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A COMPARISON OF THE EFFECTIVENESS
OF FOUR UNITS OF INSTRUCTION FOR PESTICIDE
CERTIFICATION IN KANSAS

by

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CHAPTER I

INTRODUCTION

In Chapter I the writer presented an overview of the importance of instructional units for pesticide usage. Included is a background for the study, statement of the problem, limitations of the study, importance of the study, and definition of terms used in the study.

Background

Since the passage of Kansas Pesticide Use Law in 1970, educators have been called on to provide training for various groups who may choose to become qualified to apply pesticides in Kansas after January 1, 1973.

This has created a need for identification of competencies for pesticide applicators in order that proper and valuable training will be provided for pesticide certification in the State of Kansas. In a meeting on December 14, 1970 with a representative of the Kansas State Board of Agriculture, it was stated that as many as 5,000 pesticide applicators needed different levels of instruction in order to meet qualifications for licenses to apply pesticides in the State of Kansas in 1973. In addition to those in business prior to 1973, new trainees would be needed to supply the manpower to meet the demands of a growing industry.

In January 1965, the staff and advisory committee for the Center of Research and Leadership Development in Vocational and Technical

Education at the Ohio State University recommended development of curricular materials in a number of areas based on research and emerging trends, which were particularly pertinent at the time to manpower problems in agriculture and which needed further detailed study. The area of agricultural chemicals at the technical level was one of the areas which was studied, (Ohio, 1965).

It seemed logical to the writer that if the competencies required for licensed applicators of pesticides were determined then and the current courses of study could be evaluated, and adapted to aid in the certification of present and future pesticide applicators and users. The suggested program could be incorporated in the Vocational Agriculture curriculum to better prepare agriculturists for future pesticide involvement. A Federal Law passed by Congress effected the involvement and environmental control of pesticide usage by the Environmental Protection Agency to cover all agriculturists in the State of Kansas. The Kansas Pesticide Use Law, 1970, (K.S.A. 2-2413 to 2-2437, enforcement date January 1, 1973) required that an applicant for a license shall show upon examination that he possessed adequate knowledge concerning the proper use and application of pesticides. The Manufacturing Chemist' Association, Inc. (1963) stated that, "An effective management of our environment, by chemical and other means, is of evergrowing importance."

The range of applicator personnel requiring certification encompassed people of different ages, different educational levels and occupational experiences. Instructional materials must be evaluated in order to meet the needs of people requiring certification under the present law. Additional instructional materials needed to

be developed and made available and new materials needed to be adapted to various classroom situations. The writer was an instructor of Agricultural Chemical Technology at the Liberal Area Vocational and Technical School hereafter referred as LAVTS. He desired to use the available instructional materials in his classroom situation.

Units of instructional materials available were: (1) Study Guides by the Weed and Pesticide Division of the Kansas State Department of Agriculture (1972), (2) Kansas Pesticide Users Handbook by Kansas Extension Service (1972), (3) Agricultural Chemical Special, and (4) Agricultural Chemical Regular. Units three and four were produced at the LAVTS in 1970 by the instructors, Kenneth Schuster and his assistant, the writer of this report.

Statement of the Problem

This study was an evaluation of the units of instructional material which were available. It included the Study Guides by KSDA, Kansas Pesticide Users Handbook, and the two units of instructional material for pesticide certification developed by the instructor of Agricultural Chemical Technology at the LAVTS. The null hypothesis was that there was no difference between the means of the scores produced by examination using the four units of instruction.

Limitations of the Study

This study was restricted to pesticide applicators in southwestern Kansas and further limited to only those participating in the study offered at the LAVTS. The study was completed in a 12 month period. The research program was limited to the four different units of instructional material as stated in the problem.

Importance of the Study

With the passage of the Kansas Pesticide Use Law of 1972 it became imperative that all pesticide applicators pass an examination on the proper handling of pesticides. The implementation of this act was given very high priority by state and federal authorities. The Manufacturing Chemists' Association, Inc. (1963) stated, "In the immediate years ahead, it will become increasingly apparent that the problems of our environment are many, extending from the land and to the water and even to the air we breathe. In many ways, we are the victims of our own success, which has brought us health, extended our life span, and increased our numbers until the seams of our cities are bursting. Indeed, our world may soon be too small."

It is important to evaluate the units of instructional material on pesticides and their use to insure that chemical applicators could meet the needs of the present and of the future. The assessment and adjustment of information regarding pesticides must provide the criteria for guidance in a continuous process of education for applicators and agriculturists.

Definition of Terms

Agribusiness. Agribusiness refers to those non-farm agricultural industries and businesses which provided supplies and services to farmers and other agricultural personnel.

Certification. Certification of personnel by examination for pesticide applicator's license and certification that the holder possessed adequate knowledge concerning the proper use and application

of pesticides.

Competencies. The term competencies are used to indicate those abilities and understandings necessary to complete a given task.

Criterion. The post-test which the researcher used to test the hypothesis.

Defoliant. Any substance or mixture of substances used to cause the leaves or foliage to drop from a plant.

Desiccant. Any substance or mixture of substances used to artificially accelerate the drying of any plant tissue.

Environmental Protection Agency. The Agency which was implemented in 1970 by the Federal Government to handle all chemicals as they pertained to man and his environment.

General Safety and Law. General Safety pertained to the safety of handling and applying chemicals and the Law to understand the implications and limitations of the Act.

Herbicides. Herbicides mean, but is not limited to, any substance or mixture of substances intended to be used as a plant (weed) killer.

Insect. A small invertebrate animal having the body segmented, belonging to the class insects, and other classes of arthropods.

Insecticides. Insecticides mean, but is not limited to, substance or mixture of substances, including any living organism or

any product derived therefrom, used to prevent, destroy, control, repel, attract, or mitigate any insect or other arthropods.

KSDA. Kansas State Department of Agriculture.

LAVTS. Liberal Area Vocational and Technical School.

Occupational experiences. Experiences relative only to chemical and pesticide involvement.

Pest. Pest means, but is not limited to, any insect, fungus, rodent, nematode, snail, slug, weed and any form of plant or animal life or virus, except virus on or in living man or other animal.

Pesticide. Pesticide means, but not limited to, (1) any substance or mixture of substances, including any living organism or any product derived therefrom, used to prevent, destroy, control, repel, attract, or mitigate any pest, and (2) any substance or mixture of substances intended to be used as a plant regulator, defoliant or desiccant.

Pesticide applicator. A person who owns or who manages a pesticide application business performing the services of applying pesticides.

Weed. A plant or part thereof which grows where not wanted.

Weed and Pest Division. Division of Kansas State Department of Agriculture charged with administration of the law.

CHAPTER II

REVIEW OF SELECTED LITERATURE

A survey was made of literature, which included Master's reports, Ph.D. dissertations, textbooks, bulletins, pamphlets, and other published and unpublished materials. From the survey, certain literature was selected for review in this report.

A limited number of studies had been conducted to identify the competencies required for employment in the agribusiness industry of pesticide application. The reason for unavailability of studies may have been that there had not been restrictions on chemical pesticide applicators. The significance and urgency for change was made prevalent by the recognized importance of such topics as environmental controls, pollution by agriculture, and other factors. The Vocational Education Act of 1963 that was passed called for training for employment in agriculturally related occupations by vocational agriculture departments. An increased importance had been added since the Environmental Protection Agency had taken over the duties from the Agriculture Department for handling agricultural chemicals.

A major work by Bundy (1965:180-181) in the area of agricultural chemicals tested twenty-nine competencies in the managerial, sales, and service areas of agrichemical employment. Managers indicated that twenty-six of the twenty-nine competencies were "much needed" in their job. Sales personnel needed "much" competence in seventeen of

the twenty-nine areas and fourteen of the twenty-nine were "much" needed by the service men. Bundy (1965) combined the three groups and in order of importance the most ten needed competencies were:

1. Ability to determine the amount of fertilizer required for various levels of crop production.
2. Knowledge of seed quality and plant population relative to fertilizer response.
3. Knowledge of weed and insect problems and their control.
4. Ability to interpret soil test reports.
5. Ability to identify fertilizer materials and evaluate fertilizer formulas.
6. Ability to make proper recommendations regarding fertilizer and pesticides uses.
7. Ability to recognize good new fertilizer and pesticides, and recommend their use.
8. Ability to make recommendations in absence of a soil test report.
9. Ability to recognize plant food deficiency in growing crops.
10. Ability to determine an individual's financial situation and management level.

Subject matter knowledge considered most important for agribusiness employment as selected from forty-six technical subjects as determined by Agan (1964:15-16) in a Kansas study in order of importance were:

1. Current general agricultural knowledge.
2. Salesmanship.
3. Tractors, power units, and mechanics.
4. Soils and crops.
5. Agricultural chemicals, insects, and pest control.

Stevenson (1966:136-137) of Oklahoma reported that managerial employees in an agricultural supply business, such as chemical retailer, should be highly trained in plant and animal science, have some training in chemicals, soil science, and agribusiness management, but needed very little training in agricultural mechanics.

Agan (1964:15) reported that employees of all agribusiness should possess non-technical competencies in conjunction with the

technical competencies. It was found that the average agribusiness employee works with people outside the firm 28 percent of the time. He must be able to meet farm people, meet non-farm people, diagnose, consult, advertise, sell, estimate cost, and buy wisely.

The employee also worked 28 percent of the time with equipment, tools, and supplies. He should be able to operate, maintain, adjust, inspect, and trouble shoot the available applicator equipment. He worked with business problems 21 percent of the time and should be able to keep records and accounts, make decisions wisely, and handle money properly.

Agan (1964:17) indicated the average employee worked with production and services 15 percent of the time. He should be able to make use of technical and service manuals, inspect for weaknesses, and assemble and mix products. He worked with personnel in the firm 6 percent of the time and should be able to handle men and train others.

Many undesirable side effects have occurred, stated Brooks (1972:G-27), because of lack of technical training and information about the total environment. As our knowledge of pesticides developed only through the most discriminate use of chemicals can problems with usage be avoided. Pesticides must be used intelligently to avoid serious consequences. Application of chlorinated hydrocarbon pesticides by aircraft have at times resulted in severe residue problems on forage and feed crops although they were one-half mile or more from the impact area. Applicators must know what they are doing to avoid serious accidents.

