ASPECTS OF STEVENS COUNTY FARMERS' KNOWLEDGE AND PRACTICES AS RELATED TO SORGHUM PEST MANAGEMENT

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by

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INTRODUCTION

BACKGROUND

During the summer of 1968 an aphid called the greenbug, Schizaphis graminum (Rondani), became a major problem on grain sorghum in the High Plains. From that time greenbugs have continued to be a factor in grain sorghum production in Stevens County, Kansas. Since the beginning of the greenbug problem there have been, in many instances, incorrect identification of greenbugs and unscientifically based control measures applied to grain sorghum.

As a result of the infestation of greenbugs some Stevens County farmers participated in a pest management pilot program which began in the summer of 1973.

This study examined greenbug control measures applied by farmers and assesses their ability to recognize key pests and predators of grain sorghum. As a result of this study an informal educational program to increase farmers knowledge of grain sorghum pest management was developed.

PROBLEM AND IMPORTANCE OF STUDY

Stevens County is located in the southwest portion of Kansas, and is adjoined by Texas County, Oklahoma on the south, Seward County on the east, Grant County on the north, and Morton County on the west.

The county seat of Stevens County is Hugoton. In 1970, the population of Hugoton was 2,769, and the county population was 4,198.[1]

This study is important because of the economic impact of the large acreage of grain sorghum in Stevens County and the Great Plains states.

In 1970, Stevens County had the highest grain sorghum acreage of any county in Kansas. There were 139,000 acres of sorghum that produced a yield of 6,262,200 bushels.[2]

The Great Plains states of Texas, Kansas, Nebraska, Oklahoma, Colorado, South Dakota, and New Mexico, harvest approximately 90 percent of the total sorghum produced annually in the United States. In 1970, the acreages planted and harvested, and total yields were: United States, 16,807,000 acres; Great Plains states 15,041,000 acres; United States, 697,050,000 bushels; and Great Plains states, 613,688,000 bushels.[3]

As a result of the abundant supply of grain sorghum produced in the Great Plains states, many industries have developed. One of these is the cattle feeding industry. Sorghum was the key ingredient in the finishing ration of 13,038,000 cattle marketed from Great Plains' feedlots in 1971.[4]

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[1] General Population Characteristics, Kansas 1970, Census of Population, U. S. Dept. of Commerce, Bureau of the Census. PC(1) B 18.

[2] Farm Facts, Kansas State Board of Agriculture, State Printing Office, Topeka, Kansas. 1970-1971.

[3] Agricultural Statistic, United States Department of Agriculture. 1971.

[4] R. C. McIntyre, and G. L. Teetes, "High Plains-Panhandle Sorghum Pest Management Program Proposal." Great Plains Sorghum Pest Management Proposal. 1972. pp. 1-26.

In 1968, economically damaging infestations of greenbugs occurred on grain sorghum throughout the Great Plains states. The estimated grain sorghum acreages treated were: Texas, 1,500,000 acres; Kansas, 600,000 acres; Nebraska, 540,000 acres; Oklahoma, 300,000 acres; Colorado, 150,000 acres; and New Mexico, 137,000 acres.[5]

Sorghum may be attacked in any of its growth stages above ground and is damaged more severely by greenbugs than other aphids. Greenbugs inject into the sorghum plant a toxin that kills the plant tissues.[6] Damage is more critical on young sorghum plants where a few greenbugs may completely kill a seedling stand or severely affect its growth. More mature plants usually survive infestations but yields may be decreased.[7]

DEFINITIONS

The farmers in this study were referred to as respondents and cooperators. The respondents were the farmers that responded to the questionnaire that was mailed to them. Cooperators were the farmers interviewed who were involved in the pest management program.

Pest management is a method of insect suppression that will allow economic crop production, while at the same time create a minimum amount of disruption to the agricultural eco-system.

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[5] Cooperative Economic Insect Report, Plant Pest Control Division, Agriculture Research Service. USDA. 1968. 18:781.

[6] R. M. Chatters, and A. M. Schlehuber, Mechanics of Feeding of the Greenbug. Oklahoma Agricultural Experiment Station Bulletin. T-40. 1951. p. 18.

[7] L. J. DePew, "Evaluation of Foliar and Soil Treatments for Greenbug Control on Sorghum." Journal of Economic Entomology 64(1). Feb. 1971. pp. 169-72.

Effective pest management techniques are practices related to pest management; such as utilization of natural controls, more timely application of pesticides, correct identification of grain sorghum related insects, and correct insect control measures.

The pest management project was a farmer educational program on pest management techniques in grain sorghum. This project was a co-operative pilot study of Kansas State University, Stevens County Extension Council, and the United States Department of Agriculture.

The farmer and producer was a person who raised grain sorghum in Stevens County.

Predators are beneficial or natural control insects that feed on aphids.

Parasitic wasps are beneficial or natural control insects that parasitize and kill the aphids.

The term control was used to infer the reduction or elimination of insects artificially with applied chemicals or natural occurring insects.

Chapter II

LITERATURE REVIEW

HISTORY

In 1968, the Great Plains states sorghum producers were confronted with a crisis. The greenbug, Schizaphis graminum (Rondani), an aphid which had been primarily a pest of small grains, infested grain sorghum. Prior to this time the greenbug was not considered a major sorghum pest in the United States. This greenbug infestation, which was the first to cause widespread economic damage to grain sorghum, occurred in the summer of 1968. Severe infestations were reported from Arizona, Colorado, Kansas, Nebraska, Oklahoma, South Dakota, and Texas.[8]

In 1968, two major crops, wheat and sorghum, were threatened due to the outbreak of the sorghum greenbug. Wheat and sorghum could provide a year around host because of their overlapping growing seasons. In 1968, the greenbugs that attacked sorghum transferred to small grains, and killed volunteer wheat and seedling rye, during August.[9]

NEW GREENBUG BIOTYPE

The sorghum greenbugs were lighter in color and had different identifiable markings compared with the greenbugs originally found on

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[8] Cooperative Economic Insect Report, 1968. Ibid.

[9] T. L. Harvey, and H. L. Hackerott, "Plant Resistance to a Greenbug Biotype Injurious to Sorghum." Journal of Economic Entomology 62(6). Dec. 1969. pp. 1271-74.

wheat. The populations were greatest during June, July, and August, when temperatures were high, which indicated a new strain or biotype had developed.[10] Previous outbreaks of greenbugs on small grains had occurred during cool months, when the optimum temperature for greenbug reproduction was about 73 degrees F.[11]

Fort Hays Branch, Kansas Agricultural Experiment Station, conducted a study to distinguish between greenbugs originating on sorghum from those originating on wheat. This study established the existence of different biotypes of greenbugs and their effects on sorghum and small grains. The results of this study indicated a new biotype, called C, preferred sorghum more than the B biotype which preferred small grains.[12] This new greenbug biotype has been a perennial pest in grain sorghum since 1968. Since that time it has been considered a key pest of grain sorghum.[13]

INSECTICIDE EVALUATION

It was determined that the greenbug attacking grain sorghum reacted differently from the wheat greenbug under the same environmental conditions. Therefore, insecticides that controlled greenbugs infesting small grains during cool months may react differently when applied to sorghum during hot summer months.[14]

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[10]T. L. Harvey, and H. L. Hackerott, 1969. Ibid.

[11]N. E. Daniels, "The Effects of High Temperatures on Greenbug Reproduction." Journal of Kansas Entomology Society 40. 1967. pp. 133-37.

[12]Harvey and Hackerott, 1969. Ibid.

[13]G. L. Teetes, "Greenbugs on Sorghum." Crops and Soils Magazine. April-May 1973.

[14]DePew, 1971. Ibid.

