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THE ADOPTION OF TWO FARM PRACTICES IN A CENTRAL IOWA COMMUNITY

by George M. Beal and Everett M. Rogers



Department of Economics and Sociology

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The Adoption of Two Farm Practices In a Central Iowa Community¹

BY GEORGE M. BEAL AND EVERETT M. ROGERS²

One of the salient characteristics of modern American agriculture is its rapidly changing technology. New practices and techniques are constantly being developed by research agencies. Society benefits from these research findings, however, only to the degree that they are diffused to and used by farmers.

One of the important problems inherent in a rapidly changing economy is that of effectively communicating scientific information to the potential user of that information. Much research has been done in recent years to determine the nature of the process by which new ideas and practices are diffused from their source of origin to ultimate use. The research presently reported is built upon the base of these past findings. It is assumed that clearer understanding of this process of communication will result in the more rapid, effective and efficient diffusion of ideas so that both farmer and society as a whole will benefit to a greater extent from technological research findings. Thus, the findings from these studies should have significance, not only to agricultural research workers and to farmers, but also to the many mass media communicators, government "change agents" and commercial concerns and their agents, salesmen and dealers.

The purpose of this publication is to report findings from a study of the adoption of two new farm practices in a central Iowa community. The basic framework for this study was developed from a review and synthesis of the previous research studies by rural sociologists.³

More specifically, this report deals with: (1) the stages in the adoption process (awareness, information, application, trial and adoption); (2) sources of information used by farmers at the different stages; (3) the rate of adoption over time; (4) the interrelationships between time of awareness, trial and adoption, and the time lags between these several stages:

and (5) personal, social and economic characteristics of the adopter categories (innovators, early adopters, early majority, late majority and laggards).

THE PRACTICES STUDIED

The two new farm practices examined are the use of 2, 4-D spray for field weed control and the feeding of antibiotic feed supplements to hogs. These practices were selected because of their importance to Iowa agriculture and because the majority of farmers had adopted them within the 10-year period preceding the study. Because of their fairly recent innovation, it was believed that farm operators would be able to recall certain information about the process by which they adopted these practices.

The weed spray, 2,4-D, was first available to Iowa farmers in 1945 and was recommended by the Co-operative Extension Service in Iowa at about that time. It was a major departure from existing practices in that it involved the use of chemicals in the control of weeds. The adoption of this practice usually required the purchase of a major piece of new equipment, a power sprayer. Some Iowa farmers had already secured a power sprayer for control of corn borers.

Most commercial feed companies were offering swine feeds containing antibiotic supplements by 1949. The main advantages of this new livestock practice were an increase in rate of gain and a decrease in sickness and death losses. For most farmers, the adoption of antibiotics did not mean the purchase of new equipment. Most farmers were already feeding commercial protein supplements to their swine. The inclusion of antibiotics as a part of a feeding program, however, was new and different to many farmers.

THE LOCALE AND SAMPLE

Interviews were conducted in 1955 with the 148 farm operators residing in a trade area community in central Iowa. The authors of this publication make no claim that the findings may be applied to all Iowa farmers. Rather, a brief description of the community that was studied will be presented so that the reader may determine the degree to which he believes these findings may be generalized to his own situation.

¹ Project 1236, Iowa Agricultural and Home Economics Experiment Station.

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³ Subcommittee for the Study of Diffusion of Farm Practices, North Central Rural Sociology Committee. How farm people accept new ideas. Iowa Coop. Ext. Serv. Special Report 15, 1955. For a summary and synthesis of much of this research see: George M. Beal and Joe M. Bohlen. The diffusion process. Iowa Coop. Ext. Serv. Special Report 18, 1957.

The population of the village center was 420 in 1950. The agriculture is predominately "corn-hog" farming. This area is a prosperous, highly commercialized farming area. A vocational agriculture department, the county extension agencies are available. Most farmers subscribe to several farm papers or magazines, and most farm homes contain a radio and television set. There is easy access to a variety of types of communication devices carrying news of improvements in agricultural technology.