Continuous involvement and assessment of the needs of agri-

business and industry are essential in providing program adjustment and information regarding employee training. The Document Resume (1972:3) further stated that quality must be assured as quantity of education is increased. Many individuals are involved in decision and operational processes of education. Each must have essential criteria available for guidance.

The Kansas Pesticide Use Law (1972:11-17) required that an applicant for certification shall show upon examination that he possessed adequate knowledge concerning the proper use and application of pesticides in the classification for which he applied. The permit shall expire at the end of the calendar year of issue. Constant study and evaluation of materials will be made each year to insure the proper information is available to applicators and agriculturists on any changes dealing with pesticides.

In summary the related reading indicated the importance of instruction in the agricultural chemical areas of:

1. Knowledge of weed and insect problems and their control.
2. Ability to make proper recommendations regarding pesticides uses.
3. Ability to recognize good new pesticides and recommend their use.

Also in the author's opinion Agan's (1964) work of subject matter knowledge and the rank of importance he placed on them has changed with the passing of the Kansas Pesticide Use Law. Perhaps agricultural chemicals, insects, and pest control may have gained the position of first place on the urgency list of priorities. The Kansas Pesticide Use Law required the applicators to pass a test over the above items in depth. With this in mind the author organized a program to prepare students for the Pesticide Use Examination.

CHAPTER III

PROCEDURE OF INVESTIGATION

The major purpose of this study was to analyze and evaluate available units of instructional material for the preparation of chemical applications. The investigation was made at the Liberal Area Vocational Technical School, Liberal, Kansas, in conjunction with Kansas State Department of Agriculture and Kansas State Department of Education. The population groups were pesticide applicators and students from the surrounding area of southwestern Kansas.

Four groups of fifteen individuals each were randomly selected from those who applied at the LAVTS for the pesticide applicators certification in Kansas. There were four different units of instructional material utilized in this study. Group number one used Study Guides consisting of three sections (General Safety and Law, Insecticides, and Herbicides); group two used the Kansas Pesticide Users Handbook (1972); group number three used the LAVTS instructor developed material called Agricultural Chemicals Special, and group four used LAVTS instructor developed material called Agricultural Chemicals Regular.

The fifth group, consisted of six students from the Agricultural Chemicals Regular who were given pre-test and post-test by the writer. The test consisted of three areas, General Safety and Law, Insecticides, and Herbicides.

Instructional materials needed to be developed and available materials needed to be adapted to classroom situations. The author was an instructor of Agricultural Chemical Technology at the Liberal Area Vocational and Technical School. He desired to use and involve the various materials in his classroom situation.

Units of instructional material available were: (1) Study Guides for General Safety and Law, Herbicides, and Insecticides by the Weed and Pesticide Division of the KSDA, (2) Kansas Pesticide Users Handbook by Kansas Extension Service, (3) Agricultural Chemicals Special unit and (4) Agricultural Chemicals Regular unit. Three and four units were developed by the Agricultural Chemicals instructors at the LAVTS.

The Study Guides unit consisted of programed study. General, Safety, and Equipment information was in Section I, Section II contained Herbicides (Defoliants, Desiccants, and Plant Regulators), and Section III presented Insecticides. In each Section information was given, followed by completion questions to aid in studying.

The Kansas Pesticide Users Handbook by Kansas Extension consisted of seven Sections, Section I General, Section II Safety, Section III Equipment, Section IV Herbicides, Section V Insecticides, Section VI Fungicides and Section VII Rodenticides. Each Section contained compiled data and information pertaining to that Section's subject, plus publications (pamphlets and bulletins) from the Extension Service. The arrangement was loose leaf so information could be added or discarded periodically.

The third unit of instructional material was Agricultural Chemical Special by LAVTS. The material was prepared by Kenneth

Schuster and his assistant Dennis Zahn of the LAVTS and consisted of three forty hour courses. One course covered identification of insects and insecticides in depth. Another course covered plant identification and herbicides in all phases and the third course covered, fungicides, rodenticides, nematocides, the Kansas Pesticide Use Law and General Safety of handling chemicals. The Special was offered in the evening classes and students attended classes for a total of 120 hours.

The fourth unit of instruction offered was Agricultural Chemical Regular by LAVTS. The material was prepared by Schuster and the writer using Ohio Research Center Outline Guide, textbooks, bulletins, pamphlets, and eighteen years of experience in the chemical field. There were courses in Herbicides, Insecticides and Plant Regulators. They covered identification, chemistry, soils, equipment and use of chemicals in depth. The courses were offered to students enrolled in the regular scheduled semester. Each course covered sufficient hours to be equivalent to 48 college hours of instruction consisting of two hour lectures and two hour laboratory work.

After the completions of the four instruments by the research population an examination was given by the Weed and Pesticide Division of KSDA. The examination contained the required competencies for a pesticide applicator. The fifteen students for each group were randomly selected by assigning a number to all the students in that group and placing them in a hat and then drawing one number at a time until fifteen numbers were reached for each of the four program treatments. The examination and the requirements were confidential to the KSDA. The scores of the research population were made

available by the KSDA in frequency statistics according to the number of correct responses made by each individual.

After the examination, scores were received by the writer. The results were presented by the use of frequency statistics in tabular form. The results of use of the four instructional treatments were compared. Following an analysis of the findings, conclusions and recommendation were made.

CHAPTER IV

PRESENTATION OF THE DATA

The study consisted of the evaluation of four units of instruction material. The population from southwest Kansas consisted of aerial applicators, chemical dealers, potential pesticide applicators, and farmer applicators. The students who enrolled were interested in improving their knowledge of the Pesticide Use Law and pesticides in general so they could be certified to use chemicals in Kansas. The population ranged in ages from nineteen to fifty-five years of age. The experience of businessmen, applicators and regular students who enrolled ranged from no experience to those with twenty-five years of experience. The units were offered publicly and anyone could enroll. One hundred and twenty-five signed up for the different units over a twelve month period.

The test was administered by the Weed and Pesticide Division of KSDA. The populations for the four groups were randomly selected and divided into groups of 15 each. Each group used the four different units of instructional material. The scores for each group were given to the writer by the KSDA according to the number of correct responses. The figures were compiled and analyzed by the use of Tables I through IV. and then by the use of Graphs I through VI.

Group Analysis

A comparison of the results of the use of four units of

instruction in the area of General Safety and Law is illustrated in Table I. The students in the LAVTS Regular group had the highest scores with 28.1 correct answers out of 30 questions for 93.6% for the area of General Safety and Law. The students who used the KSDA Study Guides had the lowest scores with 27.5 correct answers out of 30 questions for 91.6%. The LAVTS Special and Regular groups had .3% difference in their scores with both being above the average for the four groups.

TABLE I
A COMPARISON OF FOUR UNITS OF INSTRUCTION AND
TEST SCORES IN THE AREA OF GENERAL
SAFETY AND LAW

UNITS OF INSTRUCTION	NUMBER RIGHT*	PERCENTAGE
Weed and Pesticide Division	27.5	91.6
Handbook by Kansas Extension	27.6	92.0
LAVTS Special	28.0	93.3
LAVTS Regular	28.1	93.6
Averages	27.8	92.6

*There were 30 questions in the area of General Safety and Law

Insecticides were more challenging and technical in comparison of the other two areas of instruction and test scores indicated in Table II that lower percentages were prevalent. In this comparison it was found that the LAVTS Regular students again had the highest scores, but LAVTS Special students were the lowest with a score of

24.5 correct answers out of 30 questions for 81.6%. The students using the Weed and Pesticide Study Guides had scores of 85.3% and were second. The students using the Handbook by the Kansas Extension Service was third. Materials of instruction for Insecticides were more technical than for the other units of instruction.

TABLE II
A COMPARISON OF FOUR UNITS OF INSTRUCTION AND
TEST SCORES IN THE AREA OF INSECTICIDES

UNITS OF INSTRUCTION	NUMBER RIGHT*	PERCENTAGE
Weed and Pesticide Division	25.6	85.3
Handbook by Kansas Extension	25.2	84.0
LAVTS Special	24.5	81.6
LAVTS Regular	25.8	86.0
Averages	25.3	84.3

*There were 30 questions in the area of Insecticides.

In the comparison of the post-test scores in Table III for the Herbicides area the students using the Handbook by the Kansas Extension Service made the highest scores (88.7%). The lowest scores (82.0%) were made by students using the KSDA Weed and Pesticide Division material. Again one may note that there were lower scores for the Herbicides area than for the General Safety and Law. Herbicide materials were highly technical. The students using the LAVTS Special unit posted a 86.0% score with the average being 85.2%.

TABLE III
A COMPARISON OF FOUR UNITS OF INSTRUCTION AND
TEST SCORES IN THE AREA OF HERBICIDES

UNITS OF INSTRUCTION	NUMBER RIGHT*	PERCENTAGE
Weed and Pesticide Division	32.8	82.0
Handbook by Kansas Extension	35.5	88.7
LAVTS Special	34.4	86.0
LAVTS Regular	33.8	84.5
Averages	34.1	85.2

*There were 40 questions in the area of Herbicides.

Information in Table IV was a summary of the findings for the three areas of instruction and the four groups using different instructional materials. There were 30 questions for the area of General Safety and Law, 30 questions for Insecticides, and 40 questions for the area of Herbicides making a possible score of 100 points. A comparison of test scores indicated that the highest scores were attained by the students in the areas of General Safety and Law with a percentage of 92.6. Students averaged 84.3% for the Insecticides area and 85.2% for the Herbicides area.

The four instructional materials for the area of General Safety and Law were nearly the same with 91.6% for the KSDA materials, 92.0% for the Extension Service materials, 93.3% for the LAVTS Special materials, and 93.6% for the LAVTS Regular materials. More deviation occurred in the test scores for the use of the different instructional

materials for the insecticides and herbicides areas. It was the observation of the writer that the Insecticides and Herbicides areas were of a more technical nature and was more difficult for the student to comprehend.

