STATUS OF IPM AND INSECTICIDE USE IN TEXAS COTTON

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Abstract

A statewide survey of 1552 cotton producers representing 14.4% of the state's 5.45 million acres of cotton was conducted to obtain baseline data on acreage, pest management practices, insecticide use and pests targeted by insecticides. Insecticides were applied on more than 2.7 million acres with two pests, boll weevils and bollworms accounting for 73% of all applications. Four insecticides made up 64% of the 4.2 million pounds of active ingredients applied.

Three insecticides, Guthion, methyl parathion and Vydate dominated the boll weevil insecticide market while the pyrethroids dominated applications for bollworms. Bidrin or Orthene were used for 62% of applications for the cotton fleahopper while Furadan or Bidrin were used for 53% of applications for aphids in 1994.

IPM producers were defined as producers who use scouting, economic thresholds and 70% of the weighted management practices important to IPM in the region. Based upon this definition 64% of Texas cotton producers who farmed 68% of the acreage in 1994 qualified as IPM producers.

Introduction

Cotton is the leading cash crop in Texas, generating more than $1.6 billion per year for producers and including allied industries having an annual economic impact of $5.2 billion. In 1994, Texas farmers planted more than 5.45 million acres of cotton with 3.5 million acres being in the High Plains of West Texas.

Cotton is grown in geographically and climatically diverse areas of Texas with rainfall varying from 55 inches in the east to 6 to 10 inches in the far west. The frost free days vary from an average of 320 in the subtropical areas of the Rio Grande Valley to 150 days in areas of the High Plains where cotton is produced at elevations of 3,000 feet or more.

Due to the diversity of the areas where cotton is grown in Texas, production practices, pest complexes, pest management strategies and pesticide use also vary widely. In order to document this diversity and to obtain baseline data on pesticide use, pest problems and pest management practices used, Texas cotton growers were surveyed during 1995. This survey obtained data for the production year 1994. While the survey included information on weeds, herbicides, PGRs, defoliants and dessicants in addition to insects and insecticides, only the latter subjects will be addressed in this manuscript. Results of the entire survey may be obtained by requesting Departmental Technical Report 96-06 of the Department of Soil and Crop Sciences, Department of Entomology, Texas Agricultural Experiment Station and Texas Agricultural Extension Service, Texas A&M University, College Station, TX 77843.

Integrated pest management (IPM) has been practiced in Texas for over 20 years. The Texas Agricultural Extension Service initiated county level pilot programs in IPM in 1972 to demonstrate the economic and environmental benefits of producer-managed IPM programs. This successful program has continued to operate and expand and now encompasses 26 county or multi-county pest management units staffed by Extension Agents-IPM operating in 54 Texas counties. Private consultants, who also use and teach growers the benefits of IPM have increased dramatically during the period since the IPM program was initiated in 1972. In order to document the results of these efforts, a definition of an IPM cotton producer based upon their of IPM practices was developed and the percentage of producers who qualify as IPM producers and the percentage of the Texas cotton acres they farm were determined.

Materials and Methods

The basic survey instrument used to document cotton acres planted and harvested, yields, pesticide use, target pests and certain management practices was developed by the USDA National Agricultural Statistics Service (NASS) and is referred to as Form H:Cotton Yield Survey--1994 Cropping Practices Interview." This survey instrument was supplemented with additional questions concerning IPM practices and grower participation in educational activities sponsored by the Texas Agricultural Extension Service (TAEX). The survey obtained data on producer use of 13 different IPM practices. The Texas Agricultural Statistics Service (TASS) conducted the survey using names of cotton producers selected at random from a master list of Texas cotton producers.

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Texas was divided into three production regions for survey purposes (Figure 1). Region 10 included four counties in the Lower Rio Grande Valley, a subtropical region of South Texas. Region 20 included the Coastal Bend, Upper Gulf Coast, East Texas, the Central Texas Blacklands and South Central Texas. Region 30 included the Rolling Plains, High Plains, Trans Pecos and Far West Texas. The number of growers surveyed in each region was based upon the cotton acreage in the region.