A study to evaluate insecticides was conducted by Les DePew at the Kansas Branch Experiment Station at Garden City. The study evaluated insecticides applied as foliar and soil treatments on grain sorghum. Insecticides used were: carbo-phenothion, carbofuran, demeton, diazinon, dimethoate, disulfoton (Disyston), endrin, endosulfan, ethion, malathion, monocrotaphos, parathion, phoshpamidon, phorate (Thimet), and some proprietary compounds.[15]

The results of DePew's study, conducted in 1968, indicated all treatments except ethion were significantly effective in controlling the sorghum greenbug.[16]

A number of studies have been undertaken since the greenbugs infested grain sorghum. Economic injury to grain sorghum has been verified in studies.

GREENBUG DAMAGE TO SORGHUM

A study by Harvey and Hackerott in 1970, found that grain sorghum yields could be reduced by 45 percent when the plant in the soft dough stage lost two-thirds of its leaves from greenbug damage. It was also found that the use of insecticides to prevent the loss of more than 2.3 leaves on headed plants prevented economic damage.[17]

A study conducted by Teetes and Johnson in 1973, provided additional data on economic injury. The economic injury level is determined by

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[15]DePew, 1971. Ibid.

[16]DePew, 1971. Ibid.

[17]T. L. Harvey, and H. L. Hackerott, "Chemical Control of a Greenbug on Sorghum and Infestation Effects on Yields." Journal of Economic Entomology 63. 1970. pp. 1536-39.

the stage of plant growth, amount of leaf damage, and number of greenbugs prior to the soft dough stage of development of sorghum. Preboot and bloom stages of growth are susceptible periods for plant damage. Loss of four leaves per sorghum plant affected yield significantly. Loss of six leaves per plant, when in the preboot stage, reduced yield 36 percent. Greenbugs in excess of 1300 per plant and leaf loss in excess of three leaves per sorghum plant, at or near bloom stage, caused significant yield loss.[18]

CORN LEAF APHID STUDY

The amount of insecticides applied to grain sorghum has increased since 1968. A large amount of these insecticides has been used to control the corn leaf aphid. This aphid has not been proven to be an economic pest of grain sorghum.[19]

Due to the increased concern of sorghum growers in Kansas about reported damage to grain sorghum by the corn leaf aphid, a study was conducted at Kansas State University by Clifford E. Odinkenmere Ohiagu in 1972. One of the purposes of this study was to determine the economic injury level of this aphid in grain sorghum. This study was conducted at Rocky Ford Experiment Station, Manhattan, Kansas.

A granular insecticide, Thimet, was used on the treated rows to remove the corn leaf aphid populations. Corn leaf aphid counts were

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[18]George L. Teetes, and Jerry W. Johnson, "Damage Assessment of the Greenbug on Grain Sorghum." Journal of Economic Entomology 66(5). 1973. pp. 1181-86.

[19]McIntyre and Teetes, 1972. Ibid.

conducted in two fields which had populations just over 1000 and 1500 corn leaf aphids per plant. There was no significant difference in the yields between the treated and untreated rows. This study suggests that fairly large numbers of corn leaf aphids can be tolerated in grain sorghum without economic loss.[20]

NATURAL CONTROL AGENTS

Indications are that insecticides applied for corn leaf aphid control are unnecessary. Indiscriminate application of insecticides presents a clear and present danger to the agro-ecosystem.

One of the dangers of misuse of insecticides is the possibility of increased problems with secondary pests. Indiscriminate use of insecticides in grain sorghum may upset natural balances between predators and parasites and their hosts, aphids. Some producers have automatic or preventative pest control programs, even though economic thresholds or injury levels are established for greenbug control recommendations.[21]

Grain sorghum is usually infested by both corn leaf aphids and greenbugs. Often the corn leaf aphids appear earlier in the growing season. This early infestation in the growing season is believed to be a major factor in the build up of predators in sorghum. This build up tends to keep the later greenbug infestation from reaching damaging levels until relatively late in the growing season.[22]

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[20]Clifford E. Odinkenmere Ohiagu, "A Study of the Corn Leaf Aphid, on Grain Sorghum in Kansas." (Unpublished Master of Science thesis, Kansas State University, 1973). pp. 6-47.

[21]McIntyre and Teetes, 1972. Ibid.

[22]McIntyre and Teetes, 1972. Ibid.

The seasonal abundance study of predators associated with greenbugs conducted by Teetes in 1971, established that the predominant predators throughout the growing season were the ladybug, Hippodamia spp., and the lace wing, Chrysopa spp.[23]

Seasonal abundance data on major parasites of the greenbugs indicated that the major seasonal mortality factor in the greenbug population on grain sorghum was parasitism. The parasitic wasp, Lysiphlebus tetaceipes, accounted for approximately 75 percent of the total parasitism observed.[24] This mortality factor has brought the greenbug population under control by the middle of August every year since 1969. Therefore, greenbugs are under the influence of natural control agents for most of the growing season. In order for producers to take advantage of this natural control the indiscriminate use of insecticides must stop.[25]

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[23]G. L. Teetes, Report of Research on the Greenbug on Grain Sorghum in the Texas High Plains. 1971.

[24]D. G. Bottrell, Concepts for Insect Pest Management in Grain Sorghum Proc. (26th Annual ASTA Corn and Sorghum Research Conference, 1970, Chicago, Illinois).

[25]McIntyre and Teetes, 1972. Ibid.

Chapter III

MAILED SURVEY

A survey was conducted in Stevens County during June 1973, to test the farmers' knowledge and past experience with greenbug identification and control.

A return card questionnaire was mailed to 200 Stevens County farmers, selected randomly from the Extension Office mailing list consisting of 454 farmers. A random selection method was used whereby all names of farmers in Stevens County were placed in a box and 200 were drawn out. Fifty-one questionnaires, 25 percent, were returned.

A copy of the pest management questionnaire sent to the 200 farmers appears below.

PEST MANAGEMENT QUESTIONNAIRE

(Answer what you can and mail.)

1. Which of the following has caused the most damage to your grain sorghum in the past? greenbug_____ mite_____ corn leaf aphid_____

2. If you have had damage, what chemicals did you use to control? greenbugs_____, corn leaf aphids_____, mites_____ _____

3. How many acres of your grain sorghum did you spray for greenbug control during: 1968_____, 1969_____, 1970_____, 1971_____, 1972_____?

4. What % of grain sorghum acreage did you control greenbugs?
1968_____, 1969_____, 1970_____, 1971_____, 1972_____

5. Which of the predator insects has given the best control of greenbugs? ladybug_____, parasitic wasp_____, lace wing_____, do not know_____

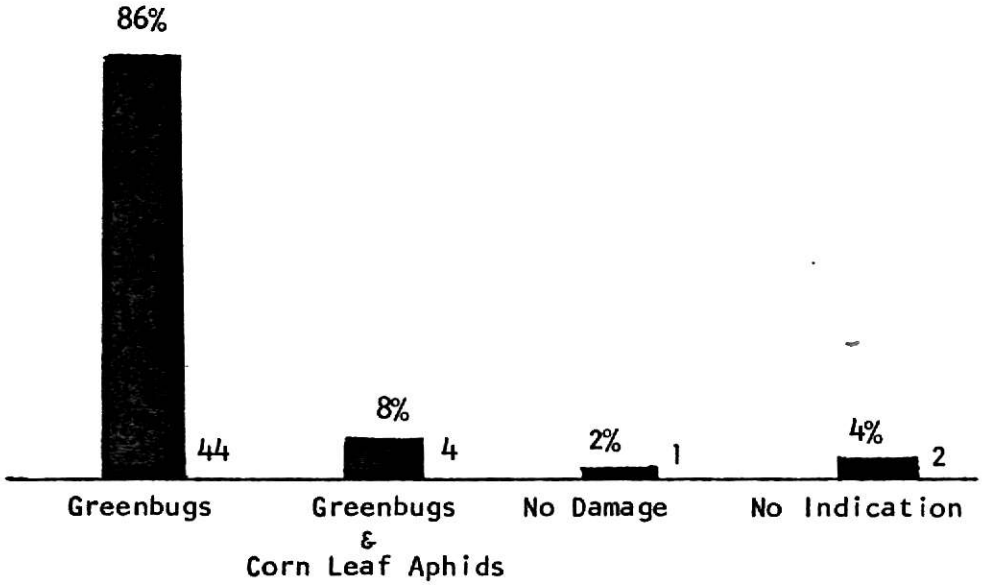
_____
Your Signature

RESULTS

The graphs presented in this study indicate the number of responses as well as the percentages they represent.