The total average for the four groups of instructional materials was 87.3% with the KSDA materials having an average of 86.3%, extension materials 88.2%, LAVTS Special materials 87.0% and LAVTS Regular materials of 88.0%. Since it was the observation of the writer that the ability level of the students in the four groups using the different instructional materials was nearly equal, it was concluded that each of the four groups of materials were satisfactory for the instruction of agricultural chemical applicators.

TABLE IV

A COMPARISON OF FOUR UNITS OF INSTRUCTION AND TEST
SCORES IN THE AREAS OF GENERAL SAFETY,
INSECTICIDES, AND HERBICIDES

TEST AREAS	TOTAL POS.	WEED DIV.		EXTENSION		LAVTS SP.		LAVTS REG.		TOTAL %
		No. RT.	%	No. RT.	%	No. Rt.	%	No. Rt.	%	
GEN. SAFETY	30	27.5	91.6	27.6	92.0	28.0	93.3	28.1	93.6	92.6
INSECT.	30	25.6	85.3	25.2	84.0	24.5	81.6	25.8	86.0	84.3
HERB.	40	32.8	82.0	35.5	88.7	34.4	86.0	33.8	84.5	85.2
TOTAL	100		86.3		88.2		87.0		88.0	87.3

The writer had a class of six students at the Liberal AVTS who did not take the examination for State certification as agricultural chemical applicators. The writer desired to determine the level of technical knowledge of agricultural chemicals by the use of a pre-test prior to the regular instruction in agricultural chemicals for the regular class in Agricultural Chemicals at the LAVTS. The writer also desired to determine that level of knowledge by the use of a post-test for agricultural chemicals at the end of the instructional period.

Information in Table V contained the pre-test and post-test scores for the six students in the Regular Post-high Agricultural Chemical Class at the LAVTS. The pre-test and post-test for the areas of General safety and Law, Insecticides, and Herbicides were developed by the writer (See Appendix). The pre-test and post-test were developed independently of the certification test developed by the Kansas State Department of Agriculture.

The average for the pre-test for the six students was 38.3% and the average for the post-test was 87.8% for a difference of 49.3%. The greatest gain was for the individual with no previous experience in agricultural chemical application who had a pre-test score of 10% and a post-test score of 81% for a gain of 71%. The least gain occurred for the individual with some agricultural chemical experience who had a pre-test of 69% and a post-test of 92% for a gain of 23%. It was the observation of the author that individuals with previous experience had the highest pre-test and post-test scores. However, it was observed that the greatest gains between pre-test and post-test scores were obtained by individuals with little prior knowledge of agricultural

chemicals and had lower pre-test scores.

Upon comparison of the average score of 87.8% for the six students using the LAVTS Regular materials and examination to the average score of 87.3% for the groups using the four different instructional materials and the KSDA Certification Examination, it was observed that there was only .5% deviation in the test scores. The writer concluded that regardless of the instructional materials and examinations if both are adequately prepared the end results will be nearly the same.

TABLE V

PRE-TEST AND POST-TEST SCORES FOR LOCAL
EXAMINATION IN AREAS OF GENERAL SAFETY
AND LAW, INSECTICIDES AND HERBICIDES

SUBJECT NUMBER	PRE-TEST SCORES	POST-TEST SCORES*	INCREASE
1	10	81	71
2	25	89	64
3	69	92	23
4	36	77	41
5	64	96	32
6	26	92	66
AVERAGE	38.3	87.8	49.5

*Post-test total possible score 100.

Individual Analysis

For the individual analysis the use of Graphs I through VI and Tables VI through VIII were used for the sample population. The sample population was obtained by random sampling the total population of one hundred twenty-five students that used the four units of instructional materials at LAVTS. The individuals in each group using the four different instructional materials were assigned a number. The numbers of the individuals were placed in a hat and drawn out one at a time to obtain a sample population of 15 for each group. The writer received the KSDA examination scores for the individuals in each group and prepared the Graphs I through VI.

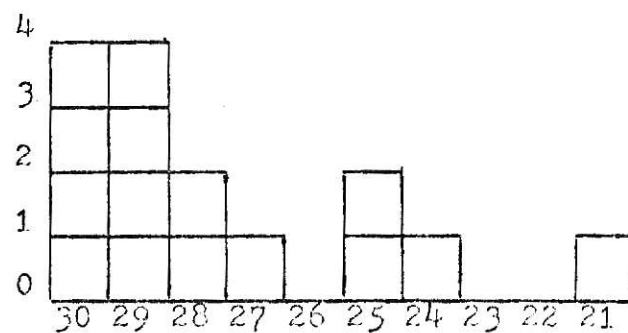
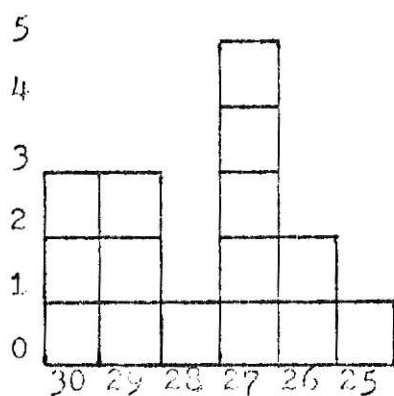
The students received more formalized classroom instruction in the LAVTS Special and LAVTS Regular groups. While the students who used the KSDA and Extension materials had more individualized study. Even though random sampling was used the writer observed that the experiences and abilities of the students varied and were contributing factors to individual achievement within each group.

The Graphs I and II and Table VI pertain to General Safety and Law. It was observed that much higher scores were made by all the groups for this area. There was a possible score of 30, and eleven individuals achieved a perfect score. Eighteen individuals scored 29 questions right out of 30. There were only six individuals who scored less than 26 questions correctly. The median scores for the students using the Extension materials and the LAVTS Special materials was 29. Students using the LAVTS Regular materials had a median score of 28 and students using the Weed and Pesticide Division materials had a median of 27. In the opinion of the author previous

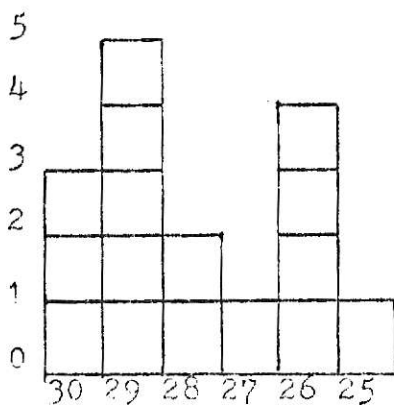
GRAPH I

A COMPARISON OF FOUR UNITS OF INSTRUCTION AND
TEST SCORES IN THE AREA OF GENERAL SAFETY AND LAW

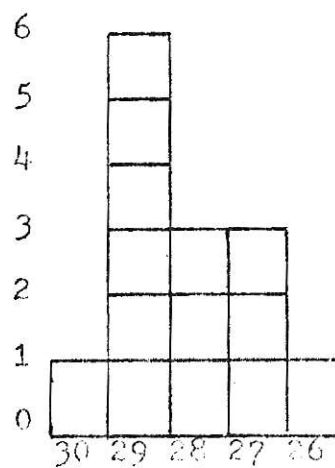
WEED AND PESTICIDE DIVISION HANDBOOK BY KANSAS EXTENSION



LAVTS SPECIAL



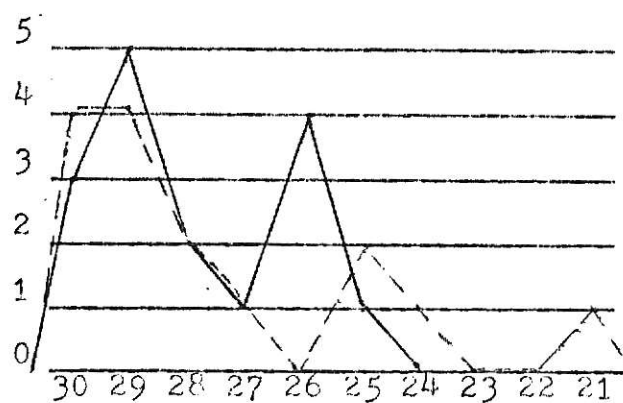
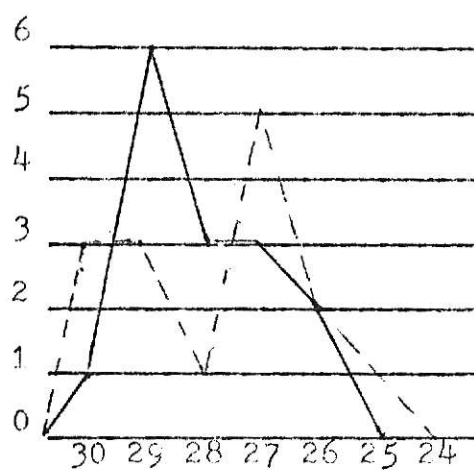
LAVTS REGULAR



GRAPH II

COMPARISON OF THE HIGH AND LOW AND THE TWO
MEDIAN TEST SCORES IN GENERAL SAFETY AND LAW

--WEED AND PESTICIDE DIVISION --HANDBOOK BY KANSAS EXTENSION
AND
— LAVTS REGULAR — LAVTS SPECIAL



experience was very important in all groups and this is evident by the individual scores in Graphs I and II.