Using standard NASS procedures, field enumerators trained by TASS completed 506 survey questionnaires while interviewing cotton growers at their farms. Another 1050 growers were surveyed by TASS employees by telephone. All surveys were assessed for completeness of the data and the number of usable surveys determined.

In order to determine the importance of the IPM tactics on which use data were obtained, a companion survey of IPM experts was conducted. This survey was completed by 35 private consultants, 27 University pest management scientists and 58 producers who were members of regional IPM steering committees. Each expert rated each IPM practice as highly important, important, somewhat important or not important to IPM in their region. Ratings were converted to numerical scores of "3", "2", "1" or "0", respectively. The tactic with the highest average score in reach region was ranked first. The tactic with the second highest score was ranked second and so on. In this portion of the study, the Trans Pecos area was separated from the remainder of Region 30 due to emphasis on cultural control practices for the pink bollworm which is not a significant pest in other portions of the region.

After determining which IPM practices were most important for each region, a 100 point rating scale was developed based upon the IPM tactics used. A producer who used the number one ranked, most important, IPM practice for the region, as determined by the expert panel, was awarded 20 points (Table 4). Use of a second or third ranked practice was worth 15 points each and a number 4,5 or 6 ranked tactic, 10 points each. Use of the 7th, 8th, 9th or 10th ranked tactic was worth 5 points each. The total possible points for any grower was 100. Any grower who scored 70 points or more scored high enough to be an IPM grower. However, we considered two of the IPM practices, scouting and the use of economic thresholds so important and basic to the IPM concept that the producer was required to use both of these in addition to scoring 70 points on the 100 point system to be considered an IPM producer. An IPM producer, then, was defined as one who used scouting, economic thresholds and 70% of the weighted IPM practices important to the production region.

Results and Discussion

A total of 1522 usable surveys were obtained from the 1556 completed by Texas growers (Table 1). This included 105 in Region 10, 279 in Region 20 and 1138 in Region 30. The survey represented 9.7% of the cotton producers in Texas and 14.4% of the acreage (Table 1).

Participation in Extension Activities

Data on grower participation in Extension educational programs and use of IPM practices are summarized in Tables 2 and 3. Statewide, 71% of producers attended a producer meeting or field day sponsored by Extension and 71% indicated that they had attended a meeting that included information on IPM. This indicates that essentially all of the meetings sponsored by Extension include IPM information. Eighty eight percent of Texas producers received a county or regional newsletter written by an Extension employee indicating that Extension is highly regarded as a source of agricultural information.

Use of IPM Practices

Eighty four percent of Texas producers used recommended cotton planting dates and 85% targeted plant populations within the suggested range for their production region (Table 2). Sixty five percent plant varieties which they believe to have some resistance to insects or diseases. Most rotate both crops to reduce insect, weed or disease pests and rotate pesticides to reduce resistance to the products they use. Almost all of the producers (98%) use mechanical cultivation in addition to herbicides to control weeds.

Eighty nine percent of cotton acres surveyed were scouted to monitor pests (Table 3). Almost one half (48%) are scouted by growers themselves, with 37% being scouted by consultants and 7% through the services of pesticide dealers or distributors. The non-profit Texas Pest Management Association in conjunction with the pest management programs operated by the Texas Agricultural Extension Service provided scouting on four percent of acres surveyed. Although growers hire others for scouting services, 65% indicate they conduct additional scouting themselves before treating their fields for pests.

Economic thresholds are used to trigger insecticide applications on 88% of cotton acres (Table 3). The exact threshold used and who determined the threshold varied widely depending upon who did the scouting and the production system used. Consultants determined thresholds for 36% of acres surveyed statewide and for approximately 60% of acres in Regions 10 and 20. Producers determined their own thresholds on 25% of acres and only 3% of acres were managed following economic thresholds recommended by The Texas Agricultural Extension Service. The figure for Extension might be somewhat misleading, however, because most growers and consultants consider the thresholds recommended by Extension as a reference point for those they use themselves although theirs vary from the specific threshold. Previous pest history was used as the basis for making applications on 10% of cotton acres.