The following graph shows the results of the first question, "Which of the following has caused the most damage to your grain sorghum in the past?"

Figure 1. Farmers' Opinion of Insects Causing Damage to their Grain Sorghum

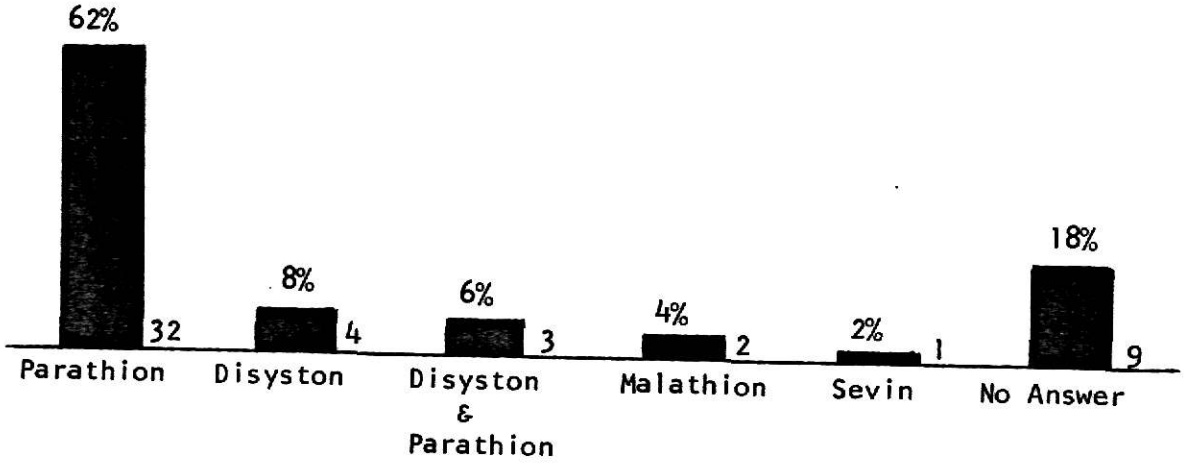


As is shown in figure 1, 86 percent of the responding farmers indicated that most damage to their grain sorghum was caused by greenbugs. Also, 8 percent of the respondents indicated both greenbugs and corn leaf aphids caused the most damage to their grain sorghum. Two percent indicated no damage from greenbugs, mites, or corn leaf aphids. None of the respondents felt mites damaged their grain sorghum.

A major portion of the respondents believed greenbug caused the most damage. This concurs with research findings. Eight percent believed both greenbugs and corn leaf aphids caused major damage to their grain sorghum. According to research findings, corn leaf aphids do not damage grain sorghum in economic terms.

The graph below shows the results of the second question, "If you have had damage, what chemicals did you use to control?"

Figure 2. Chemicals Used to Control Greenbugs on Sorghum



The majority of the respondents, 62 percent, indicated they used parathion to control greenbugs. Eight percent used Disyston and 6 percent used a combination of parathion and Disyston. Four percent of the respondents used malathion and 2 percent used Sevin for greenbug control.

Figure 3 shows the percent of farmers that used insecticides to control corn leaf aphids.

Figure 3. Chemicals Used to Control Corn Leaf Aphids

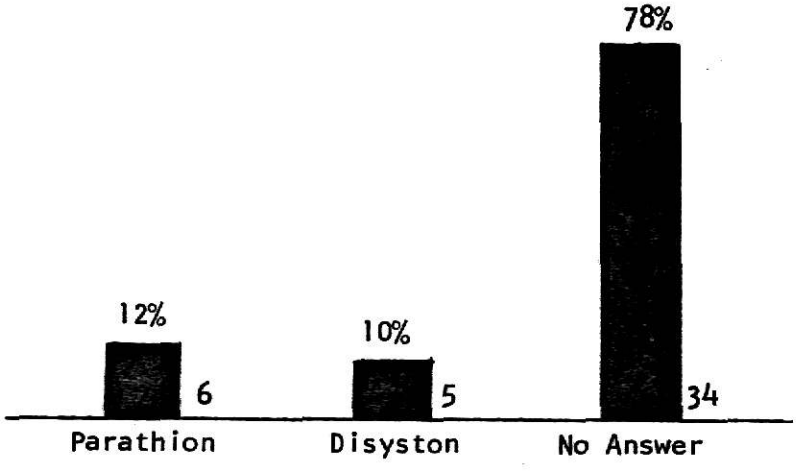
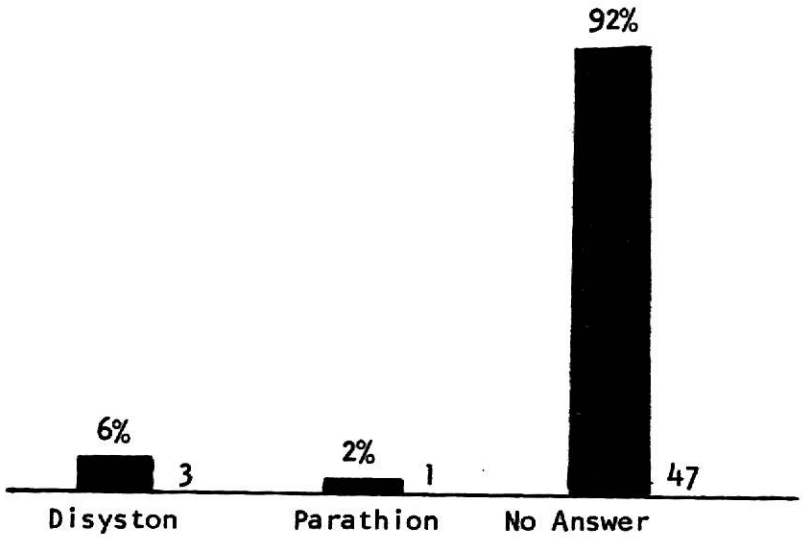


Figure 4 shows the number that used insecticides to control mites in sorghum.

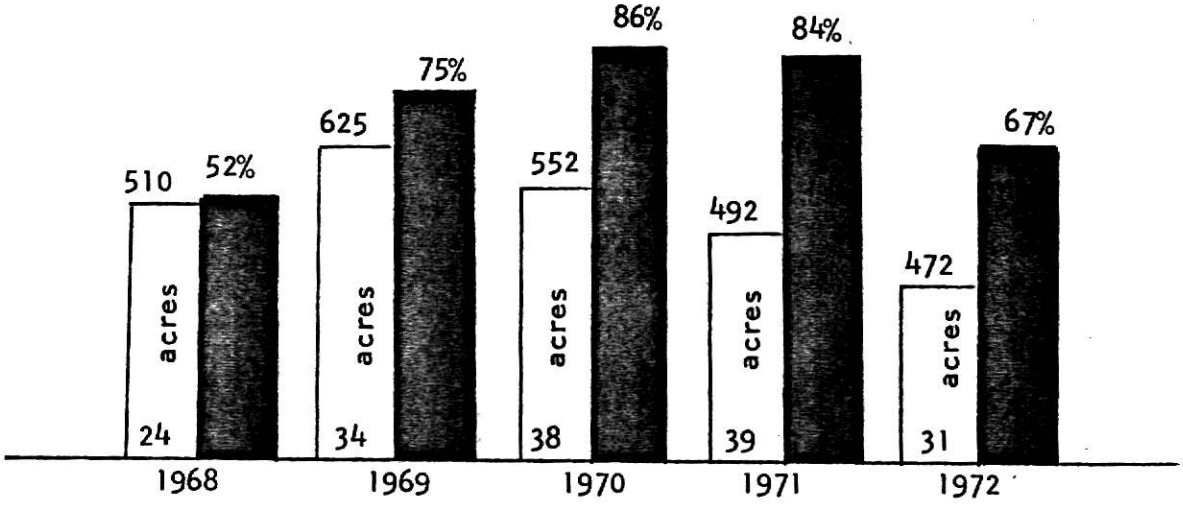
Figure 4. Chemicals Used to Control Mites



Both Disyston and parathion are registered for corn leaf aphid and mite control.