TABLE VI
TEST SCORES FOR GENERAL SAFETY AND LAW

TOTAL POSSIBLE POINTS	WEED DIV.	EXTENSION	LAVTS SP.	LAVTS REG.
30	3	4	3	1
29	3	4	5	6
28	1	2	2	3
27	5	1	1	3
26	2	-	4	2
25	1	2	1	-
24	-	1	-	-
23	-	-	-	-
22	-	-	-	-
21	-	1	-	-

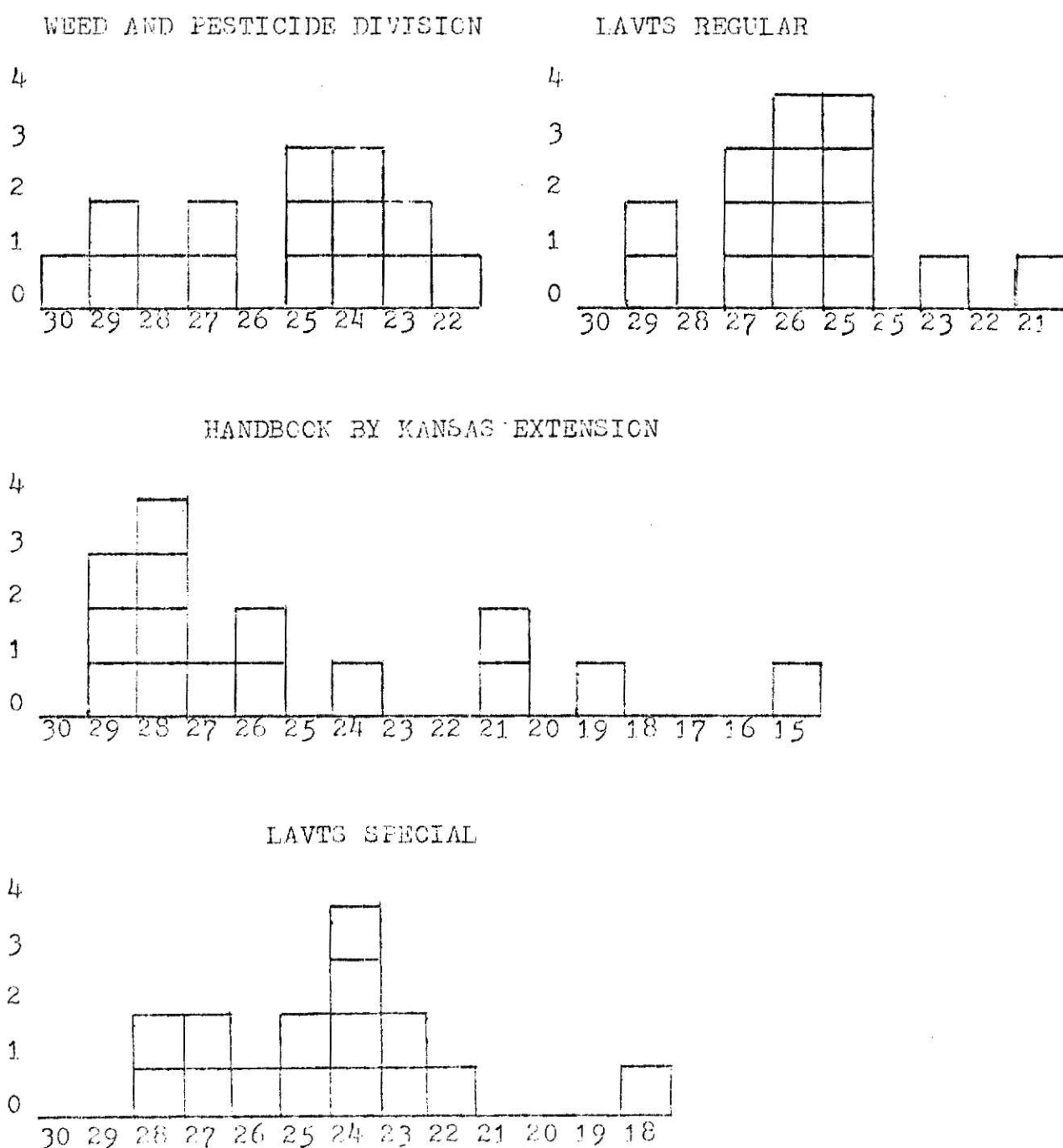
Information in Table VII and Graphs III and IV shows the frequency of individual scores of the students using the four groups of instructional materials for Insecticides. Thirty was the total possible correct score for the official test developed by the Weed and Pesticide Division of KSBA for certification of pesticide applicators. The population included fifteen randomly sampled students for each group which used a different unit of instructional materials.

TABLE VII
TEST SCORES FOR INSECTICIDES

TOTAL POSSIBLE POINTS	WEED DIV.	EXTENSION	LAVTS SP.	LAVTS REG.
30	1	-	-	-
29	2	3	-	2
28	1	4	2	-
27	2	1	2	3
26	-	2	1	4
25	3	-	2	4
24	3	1	4	-
23	2	-	2	1
22	1	-	1	-
21	-	2	-	1
20	-	-	-	-
19	-	1	-	-
18	-	-	1	-
17	-	-	-	-
16	-	-	-	-
15	-	1	-	-

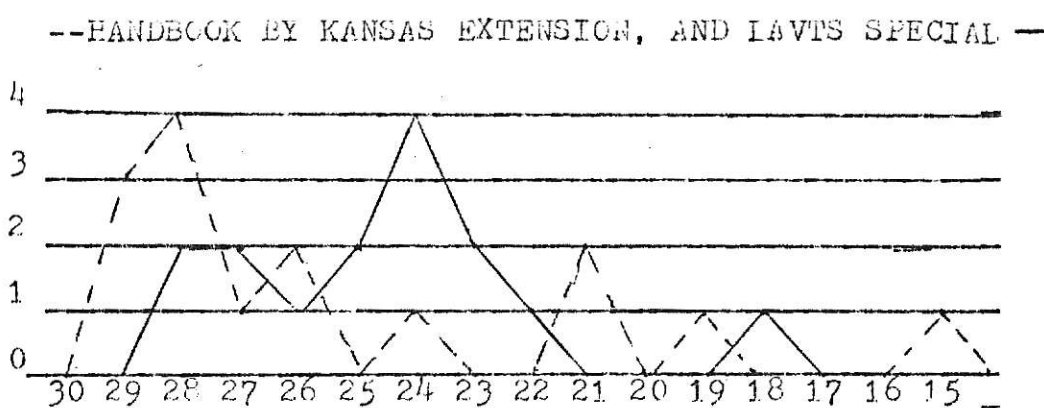
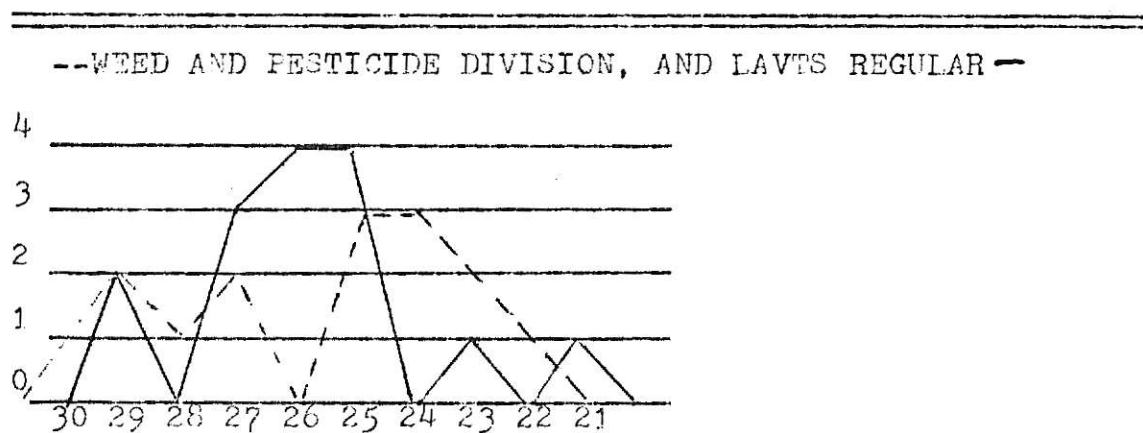
It was interesting to note that out of a total of 60 individuals in the population only one perfect score was made. The perfect score of 30 was made by an individual using the Weed and Pesticide Division materials. The lowest score was that of 15 which was made by a student

GRAPH III

A COMPARISON OF FOUR UNITS OF INSTRUCTION AND
TEST SCORES IN THE AREA OF INSECTICIDES

GRAPH IV

COMPARISON OF THE HIGH AND LOW AND THE TWO
MEDIAN TEST SCORES IN INSECTICIDES



using the Extension Service materials.

The median score for the students in the group using the Kansas Extension materials was 27, and the median score for the LAVTS Regular group was 26. The median score for the Weed and Pesticide Division group was 25, and the median score for the LAVTS Special group was 24. The writer observed that previous experience of the students varied and was a contributing factor in individual achievement within each group.

Information in Table VIII and Graphs V and VI presented an analysis of the test scores of individual students in the area of instruction for Herbicides. The test scores were obtained from the official test prepared by the Weed and Pesticide Division of the State Department of Agriculture for the area of Herbicides. The test contained 40 test items.

One of the 60 students obtained a perfect score of 40 for the 40 test items. The student with the score of 40 was in the LAVTS Special group.

Although the overall test averages for the four groups was nearly equal there were considerable differences in the individual test scores as evidenced by the information in Graphs V and VI. The greatest variations in individual test scores occurred in the groups utilizing the instructional materials developed by the Weed and Pesticide Division, the Kansas Extension, and the LAVTS Special groups. The least variation in individual test scores occurred in the LAVTS Regular group. The LAVTS Regular group had frequency distributions of four for the score of 36, five for the score of 35, three for the score of 33, and one each for scores of 32, 31, and 26 respectively.

The other three groups had no frequencies greater than three for any of the test scores, except for a frequency of four for the test score of 36 in the case of the group using the Kansas Extension materials.