Texas cotton producers are very aware of the importance of beneficial insects in pest management. Sixty nine percent statewide and almost 90% in Regions 10 and 20 considered populations of beneficial insects when making insecticide treatment decisions. They attempted to protect natural enemies in several ways when treatments were required. Forty three percent used reduced insecticide rates, 56% reduced treatment frequency and 62% tried to select products less disruptive to the beneficial insect complex. Only 2% of Texas producers purchase natural enemies from commercial sources.

Insect pheromones were used by 8% of growers statewide to monitor insect pests and 3% used pheromones as a control tool (Table 3). Seventy five percent of Texas producers calibrated insecticide application equipment as least annually so that the proper amount of insecticide could be applied. The use of stalk destruction as an insect management tactic was thought to be important statewide. Use varied from 94% of producers in Region 20 to 68% of the producers in Region 30. This is consistent with the view of most pest managers who believe cotton stalk destruction to be more important in Regions 10 and 20 than in Region 30 (Table 4) due to earlier harvest in these areas. In Region 30, stalk destruction is generally less important since the crop is harvested relatively close to freezing weather and does not normally have time to refruit prior to the first freeze. Exceptions occur in the Trans Pecos and Far West Texas areas where pink bollworms are a problem.

Defining IPM Producers

The rank and relative importance of IPM practices in four regions of Texas as defined by the panel of experts is summarized in Table 4. Statewide, scouting ranked as the most important IPM practice, followed by either use of economic thresholds, stalk destruction or sprayer calibration. Consideration of natural enemies and use of crop rotation also ranked high. Use of computer models as decision aids ranked lowest in each region.

Based upon the definition of an IPM grower as being one who uses scouting, economic thresholds in making pesticide treatment decisions and using 70% of the weighted IPM practices important to the production region, 64% of Texas cotton producers who farm 68% of the acres qualified (Table 5). Regionally, 84% of the producers in Region 10, 80% in Region 20 and 58% in Region 30 qualified. The statewide figure is very close to the national goal for IPM which is to have 75% of U.S. cropland managed using IPM by the year 2000.

Insecticide Use on Cotton in Texas

Approximately 51% of the cotton acres were treated one or more times with an insecticide in 1994 (Table 6). Insecticide use was highest in Region 10 where 96% of the crop was treated and lowest in Region 30 were 41% of the acres were treated. Of the 5.45 million acres of cotton in Texas in 1994, 2.75 million acres were treated with a total of 4.25 million pounds of active ingredients.

Growers reported using approximately 40 different insecticides on cotton in 1994 (Table 7). However, only Guthion, methyl parathion, Karate, Bidrin and Temik were used on more than 500,000 planted acres. Methyl parathion accounted for 27.2% of the pounds of active ingredients used, malathion 13%, Guthion 12.7% and Curacron 10.7% (Figure 2). Six others, including Vydate, Furadan, Orthene, Thimet, Curacron and Ammo were applied on 200,000 to 450,000 base acres (Table 7). These accounted for 91% of the 4.25 million pounds of active ingredients of insecticides applied in season. Insecticide treatments reported did not include those used for fall boll weevil diapause treatments.

Cotton producers applied 46% of the insecticides aerially and 46% with ground applicators (Table 8). Seven percent were applied in-furrow at planting and less than one percent in irrigation water. Fifty one percent were applied by the farmer and 49% by custom applicator.

The pests which received the most insecticide treatments were boll weevils which accounted for 37% of applications and bollworms which accounted for 36% of applications. Fleahoppers accounted for 10%, aphids 8% and thrips 9% of applications statewide (Figure 3). A number of regional differences were apparent. For example, 70% of all applications in the Rio Grande Valley targeted boll weevils and 49% of all applications in Region 30 were for bollworms.

Three insecticides, Guthion, methyl parathion and Vydate dominated the market for boll weevil insecticides (Table 9). These three insecticides were used for 69% of in-season applications for boll weevils statewide although many other insecticides were used by some growers.

The pyrethroid insecticides dominated the bollworm market accounting for 5 of the top six products used (Table 10). Karate, Ammo, Scout X-tra and Asana accounted for 63% of applications statewide. Products containing Bacillus thuringiensis (Bt) accounted for 11% of applications statewide and 26% of applications in Region 20.