The following graph shows the results of the third question, "How many acres of your grain sorghum did you spray for greenbug control.

Figure 5. Acres and Percent of Farmers Controlling Greenbugs



In 1968, 52 percent of the respondents indicated they controlled greenbugs, with an average of 510 acres treated by each. During 1969, 75 percent of the respondents controlled greenbugs, with an average of 625 acres treated by each. In 1970, 86 percent of the respondents controlled greenbugs on an average of 552 acres of grain sorghum. In 1971, 84 percent of the respondents controlled greenbugs on an average of 492 acres.

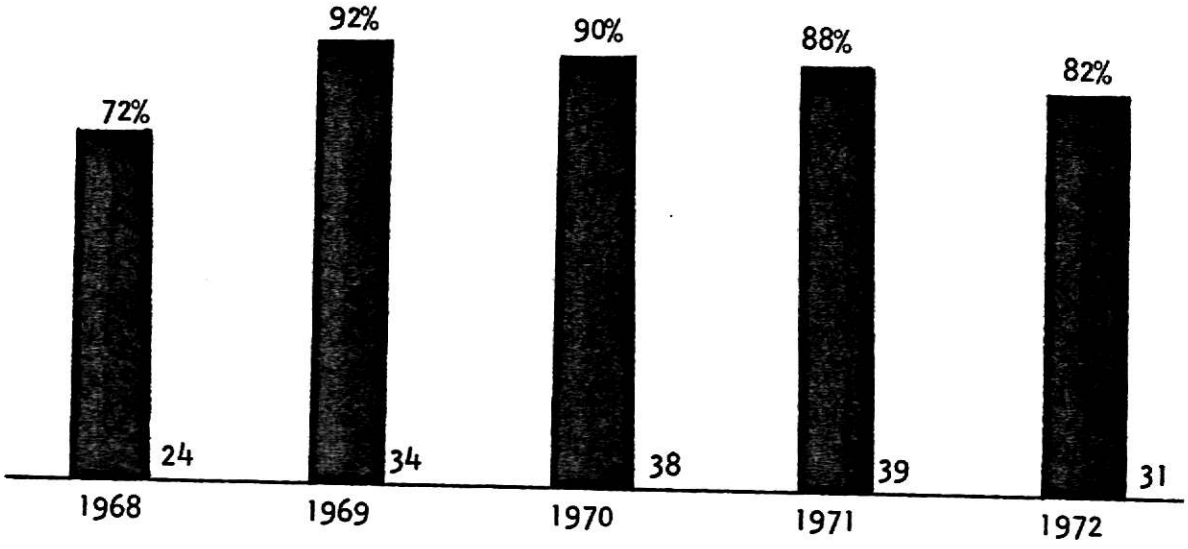
These figures indicate that approximately half the farmers controlled greenbugs in 1968. In 1969, three-fourths of the farmers controlled greenbugs and treated more acres than in 1968. In 1970, the number that controlled greenbugs increased to 86 percent but the farmers treated fewer acres than in 1969. During 1971, the number of farmers that controlled greenbugs exceeded the 1970 level but the number of acres treated continued to decrease. During 1972, the number of farmers that controlled greenbugs decreased to 67 percent and the number of acres treated decreased per farm to a level below that of 1968.

In question three the respondents indicated the number of acres they controlled for greenbugs from 1968-1972. The fourth question asked was, "What percent of grain sorghum acreage did you control greenbugs?" Figure 6 shows these percentages.

During 1968, the respondents that applied controls treated 72 percent of their total sorghum acreage. In 1969 those that controlled greenbugs increased the percentage of acres treated to 92 percent. In 1970 the percentage of total acres treated by respondents decreased

slightly to 90 percent. Again in 1971 the percentage treated decreased to 88 percent and continued to decrease to 82 percent in 1972.

Figure 6. Percent of Acres Receiving Chemical Treatment for Greenbugs as Reported by Farmers

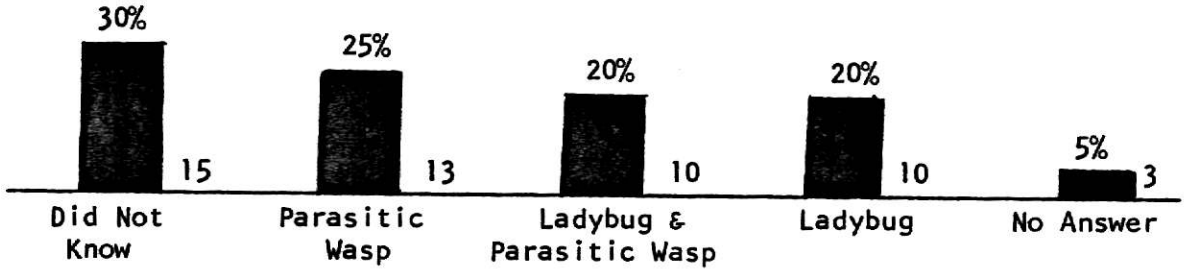


In question five the respondents were asked, "Which of the predator insects has given the best control of greenbugs; ladybug, parasitic wasp, or lace wing?" Figure 7 indicates the results.

Thirty percent of the respondents did not know which of the predators gave the best control. Twenty-five percent indicated the parasitic wasp gave the best control which, according to research, is the correct answer. Twenty percent of the respondents indicated both the ladybug and parasitic wasp gave the best control. Thus, 45 percent of the respondents gave an appropriate response. This indicates

that a large percentage of the respondents knew the key control pest for greenbugs was the parasitic wasp. Of the remaining respondents, 20 percent indicated that the ladybug gave the best control, and 5 percent gave no answer. None indicated the lace wing as the best predator.

Figure 7. Predators Which Gave Best Control in the Opinion of Farmers



INTERVIEWS

Interviews were conducted in an effort to determine the knowledge and experience of the Stevens County pest management cooperators concerning greenbug identification and control. The pest management cooperators were mailed a letter asking them to come to the Extension office to discuss the pest management project. From the 39 farmers enrolled in this project, 12 or 31 percent were interviewed. The interviews were conducted by the Stevens County Extension Agricultural Agent at the Extension office.

At the beginning of the interview the agent explained the reasons for the interview. Each cooperator was shown the pamphlet, "Insects

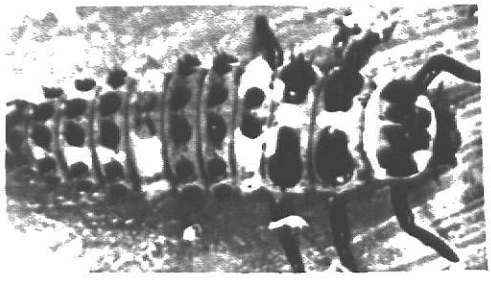
on Deciduous Fruits and Tree Nuts in the Home Orchard." This pamphlet showed pictures of beneficial insects. They were asked to identify pictures of ladybug larva, ladybug adult, lace wing adult, lace wing larva, syrphid fly adult, syrphid fly larva, a mummified aphid, and the corn leaf aphid.