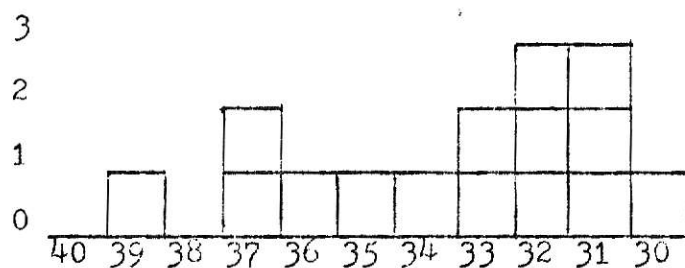
TABLE VIII
TEST SCORES FOR HERBICIDES

TOTAL POSSIBLE POINTS	WEED DIV.	EXTENSION	LAVTS SP.	LAVTS REC.
40	-	-	1	-
39	1	1	1	-
38	-	-	3	-
37	2	1	-	-
36	1	4	1	4
35	1	1	2	5
34	1	2	2	-
33	2	1	1	3
32	3	1	1	1
31	3	-	-	1
30	1	1	-	-
29	-	2	1	-
28	-	1	2	-
27	-	-	-	-
26	-	-	-	1

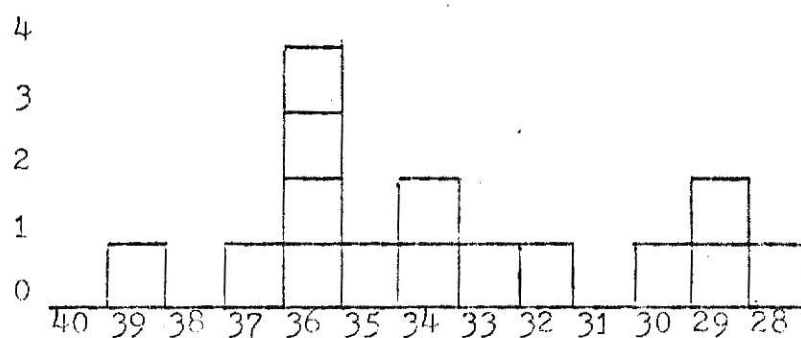
GRAPH V

A COMPARISON OF FOUR UNITS OF INSTRUCTION AND
TEST SCORES IN THE AREA OF HERBICIDES

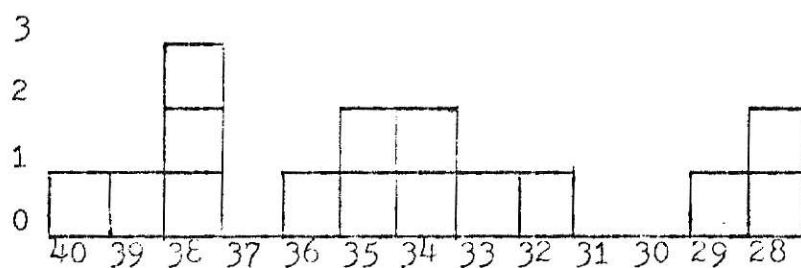
WEED AND PESTICIDE DIVISION



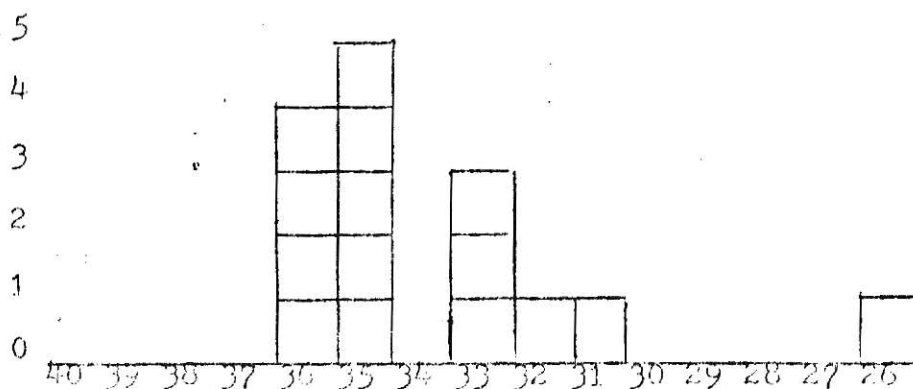
HANDBOOK BY KANSAS EXTENSION



LAVTS SPECIAL

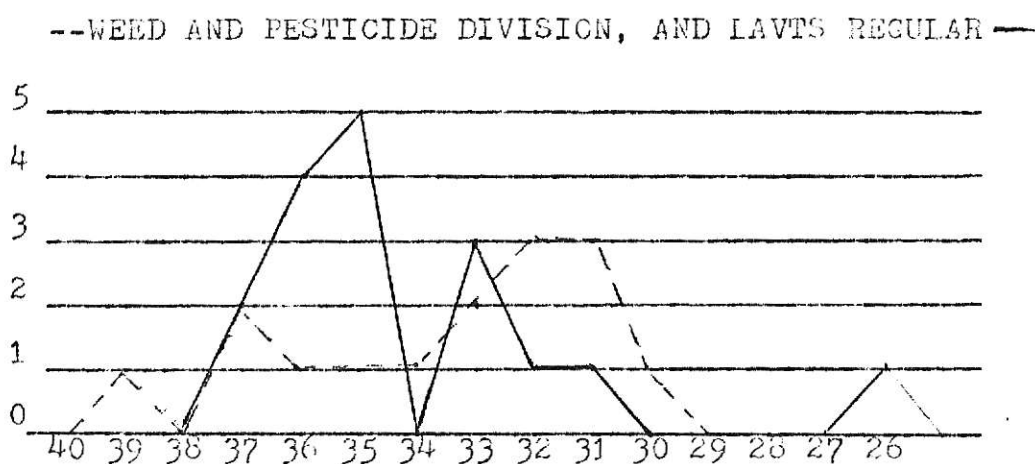
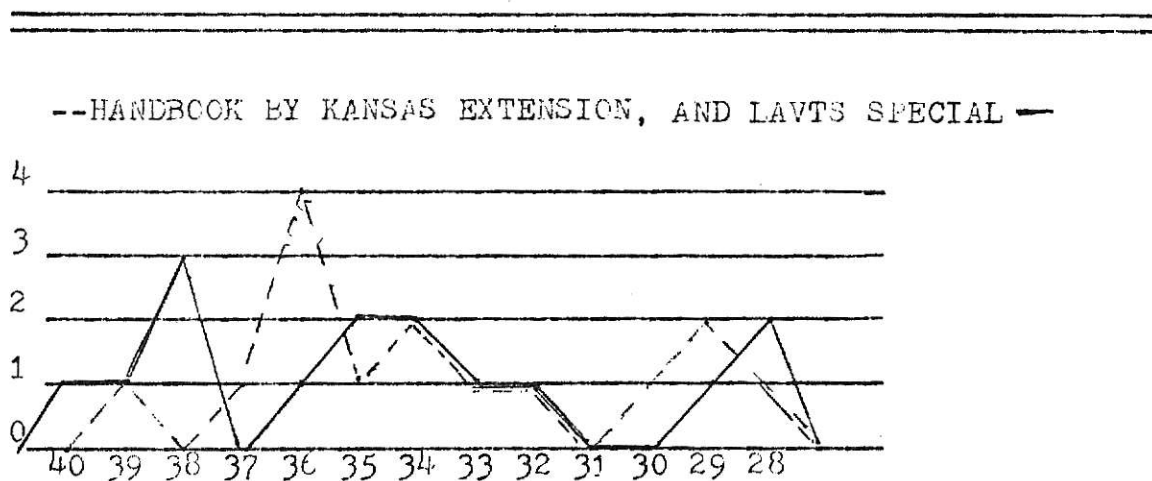


LAVTS REGULAR



GRAPH VI

COMPARISON OF THE HIGH AND LOW AND THE TWO
MEDIAN TEST SCORES IN HERBICIDES



CHAPTER V

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Since the passage of the Kansas Pesticide Use Law (1970) educators were called on to provide training for various groups who chose to become qualified for applying pesticides in Kansas after January 1, 1973. The purpose of the study was to compare and evaluate four units of instructional materials available in Kansas for educators to prepare individuals for state certification as agricultural chemical applicators.

The Kansas Pesticide Use Law (1972 amended) required that an applicant for certification show upon examination that he possessed adequate knowledge concerning the proper use and application of pesticides in the areas of General Safety and Law and/or Herbicides and Insecticides. The permit for agricultural chemical application expires at the end of the calendar year of issue.

The passage of the Kansas Pesticide Use Law also created a need for the identification of competencies for pesticide applicators. It seemed logical to the writer that if the competencies required to license pesticide applicators were determined then instructional materials which were prepared to develop the competencies could be evaluated. The results could determine which instructional units would be the most useful in the certification of future pesticide applicators.

A limited number of studies had been conducted on the competencies required for employment in the agribusiness industry of pesticides applicators. The reason for the dearth of information for pesticide applicators probably stemmed from the lack of restrictions placed on chemical pesticide application. The significance and urgency for instructional materials for the preparation of agricultural chemical applicators was made prevalent by the recognized importance of such topics as environmental controls, and pollution in agriculture. The Vocational Education Act of 1963 provided for training for employment in agriculturally related occupations by vocational agriculture departments. It was possible for vocationally reimbursed programs in agriculture to provide training for the proper application of agricultural chemicals. An increased importance had been added when the recently established Federal Environmental Protection Agency took over the duties of agricultural chemical application from the United States Agriculture Department.

Continuous involvement and assessment of the needs of agribusiness and industry in agricultural chemicals was essential to provide program adjustment and information regarding agricultural chemical applicator training. Many individuals were involved in decision making regarding agricultural chemical application. Educators needed to become knowledgeable of the instructional materials which were available for the preparation of agricultural chemical operation. The preparations for agricultural chemical applicator certification involved the training of individuals of different ages, educational levels, and occupational experiences.

Four groups of fifteen individuals each were randomly selected

from those who applied at LAVTS for the pesticide applicators certification in Kansas. There were four different units of instructional materials utilized in this study. Group number one used the Study Guides consisting of three sections by the Weed and Pesticide Division of KSDA, group number two used the Kansas Pesticide Users Handbook (1972) by the Kansas Extension Service, group number three used LAVTS Agricultural Chemical Special, and group number four used LAVTS Agricultural Regular. A fifth group, consisted of six students from the Agricultural Chemical Regular group, who were given pre-tests and post-tests by the writer to determine the quality of instruction. The study was limited to a twelve month period and included only students from the Liberal AVTS who used the four different units of instructional material.

Upon completion of the units of instruction for General Safety and Law, Insecticides, and Herbicides the research populations were given an examination by the Weed and Pesticide Division of KSDA. The test questions measured the attainment of competencies for a pesticide applicator. The examination and the requirements were confidential to the KSDA. The scores of the research population by numbers only were made available to the writer.

On examination of the comparison of the test scores made by the four different groups using the four different units of instructional material, the writer concluded that there was no difference in the average scores for the groups. The competencies set by the state could be met by using either of the units of instructional materials. There were some slight differences in the scores within different sections (General Safety and Law, Insecticides, and Herbicides) which

indicated the areas which needed strengthening in particular units. A difference was also observed in the attitude and desire of the individual students who needed to be qualified. The motivational forces were determining factors in the test scores achieved. The writer concluded that the members of the fifth group who took the pre-test and the post-test showed the importance of formal or instructor type instruction to be very valuable.