Bidrin and Othene dominated the market for fleahopper control with Bidrin being used for 44% of applications and Orthene 18% of applications statewide (Table 11). Vydate, Temik and dimethoate were also fairly commonly used.

Aphids have become a more common pest of cotton in recent years and were the target of 8% of statewide insecticide applications. Furadan and Bidrin dominate the aphicide market with slightly more Furadan being used even though its use was under a Section 18 exemption. Most of the Furadan applications were in Region 30 (Table 12).

Conclusions

Approximately two thirds of Texas cotton growers are IPM producers and farm using IPM principles. Most growers participate in educational programs of the Texas Agricultural Extension Service. Use of IPM principles has resulted in approximately 90% of the cotton in Texas being scouted and only 50% of the acres to be treated with insecticides. Texas cotton growers rely heavily on beneficial insects and use various methods to conserve them.

While insecticides were applied to more than 2.7 million acres of cotton in 1994, this represents only one half of the state's acreage. This indicates that Texas cotton producers use insecticides judiciously and 88% apply insecticides to prevent economic losses only when thresholds are exceeded. While there are numerous choices of insecticides available for most economic pests, Texas growers tend to use a selected few products for specific target pests.

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Table 1. Overview of Cotton Growers and Acreage, 1994.

Cotton in Texas	Region			
	10	20	30	State
Number of Growers				
In the survey	105	279	1,138	1,522
Total in region	519	3,095	11,997	15,611
% in the survey	20.2%	9.0%	09.5%	9.7%
Number of cotton acres				
In the survey	46,405	102,528	636,852	785,785
Total in the region	286,000	761,000	403,000	5,450,000
% in the survey	16.2%	13.5%	14.5%	14.4%

Table 2. IPM Practices of Texas Cotton Farmers, 1994.

Grower Practices in IPM	Region			
	10	20	30	State
Participated in Extension	% of growers			
Programs				
Meeting or field day	74	80	68	71
Meeting of IPM content	82	81	71	71
Receives Extension Newsletter	90	88	88	88
Use Recommended Practices	% of acres			
Planting dates	96	96	81	84
Plant populations	94	91	83	85
Resistant varieties	78	75	62	65
Soil fertility test	25	28	42	39
Rotate crops to reduce				
Insect pests	87	73	48	53
Rotate Insecticides	85	86	50	56
Cultivated one or more times	97	97	98	98

Table 3. Use of IPM Practices by Texas Cotton Growers, 1994.

IPM Practice	Region			
	10	20	30	State
	% of acres			
Use scouting	99	98	86	89
Of scouted acres, % scouted by:				
Farmer	34	37	53	48
Consultants	48	53	31	37
Dealers	11	1	8	7
Texas Pest Mgmt Association	2	7	3	4
Others	5	2	5	4
% Farmers doing additional scouting	58	61	66	65
Basis for insecticide treatment				
Economic Thresholds determined by:				
Consultant	58	60	30	36
Farmer	21	18	26	25
Extension Service	4	5	3	3
Others	6	7	28	24
Previous history	6	8	10	10
Unknown basis	5	2	3	2
Beneficial Insects	% of growers			
Considered in control decisions	89	88	64	69
Protected beneficials by:				
Reduced pesticide rate	49	53	39	43
Reduced frequency of treatment	59	66	52	56
Selecting less harmful insecticide	74	75	56	62
Used other protective methods	6	5	21	16
Purchased beneficials	<1	2	2	2
Pheromones				
Used to monitor insect populations	19	19	6	8
Were used for insect control	18	5	2	3
Calibrated Sprayer	90	94	70	75
Destroy Stalks	92	94	68	73

Table 4. Relative Importance of IPM Practices in Texas Cotton.