MAJOR CONCEPTS AND DEFINITIONS

STAGES IN THE ADOPTION PROCESS

A study of the adoption of a new farm practice is essentially a study of individual decision-making. The process by which a farmer becomes aware of, gathers information about and decides to use or not to use a new farm practice is called the *adoption process*. Recent research has indicated that this adoption process is empirically valid.⁴ Evidence was secured to show that the five stages are recognized by most of the individuals passing through the adoption process.

The five stages have been labeled: Awareness, Information, Application, Trial and Adoption. The type of behavior at each of the stages is as follows:

1. *Awareness Stage*. At this stage the individual is initially exposed to the new idea or practice. He learns of the existence of the new practice but lacks details about it. The motivation to seek additional information about the new practice may not yet be created.

2. *Information Stage*. At this stage the individual is motivated by his curiosity and interest, or by some outside influences to seek additional information about the new practice. The individual is attempting to get general information about the new idea and to relate the new idea to his past experiences and knowledge.

3. *Application Stage*. The individual is concerned with applying the new practice to his own situation at this stage. This stage might be called a "mental trial." The relative advantages of the new practice over other alternatives are considered. The decision to try or not to try the new practice is made.

4. *Trial Stage*. The individual is motivated to actually try out the new practice in his own situation at this stage. The answers to the specific questions of how, when, where and how much are sought by the individual from the various information sources. The trial is usually performed on a small scale.

5. *Adoption Stage*. The decision is made at this stage either to continue use of the new practice or to discontinue its use. The thought process at the adoption stage includes mainly the evaluation of the trial.

The five stages in the adoption process will be used as a framework throughout this publication.

DEFINITIONS OF TERMS

Many of the terms used in this publication may not be completely familiar to the reader or may have another or an ambiguous common usage.

1. *Farm practices* are sometimes referred to also as innovations, new farm practices, improved farm practices and recommended farm practices. In the more restricted usage of this publication, a new farm practice is regarded as synonymous with a new idea. The new practices are generally new ways or methods of agricultural technology. Many require the purchase of a new type of product. These farm practices are "new" in that they are usually of fairly recent development and are "new" to the farmer-user, although they may not be new to the research worker or the change agents concerned.

2. *Adoption* of a farm practice is defined as the continued usage of a practice. In terms of time, adoption takes place at the point in time when the farmer has decided that he is satisfied with its use and will continue to use the practice in the next decision-making period.

3. *The diffusion process* is the process by which a new idea or practice is communicated from its source of invention or development to its ultimate users or adopters. In the case of most farm practices, the point of origin is usually with agricultural scientists at agricultural colleges or commercial concerns. The users are the farmers.

4. *The adoption process* is the mental process through which an individual passes as he adopts a new practice. This process has been described as a series of steps or stages which an adopter goes through in learning about and deciding to adopt a new farm practice.

The adoption process is one that centers around the individual adopter's thought patterns and actions, while the diffusion process deals with the flow of ideas through various communications channels and social systems to potential adopters.

5. *Communication agencies* are the individuals, organizations, and media which transmit the information about the new practice to the farmers. In this publication, these communication agencies are also referred to as diffusion agencies, communication devices and sources of information.

6. *Change agents* are the representatives of organizations and agencies such as county agents, teachers and sales people whose job it is to communicate information about the new practices to potential users and to secure change in these people through their adoption of new practices.

7. *The adoption period* is the time which is required for the adoption of a new practice to take place. It is empirically measured by the number of time units (years, months or weeks) that an individual requires to pass from the awareness stage to the

⁴ George M. Beal, Everett M. Rogers and Joe M. Bohlen. Validity of the concept of stages in the adoption process. *Rural Soc.* 22:166-168, 1957. For another study with generally similar findings see: James Copp, Maurice L. Still and Emory J. Brown. The function of information sources in the farm practice adoption process. *Rural Soc.* 23:146-157, 1958.

adoption stage; i.e., through the adoption process. The adoption period has been referred to as the decision period, deliberation period and time lag by other authors.