The result of the data convinced the writer that studies can do much to inform educators of the validity of instructional materials. The writer recommended that agricultural instructors be made aware of the results of studies concerned with all phases of pesticide application. The writer also recommended that constant study and evaluation of available materials be made annually to insure that the most effective information is made available to agricultural chemical applicators.

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APPENDIX

1. SELECT THE PURPOSE OF THE PESTICIDE USE LAW:
☐ regulate use of pesticides ☐ growth in agriculture
☐ plant growth regulators
2. WHAT AGENCY GOVERNS THE PESTICIDE USE LAW?
☐ Committee of Agriculture and Livestock
☐ Kansas State Board of Agriculture
☐ U. S. Department of Agriculture
3. THE FEE FOR A PESTICIDE APPLICATOR'S BUSINESS LICENSE?
☐ \$10 ☐ \$25 ☐ \$50
4. THE FEE FOR A PUBLIC EQUIPMENT OPERATOR PERMIT IS?
☐ \$50 ☐ \$10 ☐ \$25
5. WHAT IS THE FEE FOR A PESTICIDE EQUIPMENT OPERATOR'S PERMIT FOR BOTH AIR AND GROUND APPARATUSES?
☐ \$25 ☐ \$50 ☐ \$10
6. THE FEE FOR EACH UNIT OF EQUIPMENT TO BE LICENSED IS:
☐ \$10 ☐ \$50 ☐ \$25
7. ALL PESTICIDE LICENSES EXPIRE:
☐ The end of the calendar year issued
☐ One year from date of issuance
☐ The end of the following calendar year.
8. THE MINIMUM SURETY BOND REQUIRED FOR THE FIRST UNIT OF APPLICATION EQUIPMENT IS:
☐ \$8,000 ☐ \$10,000 ☐ \$25,000
9. DETAILED RECORD OF ALL PESTICIDE APPLICATIONS MUST BE KEPT BY EVERY PESTICIDE LICENSEE AND REGISTRANT FOR A PERIOD OF:
☐ 1 year ☐ 3 Years ☐ 5 years

10. SOME ITEMS OF INFORMATION REQUIRED IN PESTICIDE APPLICATOR'S RECORDS ARE?

____ Name of registrant
____ Name of customer
____ Town and address of landowner
____ Date of application
____ Brand of pesticide used
____ Quality used

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11. IF YOU EXPERIENCE DRIFT DAMAGE AND SEEK DEPARTMENTAL ASSISTANCE, YOU MUST FILE A REPORT WITH THE DIRECTOR WITH - IN ____ DAYS FROM THE TIME THE DAMAGE OCCURRED AND IF A GROWING CROP IS DAMAGED, THE REPORT MUST BE FILED PRIOR TO HARVEST OF WHAT PERCENT OF THAT CROP?

____ 30 days ____ 60 days ____ 90 days
____ 20% ____ 25% ____ 30 %

12. WHAT IS THE MINIMUM LIABILITY INSURANCE?

WHAT IS THE MAXIMUM DEDUCTIBLE CLAUSE?

____ \$35,000 ____ \$15,000 ____ \$25,000
____ \$100 ____ \$200 ____ \$250

13. GROUNDS FOR DENIAL, SUSPENSION OR REVOCATION OF LICENSE AS LISTED IN THE KANSAS PESTICIDE USE LAW ARE?

____ Make false or fraudulent claims through any media
____ Impersonate any inspector or official
____ Applied known or ineffective materials
____ Aided or abetted a licensed or unlicensed person to evade any of the provisions of this act
____ Used fraud or misrepresentation in making application for renewal of a license or permit
____ Operated faulty or unsafe equipment
____ Operated unlicensed equipment

- ☐ Operated in a faulty or negligent manner
- ☐ Comply with provisions of this act
- ☐ Made a pesticide recommendation or application not in accordance with the directions for use shown on the label registered under the Kansas Agricultural Chemical Act and/or by the United States Department of Agriculture, except that lesser specifications may be used upon agreement between applicator and customer
- ☐ Refused or neglected to comply with any limitations or restrictions on or in a duly issued license or permit
- ☐ Keep and maintain records according to requirements and send to county agent
- ☐ Operate licensed equipment with a licensed person

14. THE PESTICIDE ADVISORY BOARD'S MAIN DUTY IS?

- ☐ Grant licenses to all who pass the tests
- ☐ Advise the secretary on any or all problems relating to the use, manufacture, transportation, application and restriction of pesticides in the state
- ☐ Set up rules and regulations for the Pesticide Use Law

15. ITEMS DEFINED AS PESTICIDES IN THE PESTICIDE USE LAW ARE?

- | | | |
|---|--------------------------------------|---|
| <input type="checkbox"/> animal antibiotics | <input type="checkbox"/> Fertilizer | <input type="checkbox"/> Feed additives |
| <input type="checkbox"/> rodenticides | <input type="checkbox"/> fungicides | <input type="checkbox"/> herbicides |
| <input type="checkbox"/> insecticides | <input type="checkbox"/> nematocides | <input type="checkbox"/> defoliants |
| <input type="checkbox"/> desiccants | <input type="checkbox"/> fumigants | <input type="checkbox"/> disinfectants |

16. MATCH THE PROPER LICENSE AND/OR PERMIT REQUIRED BY THE STATE BOARD OF AGRICULTURE:

- a. Pesticides applicator's business license or government agency registration issued by the secretary
- b. Equipment operator's license
- c. None
- d. Public equipment operator's permit

- ___ 1. The owner of a business who is applying pesticides to the land of others
- ___ 2. A person applying pesticides to his own lands
- ___ 3. Any person working for an applicator and responsible for applying pesticides to lands of others
- ___ 4. A farmer applying pesticides to the lands of another farmer occasionally
- ___ 5. Any person employed by a public agency who is responsible for the operation of a spray apparatus

17. SOME SAFETY PRECAUTIONS TO FOLLOW WHEN USING HERBICIDES ARE?

- ___ Herbicides may be hazardous to you while storing, mixing, or applying them
- ___ Crop residues may adversely affect people and animals
- ___ Herbicides are not harmful in any way
- ___ Soil residue may harm following crops
- ___ Soil residues do not harm any crops

18. DOES THE INFORMATION ON THE LABEL CONTAIN THE FOLLOWING?

- ___ Manufacturer
- ___ Correct chemical name of the material
- ___ License requirements
- ___ Percent of active ingredients
- ___ Percentage of crop damage
- ___ Safety precautions when using material
- ___ Approved use
- ___ Brief record of use
- ___ Timing of application to avoid illegal residue
- ___ Warnings to the user about its toxicity
- ___ Any other pertinent information that would apply in the use of this particular chemical.

- ___ Read label
- ___ Wear proper protective clothing if directions call for it. This is required less often for herbicides than other pesticides
- ___ Pour dust, powder and liquids slowly in an open area, not an enclosed room, so that you will not inhale any or spill it on you. Avoid splashing.
- ___ Forget all above information
- ___ Remove screen on spray tank before putting in herbicide concentrate
- ___ Mix two herbicides only if label or current local recommendation direct you to do so.
- ___ re-use all contaminated containers
- ___ Do not mix herbicides that are incompatible to each other; they may become much more toxic or be neutralized and not perform as they would alone
- ___ Clean out measuring containers after each use
- ___ Store in original labeled container -- not drinking containers
- ___ Sleep in the room where herbicides are stored
- ___ Store herbicides in front office
- ___ Have a responsible person on hand to take delivery of herbicides and properly store them under lock and key in a dry room
- ___ Know your nearest poison control center

20. SINCE THE "EMPTY" PESTICIDE CONTAINER IS A DANGEROUS HAZARD, AN "UNLOADED GUN", A POTENTIAL KILLER, YOU SHOULD DO WHAT?

- ___ Throw empty container in stream or river or well
- ___ Make sure container is completely empty
- ___ Do not re-use herbicide containers
- ___ Select a disposal area away from home well, streams, and livestock

**THIS BOOK CONTAINS
NUMEROUS PAGES
WITH THE PAGE
NUMBERS CUT OFF**

**THIS IS AS RECEIVED
FROM THE
CUSTOMER**

- ___ Break glass containers and punch holes in metal containers
- ___ You can re-use any herbicide container
- ___ Bury at least 18 inches deep, deeper in sandy soils
- ___ Burn bags, taking care that you and your neighbor will not be exposed to fumes or smoke
- ___ Never throw containers in garbage cans

21. DISEASE SYMPTOMS AND HERBICIDES INJURY ARE OFTEN CONFUSED, SO BE SURE YOU KNOW THE SYMPTOMS FOR THE COMMON DISEASES

- ___ Soybean seedling blights are often mistaken for Aartex injury
- ___ Soybean blights are often mistaken for fertilizers
- ___ Soybean mosaic can cause leaf abnormalities similar to those caused by 2-4, D.
- ___ Corn seedling blight may be confused with Lorox or Maloran injury
- ___ Corn seedling blight may be confused with fungus spots

22. THE FOOD AND DRUG ADMINISTRATION ESTABLISHED A SAFE LEVEL OF RESIDUE?

- ___ Intolerance
- ___ Eradication
- ___ Tolerance

23. ILLEGAL RESIDUE IS _____ THAN THE LEVEL THAT HAS BEEN PRE-ESTABLISHED. THE FOOD AND DRUG ADMIN. WILL NOT ALLOW PRODUCE TO BE SOLD FOR HUMAN OR ANIMAL CONSUMPTION WHICH HAS AN ILLEGAL OR EXCESSIVE RESIDUE

- ___ More even
- ___ Lower
- ___ Higher

24. TOXICITY LEVELS ARE BASED ON THE FOLLOWING:

- ___ L, D. 50 ___ p. p. m. ___ Pound per gallon

25. METHODS OF WEED CONTROL ARE?

47

- ___ Prevention
- ___ Crop rotation
- ___ Eradication

26. WEED CLASSIFICATIONS ARE

- ___ Quarterly
- ___ Annuals
- ___ Perennials

27. THE PRINCIPAL METHODS OF WEED CONTROL ARE:

- ___ Mechanical
- ___ Control
- ___ Fire
- ___ Annuals
- ___ Growth regulars
- ___ Crop competition
- ___ Crop rotation
- ___ Biennials
- ___ Soil sterilant

28. SPECIAL METHODS BY WHICH PLANT PROPAGATE & DISSEMINATE THE SPECIES ARE?

- | | | |
|---------------|-------------------|------------------------|
| ___ Seed | ___ Tubers | ___ Bulbs and bulblets |
| ___ Rhizomes | ___ Crop rotation | ___ Stolons |
| ___ Broadcast | ___ Roots | ___ Preemergence |

29. THE FACTORS AFFECTING DORMANCY ARE?

- | | | |
|---------------------------------------|----------------------|------------|
| ___ Temperature | ___ Moisture | ___ Oxygen |
| ___ Light | ___ Seed | ___ Manure |
| ___ Mechanically resistant seed coats | ___ Immature embryos | ___ Tubers |

30. MATCH THE CORRECT WORD OR WORDS TO THE BLANKS IN THE FOLLOWING SENTENCES BY NUMBERING THE CORRECT ANSWER.

48

1 2 3 ARE USUALLY APPLIED AS SPRAYS.
4 IS THE USUAL DILUENT OR CARRIER, ALSO, 5
ARE USED BOTH AS A 6 AND AS A CARRIER. 7
MATERIALS ARE SPREAD BY HAND OR BY SPECIAL MECHANICAL
8. 9 VOLUME SPRAYERS USUALLY APPLY LESS THAN
10 GALLONS OF SPRAY PER ACRE.