Recommended IPM Practice	Ranking within region				
	10	20	30	Trans Pecos	State
Scouting for pests	1	1	1	1	1
Economic thresholds	4	2	2	3	2
Stalk Destruction	2	3	8	2	3
Annual Sprayer Calibration	7	4	3	6	4
Natural Enemies	8	5	4	4	5
Crop Rotation	2	6	5	10	6
Mechanical weed control	8	7	6	7	7
Recommended planting dates	5	7	12	8	8
Pest-resistant varieties	5	9	11	9	9
Pheromones to monitor or control	12	10	8	4	9
Soil testing	11	11	7	11	11
Recommended plant population	10	12	10	11	12
Computer models for decision aid	13	13	13	13	13

Table 5. Percent of Texas Cotton Growers and Acreage That Meet IPM Defination*

	Region			Trans Pecos	State
	10	20	30		
By growers	84	80	58	64	64
By acreage	86	89	64	60	68

***IPM definition require growers to use scouting, economic thresholds and 70% of the IPM tactics important to their region.**

Table 6. Overview of 1994 Insecticide Use in Texas Cotton.

Insecticide Use	Region			
	10	20	30	State
Insecticides				
% of cotton acres treated	96	85	41	51
Total lbs. applied (X1000)	657	1,684	1,954	4,245

Table 7. Insecticides Applied to Texas Cotton in 1994.

Active ingredient	Recognized trade name	Planted acres (x 1000)	Average # of applications	Total lbs. A.I. applied (x 1000)
Azinphos-methyl	Guthion	848	2.5	541
Methyl Parathion	several	622	2.9	1,156
Lambda-cyhalothrin	Karate	598	1.9	29
Dicrotophos	Bidrin	545	1.6	240
Aldicarb	Temik	538	1.1	254
Oxamyl	Vydate	451	1.9	205
Carbofuran	Furadan	385	1.3	116
Acephate	Orthene	340	1.6	128
Phorate	Thimet	322	1.0	179
Profenofos	Curacron	265	2.5	455
Cypermethrin	Ammo	240	1.3	14
Esfenvalerate	Asana	188	1.2	8
Tralomethrin	Scout X-tra	171	1.5	5
Malathion	several	147	4.0	553
Endosulfan	Thiodan	122	1.5	73
Cyfluthrin	Baythroid	112	1.6	8
Thiodicarb	Larvin	101	2.2	40
Zeta-cypermethrin	Fury	72	2.2	5
Dimethoate	several	72	1.5	26
Bifenthrin	Capture	66	2.0	4
Methomyl	Lannate	55	1.2	24
Ethyl parathion	several	34	2.9	101
Permethrin	Pounce	32	1.4	5
Chlorpyrifos	Lorsban	27	1.3	12
Amitraz	Ovasyn	23	2.1	14
Disulfoton	Di-Syston	22	1.0	8
Others*	several	67	1.1	27

***Others include methamidophos, diflubenzuron, oxydemeton-methyl, carbaryl, naled, fenpropathrin, diazinon, abamectin, and sulfur.**

Table 8. Methods of Insecticide Application.

	Responses per region			
Application	10	20	30	State
Time				
Before planting	1	1	2	2
At planting	3	5	20	11
After planting	96	94	78	87
Methods				
Aerial application	39	37	58	46
Ground-broadcast	44	40	14	29
Ground-banded	8	13	12	12
Ground-directed	7	7	3	5
In-furrow	2	3	12	7
In irrigation water	0	0	<1	<1
Applicator				
Farmer	55	61	40	51
Custom applicator	45	39	60	49
Number of responses	*283*	*824*	*835*	*1,942*

Table 9. Boll Weevil Insecticides.

Active ingredient	Recognized trade name	Region 10	20	30	State
		% of applications			
Azinphos-methyl	Guthion	34	35	17	31
Methyl parathion	several	36	18	12	22
Oxamyl	Vydate	6	20	21	16
Lambda-cyhalothrin	Karate	6	4	5	5
Dicrotophos	Bidrin	0	5	3	3
Malathion	several	2	2	12	3
Others*		16	16	30	20
Number of responses		*175*	*299*	*121*	*595*

*** Numerous other products which were 3% or less of the regional or statewide markets**.

Table 10. Bollworm Insecticides.