CATEGORIZATION OF THE SOURCES OF INFORMATION

For the purpose of this publication the various sources of information are categorized on two different bases. One categorization results in four types of sources of information: mass media, agricultural agencies, commercial sources and informal sources (such as relatives, neighbors and friends). The method of categorization is similar to that used by other rural sociological research workers.

Included in the category of *mass media* are: farm magazines, farm papers, newspapers, radio and television. Included as *agricultural agencies* are the following sources of information: direct contact with Iowa State University, extension service or county agent, state agriculture college bulletins, Farm Bureau,⁵ high school vocational agriculture, adult evening or young farmer classes, 4-H clubs, Veterans On-Farm Training, Soil Conservation Service and the Agricultural Stabilization and Conservation Service.

Commercial communicating agents include: feed dealers, door-to-door salesmen, commercial sprayers, printed directions on sacks or containers, implement dealers, commercial circulars and veterinarians. The *informal* informational sources are: relatives, friends, neighbors, former employers, landlords and farm managers.

The other method of categorization was on the basis of "personal" and "impersonal" sources of information. Personal sources of information are defined as those communication contacts which involve a direct face-to-face exchange between the communicator and the communication receiver (the farmer, in the present study). Included in the category of *personal* sources of information are: relatives, friends, neighbors, landlords, former employers, farm managers, door-to-door salesmen, implement dealers, veterinarians, direct contact with Iowa State University, county agents, vocational agriculture teachers, veterans' teachers and meetings such as 4-H, Farm Bureau, etc.

The category of *impersonal* sources of information includes: farm magazines, newspapers, radio, television, state college bulletins, printed directions on sacks or containers and commercial circulars.

When comparing personal and impersonal sources of information, some of the important characteristics of personal sources are:

1. Two-way communication is possible in that the communication receiver may secure clarification or additional information from the communicator.

2. The message can be aimed more accurately and specifically because the target is a more limited communication audience. The information may be tailored to fit the communication receiver's situation.

3. Conviction may often be secured because "influ-

⁵ Although the Cooperative Extension Service in Iowa and the Iowa Farm Bureau Federation were legally separated in 1954, many farmers still referred to the extension service as "Farm Bureau."

encing" (in addition to information-giving) may occur.

4. Personal informational sources can't be as easily "turned off" as can the impersonal communicating agents such as the mass media. The intended communication receiver may often lack interest in the subject or even actively resist exposure to the information; hence, it frequently happens that impersonal communications never reach their intended receivers.

5. Personal sources are generally more readily available for the "information seeker." The farmer who is actively seeking additional information about some new farm practice may be more likely to seek personal sources. These can usually be located more easily; e.g., a neighbor or friend or agricultural agency representative can usually be sought. A television program or a past issue of a farm magazine, however, may be difficult to locate.

Both the four-way categorization (mass media, commercial, agricultural agency and informal sources) and the personal-impersonal categorization will be used in this publication to analyze the sources of information used by farm operators at each of the stages in the adoption process. Certain informational sources which could not be categorized as outlined were grouped in two residual categories. One category, "self," was used to include such responses as "myself," "my own experience" and "my own trial." The other category is composed of responses such as "don't know," "no answer," etc. This category has been labeled "no response."

In summary, we have categorized the sources of information into four functional categories: mass media, agricultural agencies, commercial sources and informal sources.

Another classification of sources of information is on the basis of whether each source is personal or impersonal. When combined with the first four functional categories, we form six categories: mass media-impersonal, agricultural agency-impersonal, agricultural agency-personal, commercial-impersonal, commercial-personal and informal-personal. These categories of information sources are used in the remainder of this report.