<u>1</u> and	<u>hand</u>	<u>spreaders</u>
<u>emulsions</u>	<u>oil</u>	<u>granular</u>
<u>herbicide</u>	<u>solutions</u>	<u>wettable powder</u>
<u>50</u>	<u>offset</u>	<u>30</u>
<u>Droplets</u>	<u>low</u>	<u>water</u>

31. IT IS THEORETICALLY POSSIBLE TO APPLY AS LITTLE AS _____ GAL, SPRAY PER ACRE, WITH _____ DROPS PER SQUARE INCH WITH SPRAY DROPLETS LARGE ENOUGH THAT THERE WOULD BE ESSENTIALLY NO SPRAY DRIFT HAZARD.

<u>1</u> gal.	<u>9</u> oz.
<u>2</u> gal.	<u>12</u> oz.
<u>1</u> qt.	<u>16</u> oz.

32. THE MOST IMPORTANT PART OF THE SPRAYER IS?

<u>Pump</u>	<u>Nozzle</u>	<u>hose</u>
-------------	---------------	-------------

33. SEVERAL SPRAY PATTERNS ARE?

<u>flat</u>	<u>block</u>	<u>solid</u>
<u>rectangular</u>	<u>offset</u>	<u>hollow</u>

34. WHAT DETERMINES THE SIZE AND UNIFORMITY OF THE DROPLETS

<u>Nozzle construction plus pressure</u>
<u>Pressure plus motor size</u>
<u>Pump unit plus tension on hose</u>

35. HOW DOES LIQUID ESCAPE AT LOW PRESSURE?

<u>moisture</u>	<u>liquid film</u>	<u>droplets</u>
-----------------	--------------------	-----------------

36. AS PRESSURES INCREASES DROPLET FORMATION OCCURS 1 49
 NOZZLE TIP WITH THE FORMATION 2 DROPLETS. AT HIGH
 PRESSURES DROPLETS ARE FORMED PRIMARILY FROM 3
 FORCE, AND DROPLETS MAY BE OF 4 AND 5 SIZE,
 CREATING A 6 HAZARD.

<u> </u> away from	<u> </u> closer to	<u> </u> average
<u> </u> smaller	<u> </u> hydraulic	<u> </u> fog
<u> </u> mist	<u> </u> larger	<u> </u> drift
<u> </u> agitation	<u> </u> pressure control	<u> </u> molecule

37. PRESSURE NORMALLY EXISTS ONLY FROM THE 1 THROUGH
 THE LINES AND BOOM TO THE NOZZLES IN LIQUID PRESSURE
 SYSTEMS, THE 2 IS NOT PRESSURIZED, PART OF THE
 LIQUID MAY BE 3 BACK TO THE TANK FOR 4 AND FOR
5

<u> </u> Pressure control	<u> </u> Spray tank	<u> </u> Pressure pump
<u> </u> By passed	<u> </u> Agitation	<u> </u> Pump
<u> </u> Nozzle	<u> </u> Impeller	<u> </u> Diaphragm

38. COMMON TYPES OF LIQUID PRESSURE PUMPS ARE?

<u> </u> turbine	<u> </u> hydraulic	<u> </u> diaphragm
<u> </u> impeller	<u> </u> gas	<u> </u> piston
<u> </u> gear	<u> </u> centrifugal	<u> </u> disc

39. IN A CENTRIFUGED OR TURBINE PUMP THE 1 OF THE
 LIQUID, COMBINED WITH ITS 2 GIVES IT PRESSURE. AT A
 CONSTANT SPEED, THE PRESSURE IS PROPORTIONAL TO THE 3
 OF THE 4 OF THE PUMP ROTOR,

<u> </u> wind	<u> </u> velocity	<u> </u> pressure
<u> </u> weight	<u> </u> diameter	<u> </u> radius
<u> </u> vacuum	<u> </u> square	<u> </u> fuel pump

40. WETTABLE POWDERS WILL PASS THROUGH _____ OR COARSER
 SCREENS.

<u> </u> 150 mesh	<u> </u> 35 mesh	<u> </u> 50 mesh
------------------------	-----------------------	-----------------------

41. A GOOD GRADE GARDEN HOSE WILL WITHSTAND HOW MUCH PRESSURE?

50

☐ 150 PSI ☐ 65 PSI ☐ 45 PSI

42. AGITATION WHICH TENDS TO INCORPORATE _____ MAY CAUSE FOAMING. RETURNING THE BY-PASS SOLUTION _____ THE SURFACE OF THE LIQUID WILL REDUCE FOAMING;

☐ above ☐ gas ☐ below
☐ chemicals ☐ air ☐ water

43. WHAT DOES THE FIRST TWO NUMBERS ON A TIP DESIGNATE?

☐ angle ☐ name of company
☐ size of boom ☐ number of gallons per acre

44. WHAT ARE SOME DIFFERENT TYPES OF NOZZLES?

☐ brass ☐ copper ☐ luminum
☐ plastic ☐ fiberglass ☐ nylon
☐ silver ☐ stainless steel ☐ platinum
☐ rubber ☐ glass ☐ gold

45. SPRAYERS ARE USUALLY CLASSIFIED AS TWO TYPES:

☐ low volume ☐ high frequency ☐ low intensity
☐ high volume

46. WHAT IS USUALLY SUFFICIENT TO CLEAN WETTABLE POWDER FROM SPRAY, TANK, HOSES, AND BOOM?

☐ rinse with kerosene ☐ rinse with oils ☐ rinse with water

47. WHAT WILL USUALLY STOP FOAMING IN SPRAY TANK? HOW MUCH NEEDED PER 100 GALLONS OF SPRAY?

☐ kerosene ☐ gas ☐ by-pass solution
☐ 1 pint ☐ 1 quart ☐ one gallon

48. WHAT WILL CHANGE THE RATE OF APPLICATION OF SPRAY?

☐ speed ☐ pressure ☐ nozzle size
☐ size of tank ☐ drift ☐ water

58. WHAT ARE SOME TERMS TO DESCRIBE LEAF SHAPES?

52

___ parallel ___ linear ___ oblique
___ cordate ___ oblong ___ round
___ oval ___ reniform ___ halberd-shaped

59. WHAT ARE THE FOUR MAIN PARTS OF A COMPLETE FLOWER?

___ sepal ___ bracts ___ stamen
___ pistil ___ stalks ___ petal

60. AN INFLORESCENCE IS?

___ leaf arrangement ___ seed arrangement ___ flower arrangement

61. A COLLECTIVE TERM FOR SEPALS IS?

___ perianth ___ perigynous ___ calyx

62. THE SUPPORTING STALK OF THE INFLORESCENCE IS CALLED THE?

___ peduncle ___ pedicels ___ stigma

63. THE OVARY CONTAINS WHAT?

___ pollen ___ ovules ___ disharium

64. A CHEMICAL USED FOR KILLING OR INHIBITING THE GROWTH OF PLANTS IS?

___ fungicide ___ herbicide ___ growth stimulator

65. WHAT HERBICIDE IS MORE TOXIC TO ONE PLANT THAN ANOTHER?

___ selective ___ nonselective ___ growth regulator

66. SELECTIVITY OF HERBICIDES IS PRINCIPALLY BASED UPON THE FOLLOWING FACTORS:

___ absorption ___ rates ___ translocation
___ fall application

67. WHAT MORPHOLOGICAL OR STRUCTURAL PLANT DIFFERENCES ARE RELATED TO SELECTIVITY?

___ Permit protection of the plants meristematic regions from herbicidal injury

___ Plant surfaces absorb the herbicide quickly

___ Permit selective application of herbicides

68. PHLOEM TRANSLOCATION OF HERBICIDES CLOSELY PARALLELS THE MOVEMENT OF?

53

☐ food materials ☐ saps ☐ tendrils

69. PLANT HAIRINESS INCREASES HERBICIDE TOLERANCE BY:

☐ reducing runoff ☐ reducing temperature

☐ keeps leaf dust free

70. HERBICIDES USUALLY ENTER A PLANT THROUGH THE?

☐ plant hairs ☐ roots ☐ xylem ☐ leaves

71. LEAF PENETRATIONS ARE THROUGH THE 1 OR 2.
3 IS A TERM USED TO DESCRIBE THE ELECTRICAL
PHENOMENA OF A 4 OR 5. IONS ARE OF TWO
TYPES 6 AND 7.