Active ingredient	Recognized trade name	Region 10	20	30	State
		% of applications			
Lambda-cyhalthrin	Karate	49	23	18	22
Cypermethrin	Ammo	5	1	25	15
Bacillus thuringiensis	several	0	26	2	11
Tralomethrin	Scout X-tra	8	3	13	9
Esfenvalerate	Asana	3	2	9	6
Thiodicarb	Larvin	3	11	2	6
Methyl parathion	several	10	3	2	3
Cyfluthrin	Baythroid	5	3	3	3
Dicrotophos	Bidrin	0	6	0	3
Azinphos methyl	Guthion	3	7	1	3
Others*		14	15	25	19
Number of responses		*39*	*207*	*337*	*585*

*** Numerous other products which were 3% or less of the regional or statewide markets**.

Table 11. Fleahopper Insecticides.

Active ingredient	Recognized trade name	Region 10	20	30	State
		% of applications			
Dicrotophos	Bidrin	52	44	37	44
Acephate	Orthene	15	21	7	18
Aldicarb	Temik	0	3	23	6
Dimethoate	several	4	6	7	7
Oxamyl	Vydate	19	6	10	9
Methyl parathion	several	4	3	0	2
Azinphos methyl	Guthion	0	6	0	2
Others*		6	11	16	10
Number of responses		*27*	*108*	*30*	*165*

*** Numerous other products which were 3% or less of the regional or statewide markets**.

Table 12. Aphid Insecticides.

Active ingredient	Recognized trade name	Region 10	20	30	Statewide
		% of applications			
Carbofuran	Furadan	0	16	34	29
Dicrotophos	Bidrin	17	39	19	24
Profenofos	Curacron	0	0	10	7
Chlorpyrifos	Lorsban	17	0	1	2
Acephate	Orthene	0	13	2	5
Aldicarb	Temik	0	3	4	4
Others*		66	29	30	29
Number of responses		*6*	*31*	*93*	*130*

*** Numerous other products which were 3% or less of the regional or statewide markets**.

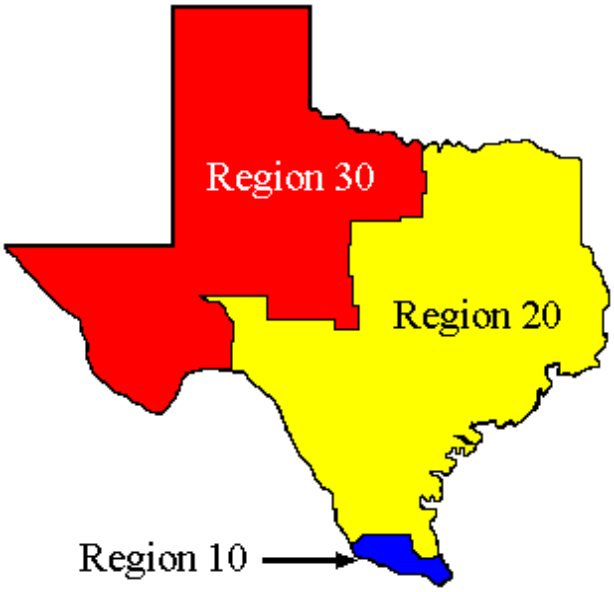


Figure 1: Survey Regions of Texas

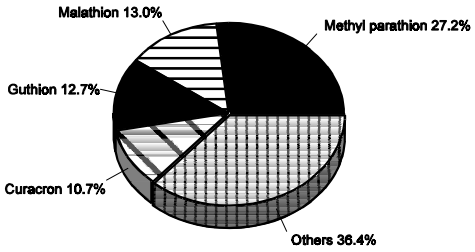
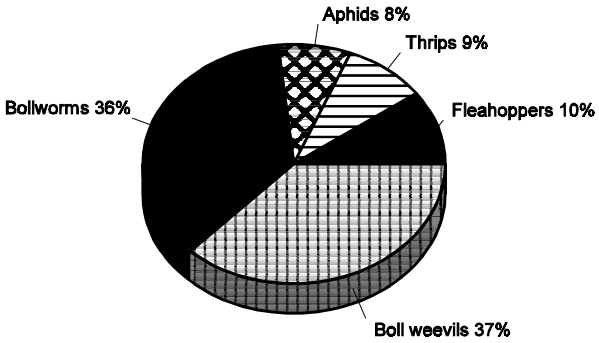


Figure 2: Major Insecticides Used in Cotton



(based on % of total active ingredient applied)
Figure 3: Percent of Insecticide Applications Targeting Specific Insect Pests

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