A copy of the Greenbug Survey used by the agent to interview the pest management cooperators is reproduced below.

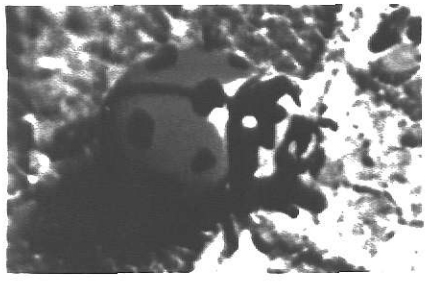
Farmer's Name _____

GREENBUG SURVEY

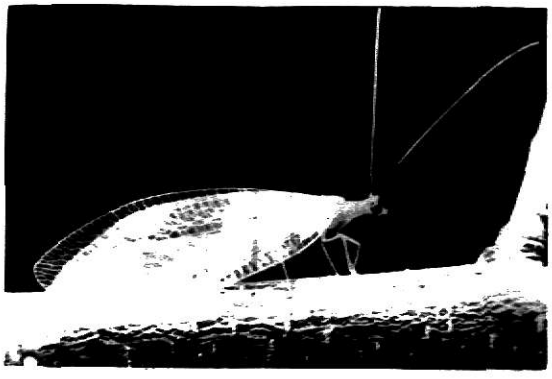
1. What is the name of this insect?



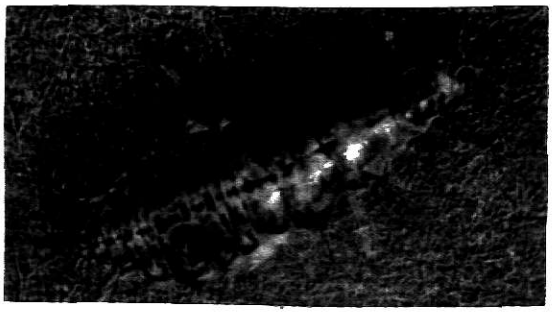
2. What is the name of this insect?



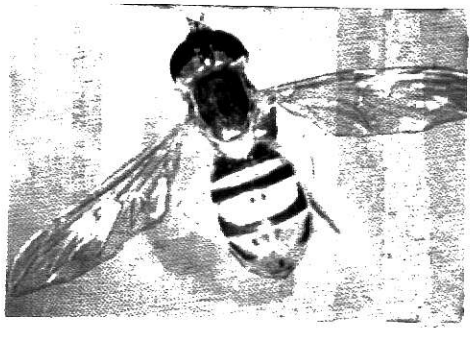
3. What is the name of this insect?



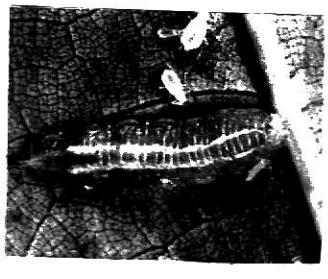
4. What is this?



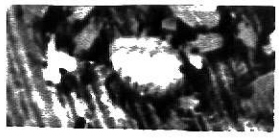
5. What is this?



6. What is this?



7. What is this?



8. What are these?

9. Which caused the most damage to your grain sorghum in the past?
greenbug_____ mite_____ corn leaf aphid_____

10. How many acres did you control greenbugs on during 1968?
_____acres, chemical used_____, grain sorghum_____%.

How many times did you spray the field?
What chemical?

11. How many acres during 1969?_____ acres, chemical used_____,
grain sorghum controlled _____%.

How many times did you spray the field? _____
With what chemical? _____

12. How many acres during 1970? _____acres, chemical used_____,
grain sorghum controlled_____%.

How many times did you spray the field? _____
With what chemical?_____

13. How many acres during 1971? _____, chemical used_____,
grain sorghum controlled _____%.

How many times did you spray the field? _____
With what chemical? _____

14. How many acres during 1972? _____acres, chemical used_____,
grain sorghum controlled _____%.

How many times did you spray the field? _____
With what chemical? _____

15. What predator insect gave the best control? ladybug_____,
lace wing_____, parasitic wasp_____, other_____, don't know_____

16. Do you think you received damage from corn leaf aphids?
yes_____, no_____, how much?_____

17. How many acres of little seed did you have during 1968_____, 1969_____, 1970_____, 1971_____, 1972_____?

18. How many acres of lodging occurred during 1968_____, 1969_____, 1970_____, 1971_____, 1972_____?

19. Do you think there is a need for field pest survey service? yes__, no__

20. How much is this service worth per acre?
50¢_____, 75¢_____, $1.00_____, $1.50_____, $2.00_____

RESULTS

The results of the beneficial insect identification questions are indicated below. Table 1 shows the number of correct and incorrect responses and the percentage they represent.

Table 1. Responses on insect identification

	Correct Answer		Incorrect Answer		
	No.	%	No.	%	Comments
Ladybug Larva	9	75	3	25	
Ladybug Adult	12	100	0		
Lace Wing Adult	7	58	5	42	
Lace Wing Larva	2	17	10	83	
Syrphid Fly Adult	0		12	100	75% indicated parasitic wasp
Syrphid Fly Larva	0		12	100	
Aphid Mummy	6	50	6	50	
Corn Leaf Aphid	3	25	9	75	50% indicated greenbug

Most of the pest management cooperators interviewed identified the ladybug larva and adult correctly. A majority identified the lace wing adult but only 2 of 12 identified the larva correctly. All cooperators gave incorrect responses when identifying the syrphid fly adult and larva. It was noteworthy that most of them identified the syrphid fly adult as a parasitic wasp. This indicated that they knew of a parasitic wasp. Half the cooperators correctly identified the mummified aphid and knew that the parasitic wasp was involved. Only 25 percent gave a correct response when identifying the corn leaf aphid. Half of them identified it incorrectly as the greenbug. The results in identifying the corn leaf aphid might have improved if pictures of both the greenbug and corn leaf aphid had been shown simultaneously

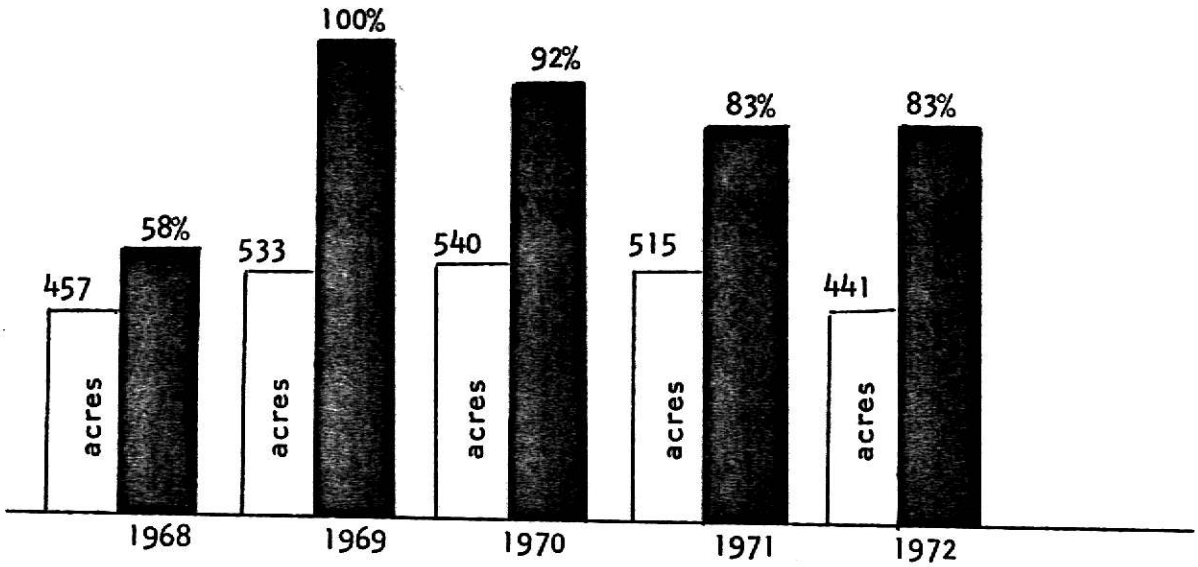
for comparison. The fact remains that most of the cooperators identified the corn leaf aphid incorrectly. This indicated a lack of knowledge.

