed trt**	Applied **1. self** **2. custom**	Band width **(inches)**	Row spacing **(inches)**	Control rating **1. excellent** **2. good** **3. fair** **4. poor**	Timing **1. preplant** **2. at preplant** **3. early (cult.)** **4. late season** **5. other (list)**	Weeds **1. Mex. bn beetle** **2. W. bn cutworm** **3. thrips** **4. sd corn maggot** **5. grasshopper** **6. other (list)**
				1 2 3 4 5 6	**1 2**			**1 2 3 4**	**1 2 3 4 5**	**1 2 3 4 5 6**
				1 2 3 4 5 6	**1 2**			**1 2 3 4**	**1 2 3 4 5**	**1 2 3 4 5 6**
				1 2 3 4 5 6	**1 2**			**1 2 3 4**	**1 2 3 4 5**	**1 2 3 4 5 6**
				1 2 3 4 5 6	**1 2**			**1 2 3 4**	**1 2 3 4 5**	**1 2 3 4 5 6**

*** Insecticide names: Asana XL, Dibrom 8E, Dimethoate 400 or 4EC, Di-Syston 15% or 8, Kelthane MF, Lannate WSP or LV, Methyl Parathion 4E, Orthene 75WSP or 75S, Penncap-M, Phaser 3EC or 50 WSB, Sevin 4F or 50W or 80WSP or 80S or XLR Plus, Sniper 2-E or 50PVA, Temik 15G, Thimet or Phorate 15G or 20G, Thiodan 3EC or 50WP or CO or WSB, Thirethrin.**

Dry Bean Fungicide/Nematicide Use, 1999

*Name of Fungicide/ Nematicide (Product and formulation)	Rate of undiluted product per acre Dry (lbs/ac, oz/ac)	 Liquid (gal/ac, qts/ac, oz/ac, etc.)	Acres	Application method 1. broadcast 2. band 3. aerial 4. chemigation 5. in-furrow 6. seed trt	Applied 1. self 2. custom	Band width (inches)	Row spacing (inches)	Control rating 1. excellent 2. good 3. fair 4. poor	Timing 1. preplant 2. at preplant 3. early 4. late 5. other (list)	Weeds 1. rhizoctonia 2. white mold 3. powdery mildew 4. blights 5. rust 6. other (list)
				1 2 3 4 5 6	1 2			1 2 3 4	1 2 3 4 5	1 2 3 4 5 6
				1 2 3 4 5 6	1 2			1 2 3 4	1 2 3 4 5	1 2 3 4 5 6
				1 2 3 4 5 6	1 2			1 2 3 4	1 2 3 4 5	1 2 3 4 5 6

* Fung/Nemat names: Seed treatment: Agrox 3-way, Apron 12.5D or 25, Arasan 70S, Captan 65 or 75 or 3000 or 300 or 400 or 4000, Chloroneb 65, Terra-Coat L-205N, Super X20.5D, Vitavax Pour-on; Nematicide: Telone II, Temik 15G, Vapam, Vorlex; Fungicide: Basicop, Bravo 720# or W75, Copper Count N, Manex, Maneb 80#, Maneb+Zn,Kocide 101 or 404S or 606#, Mertect 340F, Orthocide 50, Ridomil 2E or PC 11G, Super Six, Terraclor 75 or 10G or EC, Top Cop+S, Topsin 5G, Tri Basic Copper, Ziram F4.