☐ root surfaces ☐ stomates ☐ flowers

☐ molecules ☐ pressure ☐ temperature

☐ polar ☐ non-polar ☐ cold

72. THE ADDITION OF A WETTING AGENT TO HERBICIDES USUALLY INCREASES ITS EFFECT ON PLANTS BY:

☐ increasing the herbicide contact

☐ decreasing the herbicide contact

☐ Directing the herbicide away from the plant leaves

73. IF THE HERBICIDE IS APPLIED TO THE SOIL PRIOR TO PLANTING, IT IS KNOWN AS A _____ TREATMENT?

☐ pre-plant ☐ chemical decomposition ☐ leaching

74. TO A LARGE EXTENT, THE SIZE OF THE SEED DETERMINES THE DEPT AT WHICH IT WILL GERMINATE. HOWEVER, MOST WEED SEEDS GERMINATE IN THE SURFACE

☐ 1/2 inch ☐ 3/4 inch ☐ 1 inch ☐ 1 1/2 inch

75. WHICH AFFECT THE PERSISTENCE OF A HERBICIDE IN SOIL?

☐ Microorganisms ☐ Photo decomposition

☐ absorption on soil colloids

76. IN ADDITION TO FOOD SUPPLY, WHICH OF THE FOLLOWING DIRECTLY AFFECT MICROORGANISM GROWTH AND RATE OF MULTIPLICATION? 54

☐ volatility ☐ oxygen ☐ water
☐ mineral nutrient supply ☐ leaching ☐ temperature

77. CHEMICAL DECOMPOSITION OF A HERBICIDE MAY INVOLVE SUCH PROCESSES AS?

☐ oxidation ☐ hydration ☐ hydrolysis
☐ phosphorus ☐ reduction

78. WHICH SOIL WILL NEED THE MOST HERBICIDE PER ACRE AS A PREEMERGENCE TREATMENT?

☐ sandy ☐ sandy loam ☐ silt loam
☐ heavy clay soil

79. _____ IS THE DOWNWARD MOVEMENT OF A SUBSTANCE IN SOLUTION THROUGH SOIL.

☐ hydration ☐ leaching ☐ bacteria

80. WHAT IS ONE OF THE MOST EFFECTIVE ABSORPTIVE MATERIALS KNOWN?

☐ nitrogen ☐ paper ☐ activated charcoal

81. HERBICIDES MAY EVAPORATE AND BE LOST TO THE ATMOSPHERE AS WHAT?

☐ liquid pressure ☐ oxygen ☐ volatile gases

82. THE EXTENT TO WHICH A HERBICIDE WILL LEACH?

☐ Solubility of herbicide in water
☐ Calculation of water per foot of soil
☐ Amount of water passing downward through the soil

83. HERBICIDES ARE FORMULATED TO BE APPLIED AS?

☐ solutions of water or oils ☐ dusts
☐ emulsions ☐ solvents ☐ granules

84. THE AMOUNT OF SPRAY DRIFT DEPENDS UPON WHAT?

55

___ size of droplet ___ pressure of spray ___ amount of wind

85. MATCH THE FOLLOWING STATEMENTS WITH THE LETTER OF THE ITEM:

- ___ a liquid which is always clear in appearance a. solution
- ___ normally appears milky or cloudy when mixed with water b. emulsion
- ___ every part is like every other part c. wettable powders
- ___ an example of sugar in water d. granules
- ___ usually applied with mechanical spreaders by hand
- ___ a physically homogeneous mixture
- ___ marketed as a powder, or as a slurry
- ___ composed of solvent and solute
- ___ the constituents cannot be seen separately
- ___ an example of 2, 4-D amine in water

86. WINDS ARE LEAST GUSTY BETWEEN:

- ___ 2 - 4 p.m. ___ 2 - 4 a.m. ___ 11 a.m. - 1 p.m.
- ___ none of these

87. WINDS ARE LEAST GUSTY OR TURBULENT JUST BEFORE 1 AND SECONDLY JUST AFTER 2:

- ___ sunset ___ sunrise ___ before noon

88. THE _____ FORMULATIONS OF 2, 4-D vary FROM LOW TO HIGH VOLATILITY.

- ___ chemical ___ carbon ___ ester

89. PURE 2, 4-D ACID IS ONLY 1 SOLUBLE IN WATER, 2 IN PETROLEUM OILS, RELATIVELY 3 TO METALS, NON-4 AND 5 IN THE PLANT. DOES NOT NORMALLY REDUCE THE TOTAL NUMBER OF SOIL 6, AND IN ORDINARY USAGE IS 7 TO HUMANS AND ANIMALS.

- ___ explosive ___ polar ___ non-polar

- ☐ slightly ☐ insoluble ☐ non corrosive
☐ toxic ☐ non toxic ☐ microbes
☐ translocated ☐ non translocated ☐ monuron
90. THE FIVE FORMS IN WHICH 2, 4-D is MARKETING INCLUDE?
- ☐ salts ☐ ester ☐ emulsions
☐ alcohol ☐ acid ☐ dust
☐ granular ☐ vapor ☐ liquid
91. VOLATILITY MEANS THE TENDENCY OF A CHEMICAL TO 1 OR GIVE OFF 2.
- ☐ pressure ☐ vaporize ☐ fumes ☐ explode
92. 2, 4-D ESTERS ARE USUALLY SOLD AS 1, WHEN MIXED WITH WATER FORM 2 WHICH APPEARS 3. ESTERS ARE SOLUBLE IN MOST 4
- ☐ alcohol ☐ liquid ☐ milky
☐ dust ☐ emulsion ☐ water
93. PLANTS ARE USUALLY MOST SUSCEPTIBLE TO 2, 4-D:
- ☐ when they are small ☐ during & After fruiting
☐ while germinating ☐ just before flowering begins
94. DISCUSS THE EFFECT OF 2, 4-D ON RATE OF RESPIRATION:
- ☐ low rate stimulate ☐ high rate inhibit ☐ even (no rate)
95. SEVERAL HERBICIDES MARKETING AS WETTABLE POWDERS INCLUDE?
- ☐ simazine ☐ arsenic ☐ atrazine
☐ tyndall ☐ monuron ☐ nebruron
96. MATCH THE FOLLOWING FORMS OF 2, 4-D WITH THE CORRECT ANSWER:
- ☐ acid a. soluble in oil
☐ amine b. soluble in water

- ☐ sodium ☐ c. volatility 57
☐ ester volatile ☐ d. precipitate in hard water
☐ e. milky with water
☐ f. clear with water
☐ g. emulsified

97. DALAPON CONTROLS PERENNIAL GRASSES SUCH AS?

- ☐ rye grass ☐ quack grass ☐ Johnson grass
☐ Bermuda grass ☐ Brome grass ☐ green grass

98. SODIUM CHLORATE HAS BEEN USED FOR MANY YEARS FOR _____ CONTROL OF SERIOUS PERENNIAL WEEDS. CARE MUST BE TAKEN THAT TREATMENT DOES NOT OVERLAP THE ROOTING AREA OF _____ OR _____. SODIUM CHLORATE IS USUALLY APPLIED AT A RATE OF _____ TO _____ POUNDS ACTIVE INGREDIENT PER _____. THIS IS EQUIVALENT TO _____ TO _____ LBS/A.

- ☐ one ☐ two ☐ three
☐ .435 ☐ 870 ☐ 780
☐ 534 ☐ shrubs ☐ spot treatment
☐ flowers ☐ plants ☐ desirable trees

99. A SOIL STERILANT, AS USED IN WEED CONTROL, PREVENTS GROWTH OF _____ PLANTS.

- ☐ Bacteria ☐ green ☐ desirable

100. NEARLY ALL SOIL STERILANTS ARE _____ AND THEREFORE WILL KILL _____ OF PLANT GROWTH.

- ☐ all ☐ selective ☐ nonselective
☐ none ☐ one ☐ polar

A COMPARISON OF THE EFFECTIVENESS
OF FOUR UNITS OF INSTRUCTION FOR PESTICIDE
CERTIFICATION IN KANSAS

by

DENNIS GILBERT ZAHN

B.S., TEXAS A & M UNIVERSITY, 1953

AN ABSTRACT OF A MASTER'S REPORT

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Since the passage of the Kansas Pesticide Users Law, (1970) educators were called on to provide training for various groups who chose to become qualified to apply pesticides in Kansas after January 1, 1973. The purpose of the study was to compare and evaluate units of instructional materials available in Kansas to educate pesticide applicators for state certification and licensing.

This created a need for identification of competencies for pesticide applicators. It seemed logical to the writer that if the competencies required to license pesticide applicators were determined and the units of instructional material evaluated, the results would establish the guidelines for the present and future pesticide applicator certification. The guidelines would help in updating, arranging and utilizing the units of instructional material in agricultural curriculums to better prepare agriculturists for future pesticide involvement.

The range of applicator personnel requiring certification encompassed people of different ages, different educational levels and different occupational experiences. Four groups were used in the comparison of the four different units of instructional material. The research population was obtained by random sampling and included four groups of fifteen each that used the four different units of instructional materials.

The study was limited to a twelve month period and included only students from the Liberal Area Vocational and Technical School (LAVTS) that used the four different units of instructional materials. The units were (1) Study Guides by the Weed and Pesticide Division of the

Kansas State Department of Agriculture, (2) Kansas Pesticide Users Handbook by the Kansas Extension Service, (3) Agricultural Chemicals Special and (4) Agricultural Chemical Regular. The three and four units of materials were developed by the LAVTS instructors of Agricultural Chemicals, Kenneth Schuster and his assistant, the writer of the report.

Upon completion of the study, the research population was given an examination developed by the Weed and Pesticide Division of Kansas State Department. The examination was over the competencies which were required of pesticide applicators. The examination was confidential to the KSDA. The scores of the research population were reported according to the correct responses.

The findings indicated that there was little difference in the averages of the examination scores between the four groups. An analysis was made to determine which areas needed strengthening within the four units of instructional materials. A difference was observed by the writer in the attitude and desire which individuals had in the certification program.

The total test average for the four groups using four different instructional materials was 88.3% with students using KSDA material having an average of 86.3%, Extension material 88.2%, LAVTS Special material 87.0%, and LAVTS Regular material 88.0%. Since it was the observation of the writer that the ability level of the students in the four groups using the four different instructional materials was nearly equal it was concluded that each of the materials were satisfactory for the instruction of agricultural chemical applicators.

The results of the data convinced the writer that studies can do

much to inform educators of the validity of their instructional materials. The four groups tested demonstrated the importance of the roll of formal education for the certification of future pesticide applicators.