The cooperators interviewed were asked, "Which caused the most damage to your grain sorghum in the past, greenbugs, mites, corn leaf aphids?", the same question as in the mail survey. All the cooperators interviewed indicated greenbugs had caused the most damage.

The cooperators interviewed were also asked two other questions that were included in the mailed questionnaire. "How many acres did you control for greenbugs during 1968, '69, '70, '71, & '72?" and "What chemical did you use and what percentage of grain sorghum did you control?" In addition to the preceding questions the cooperators were asked, "How many times did you spray the field?" and "With what chemical?"

Figure 8 indicates the percentage of cooperators interviewed that controlled greenbugs and the number of acres they treated each year.

Figure 8. Percent of Farmers Controlling Greenbugs and the Average Acreage Which They Reported Treated



In 1968, 58 percent of the cooperators controlled greenbugs with an average of 457 acres treated by each. During 1969, 100 percent of the cooperators controlled greenbugs on an average of 533 acres of grain sorghum. Ninety-two percent of these farmers treated an average of 540 acres in 1970. Eighty-three percent of them treated an average of 515 acres of sorghum in 1971. The same percentage of cooperators controlled greenbugs in 1972, 83 percent, but the average acres treated decreased to 441. These figures indicate that a majority of these farmers were controlling greenbugs in grain sorghum and treating a large number of acres.

In figure 8, cooperators indicated the number of acres treated and whether they controlled greenbugs during 1968-72. The following, figure 9, shows the percentage of acres they treated for greenbugs and the percent of acres they treated more than once.

The cooperators that controlled greenbugs in 1968 treated 80 percent of their grain sorghum acreage, with 13 percent of these farmers using controls more than once. In 1969 they treated an average of 93 percent of their acreage and 17 percent treated more than once. In 1970 cooperators treated 92 percent of their acreage, with 27 percent of them treating more than once. During 1971 they treated 90 percent of their sorghum acreage and 20 percent of them treated more than one time. Those farmers that controlled greenbugs in 1972 treated 76 percent of their acreage and 10 percent of them treated more than once.

The following figures were compiled from the cooperators that indicated they controlled greenbugs in grain sorghum. The figures in this graph indicate the percent of cooperators that applied different pesticide chemicals.

Figure 9. Percent of Acres That Received Greenbug Control by Year

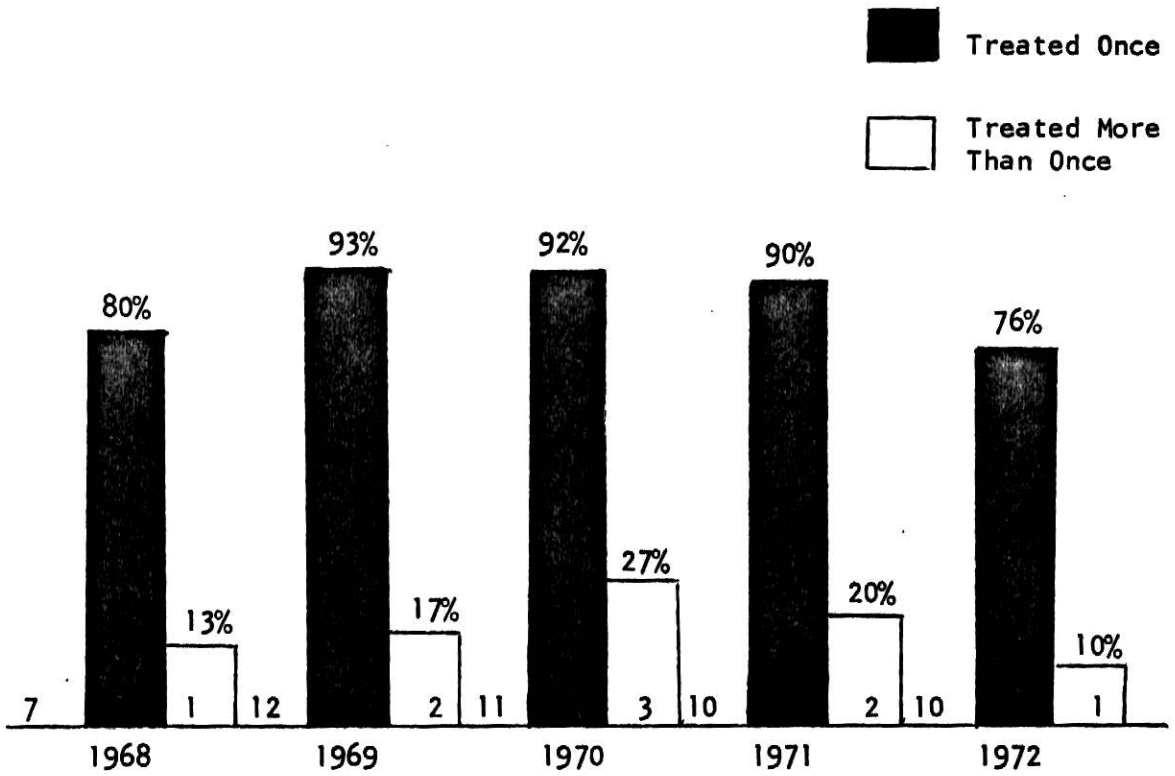
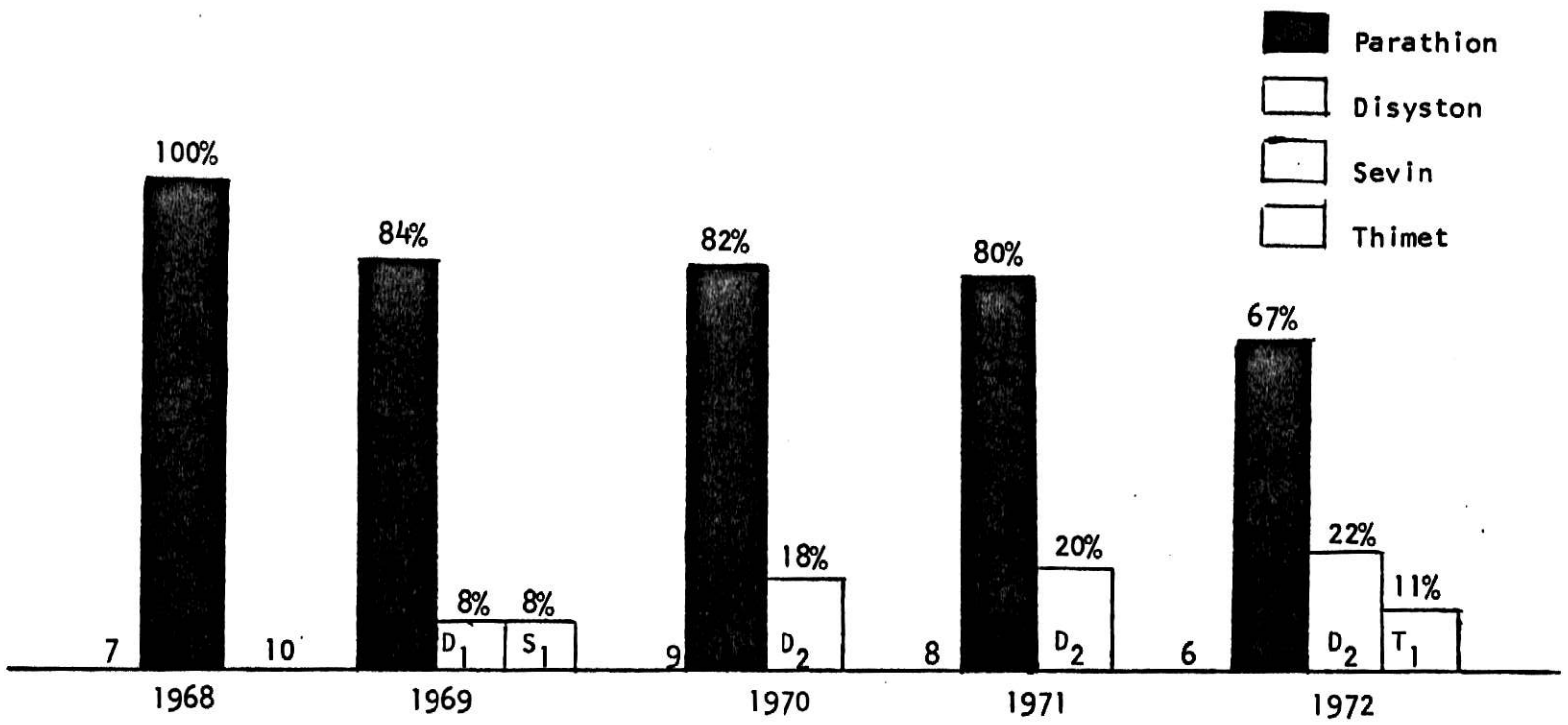


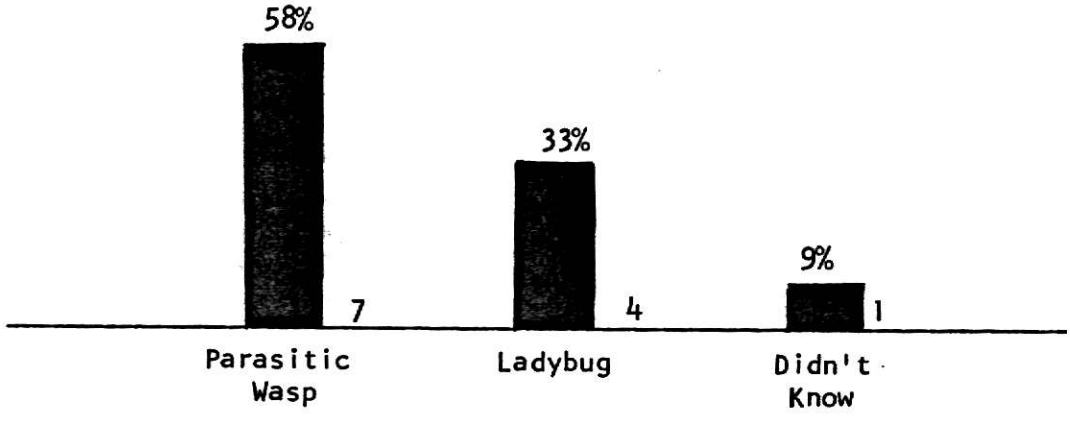
Figure 10. Pesticides Applied for Greenbug Control as Reported by a Sample of Farmers



In 1968, 100 percent of the cooperators used parathion. In 1969, 84 percent used parathion, 8 percent used Disyston, and 8 percent used Sevin. Eighty-two percent of these farmers applied parathion and 18 percent applied Disyston in 1970. In 1971, parathion and Disyston were used by 80 and 20 percent, respectively. In 1972, 67 percent applied parathion, 22 percent applied Disyston, and 11 percent applied Thimet. Research indicated all these chemicals were effective for greenbug control except Sevin.

The cooperators were asked: "What predator insect gave the best control; ladybug, lace wing, or parasitic wasp?" Figure 11 indicates their responses.

Figure 11. Opinions of Farmers' Estimate of Predators That Controlled Greenbugs Best



Fifty-eight percent of the cooperators indicated that the parasitic wasp gave the best control. Thirty-three percent indicated the ladybug and 9 percent did not know which gave the best control.

The cooperators were asked: "Do you think you received damage from corn leaf aphids?" If so, how much" The results of these questions are shown in figures 12 and 13.

Figure 12. Percent of Farmers Who Believed They Had Received Damage to Sorghum From Corn Leaf Aphids

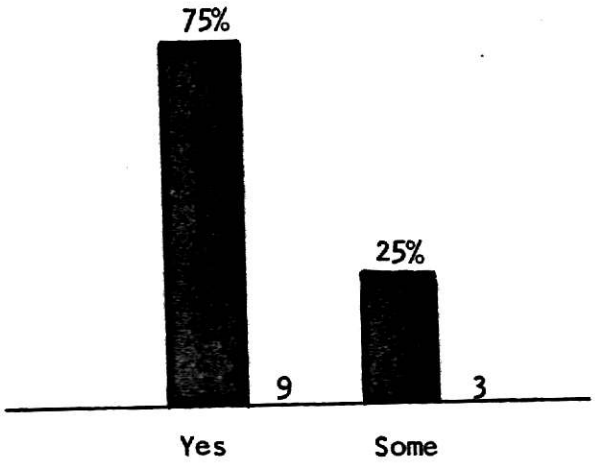
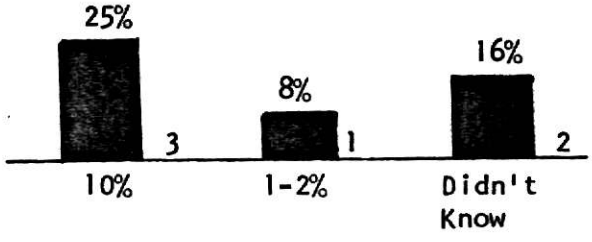


Figure 13. Amount of Corn Leaf Aphid Damage as Reported by Farmers



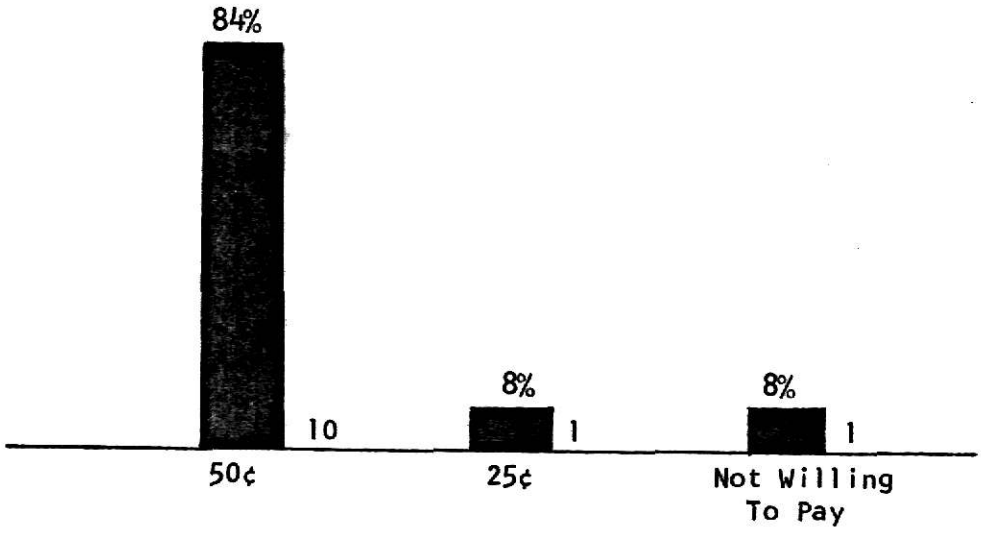
Seventy-five percent of the cooperators indicated they thought they received damage from corn leaf aphids. Twenty-five percent indicated they felt they received some damage. When asked how much damage, 16 percent of them did not know, 25 percent indicated 10 percent damage, and 8 percent indicated 1-2 percent damage.

Two questions asked the cooperators that were not used in this study were: "How many acres of little seed did you have during 1968-72?" and "How many acres of lodging occurred during 1968-72?" There were not enough answers to be significant. Also, these questions did not relate to the greenbug problem.

The cooperators were asked: "Do you think there is a need for a field pest survey service?" All of them gave an affirmative response.

The last question asked was: "How much is this service worth per acre: 50¢, 75¢, $1.00, $1.50, $2.00?" Their responses are shown in figure 14.

Figure 14. Pest Management Service Worth Per Acre



Eighty-four percent of the cooperators indicated the field pest survey service was worth 50¢ per acre. Eight percent indicated 25¢ per acre and 8 percent indicated that they were not willing to pay for the service.

Chapter IV

CONCLUSIONS

The results of the mailed survey and the interview survey were substantially the same. These surveys indicate that farmers require more knowledge of non-economically damaging pests, as well as beneficial insects. Beneficial insects would include the parasitic wasps and other predators and non-economically damaging pests being primarily corn leaf aphids.

A large percentage of the farmers knew that the greenbugs were the key pest in grain sorghum. Also, a majority of farmers used control measures on greenbugs during the years 1968-72, with 1968 being the first year they began to control greenbugs. In 1969, the number of acres controlled for greenbugs peaked and then decreased through 1972.

A large number of farmers applied insecticides to grain sorghum to control greenbugs and corn leaf aphids. A number of these farmers indicated that corn leaf aphids were damaging their grain sorghum. This contradicts research studies that have not found corn leaf aphids to cause economic damage to sorghum. This study revealed the fact that many farmers incorrectly identified corn leaf aphids as greenbugs. This indicated a lack of knowledge concerning pest identification.

It also became evident that some farmers were not able to identify the key insects beneficial to controlling greenbugs in grain sorghum. These same farmers were using large amounts of insecticides for greenbug

control that were costly and may not have been required. This again indicated a lack of farmers' knowledge of recommended pest management techniques for grain sorghum.

GOALS OF THE EDUCATIONAL PROGRAM

The preceding information indicated a need for an educational program concerning pest management techniques in grain sorghum in Stevens County. In order to reach the goal of increasing the farmers' knowledge of pest management techniques, the informal educational program will be expanded in Stevens County by the County Extension Agricultural Agent.

The long-range goals:

1. Increase the Stevens County farmers' ability to identify grain sorghum pests and use appropriate control measures.

2. Persuade the majority of farmers to adopt pest management techniques.

3. Increase the farmers' timely use of control measures.

4. Decrease the amount of pesticides applied to grain sorghum.

5. Increase the farmers' income by decreasing the amount of damage from major grain sorghum pests.

The short range goals:

1. Cooperate with the United States Department of Agriculture and Kansas State University Extension in a pest management pilot study.

2. Utilize the most effective pest management techniques in an educational program.

3. Develop more efficient activities and methods for identification of major pests and predators of grain sorghum.

4. Request the Kansas State University Extension Service to develop pest management educational material on the major pests and predators in grain sorghum.

OBJECTIVES OF THE EDUCATIONAL PROGRAM

In order to reach the stated goals the following objectives have been established:

1. Increase the Stevens County sorghum farmers' ability to correctly identify greenbugs and corn leaf aphids from the 75 percent incorrect answers in 1973 to 75 percent correct answers over the next five years.

2. Increase the farmers' identification of the beneficial insects in sorghum from the 57 percent incorrect in 1973, to 75 percent correct identification by 1978.

3. Decrease the amount of pesticides applied to grain sorghum for greenbug control in the next 5 years by 10 percent.

4. By 1976, eliminate the multiple applications of insecticides used for greenbug control on grain sorghum.

5. Change the control measures used on corn leaf aphids from 22 percent of the farmers controlling in 1972, to zero control of these aphids in five years.

6. By 1975, a majority of the Stevens County farmers will come to know that corn leaf aphids do not cause damage to grain sorghum, compared to the majority of farmers in 1973 that indicated corn leaf aphids did cause damage.

EDUCATIONAL ACTIVITIES

To meet the objectives of the informal educational program concerning pest management techniques for the Stevens County grain sorghum producers the following educational activities should be implemented:

1. Continue the pest management pilot study activities.

2. Hold meetings with the Stevens County Extension Agricultural Advisory Committee to solicit suggestions on how to best implement the educational program.

3. Utilize the Hugoton Hermes, a weekly paper with countywide circulation, to inform the farmers of current pest problems.

4. Hold meetings of grain sorghum producers to present detailed grain sorghum pest management information. An outline of the informational presentation, a 35 mm slide program on pest management techniques and sorghum pest problems, has been prepared as an Appendix.

5. Hold public meetings to explain the pest management concept and control methods.

6. Cooperate with commercial pesticide applicators to provide information and advice on control programs.

7. Utilize state and area Extension Entomology Specialists to conduct pest management educational programs.

8. Suggest that Extension editors produce major pest and predator information materials for distribution in Kansas.

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APPENDIX

35 mm Slide Presentation on Greenbugs

Slide No.	Subject
1	Greenbugs on sorghum leaf.
2 & 3	Close up of greenbugs on sorghum leaf and visible damage.
4	Field of seedling sorghum.
5, 6 & 7	Close up of greenbugs on seedling sorghum showing winged and wingless adults.
8	Pest management scout checking sorghum field for greenbugs.
9	Pest management scouts receiving field training from entomology and plant pathology specialists.
10, 11 & 12	Close up of greenbugs, corn leaf aphids, and mummified aphids.
13	Close up of a parasitic wasp.
14	Close up of ladybug larva.
15	Sorghum field with corn leaf aphid feeding evidence.
16	Close up of sorghum whorl from corn leaf aphid feeding.
17	Sorghum field view with johnsongrass and maize dwarf mosaic (MDM) symptoms next to johnsongrass.
18	Close up of MDM plants.
19 & 20	Sorghum leaf showing late season MDM symptoms.
21	Close up of leaf blight.

APPENDIX (cont'd)

Slide No.	Subject
22	Sorghum showing effects of severe MDM that delayed maturity.
23	Sorghum head with little seeds.
24	Sorghum field with pesticide burn symptoms.

ASPECTS OF STEVENS COUNTY FARMERS' KNOWLEDGE AND PRACTICES AS RELATED TO SORGHUM PEST MANAGEMENT

by

JAMES DALE CARSON

B. S., Oklahoma State University, 1963

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1974

In 1968, an aphid called the greenbug, Schizaphis graminum (Rondani), became a major problem on sorghum plants in the High Plains.

This study measured the Stevens County farmers' knowledge and experience concerning greenbug control in the years 1968-73. Two methods were used to determine farmers' knowledge and experience. The first was a mail questionnaire in which 51 of the farmers, or 25 percent sampled, responded. The second method was an interview survey in which 12 of the pest management cooperators, 31 percent, were interviewed. The following areas were measured: farmers' knowledge concerning the identification and economic behavior of sorghum pests and predators; number of farmers that used control measures; the acres of sorghum that were treated from 1968-72; and which pesticides were applied.

Conclusions of the two methods of study were in agreement. They indicated that Stevens County farmers required more knowledge of the pests and predators affecting sorghum, and that over three-fourths of Stevens County farmers have been applying pesticides to an average of about 500 acres of grain sorghum per farmer.

Based on these results, the informal educational program of Stevens County will be expanded by the Stevens County Extension Agricultural Agent to increase farmers' knowledge and skills in pest management techniques for grain sorghum.