SOURCES OF INFORMATION AT THE DIFFERENT STAGES

A general finding from past adoption research is that the various sources of information play roles of differing importance at the different stages in the adoption process.⁶ For example, it has been reported

⁶ For a general summarization of these findings see the publication by the Subcommittee for the Study of Diffusion of Farm Practices, North Central Rural Sociology Committee, op. cit. More detailed findings may be found in: Eugene A. Wilkening, Adoption of improved farm practices, N. C. Agr. Exp. Sta. Tech. Bul. 98, 1952, pp. 15-34.; Herbert F. Lionberger, Information-seeking habits and characteristics of farm operators, Missouri Agr. Exp. Sta. Res. Bul. 581, 1955, p. 34.; Eugene A. Wilkening, Sources of information for improved farm practices, Rural Soc. 15:21, 1950.; Marvin A. Anderson, Informational sources important in the acceptance and use of fertilizer in Iowa, Iowa State College in cooperation with Tennessee Valley Authority, Knoxville, Tennessee, Report P 55-1, 1955, p. 6.; and Bryce Ryan and Neal Gross, Acceptance and diffusion of hybrid corn seed in two Iowa communities, Iowa Agr. Exp. Sta. Res. Bul. 372, 1950, p. 685.

from most research studies that the mass media are the most important source of information at the awareness stage and are of relatively less importance at the later stages of the adoption process.

The data analyzed in this report were gathered in the field survey described earlier. The field schedule used in this study included questions as to where the farmers obtained their information at each of the five stages of the adoption process for both of the practices. The stages were: awareness, information, application, trial and adoption. The questions actually asked to determine the sources of information at each of these stages were as follows: (1) Awareness. Where or from whom did you first hear about the use of antibiotics (or 2,4-D)? (2) Information. After you first heard about antibiotics (or 2,4-D), where or from whom did you get additional, more detailed information about antibiotics (or 2,4-D)? (3) Application. After you had enough information to know quite a lot about antibiotics (or 2,4-D), where or from whom did you get the information that helped you decide whether or not to actually try it on your own farm? (4) Trial. After you decided to try out antibiotics (or 2,4-D) on your own farm, where or from whom did you get the most information or help on how much to use? . . . how to apply? . . . how to use? . . . where to get it? . . . and the kind to use on your own farm? (5) Adoption. After you once tried antibiotics (or 2,4-D) on your farm, how did you decide whether or not to continue using and actually adopt it?

In addition, each farmer was asked to give the dates at which he became aware of antibiotics (or 2,4-D), first tried it out, and adopted it.

The responses to the previous questions indicate that different sources of information were used at each stage in the adoption process. Tables 1 and 2 show the sources of information used at each stage for each practice.

If the assumption is made that the community of study is a sample from a universe of other communities with similar characteristics, then the utilization of statistical methods is justified. When the "no information" and "no response" categories and the adoption stage are dropped from the analysis (because of an insufficient number of cases in certain cells), a highly significant Chi Square is found for both 2,4-D weed spray and antibiotics. The sources of information for both practices varied, by adoption stage, more than could result from chance alone.⁷ In other words, real differences exist as to information sources at the adoption stages.

The specific sources of information that were most important at each stage in the adoption process (tables 1 and 2) may be summarized as follows:

1. At the awareness stage, mass media were mentioned most frequently. Informal sources played their least important role at this stage.

⁷ In the case of 2,4-D spray (table 1), Chi Square is 136.99, which is far more than the 21.67 required for significance at the 1-percent level with nine degrees of freedom. It should be pointed out that one cell contained only two cases. This cell's minor contribution to the total Chi Square, however, did not greatly affect the conclusion that the sources of information varied by adoption stage more than could result from chance alone.

In the case of the adoption of antibiotics (table 2), Chi Square is 93.94, which is far more than the 21.67 required for significance at the 1-percent level with nine degrees of freedom.

TABLE 1. SOURCES OF INFORMATION AT EACH STAGE IN THE ADOPTION OF 2,4-D WEED SPRAY.

Categorized source of information	Adoption stages									
	Awareness		Information		Application		Trial		Adoption	
	No.	%	No.	%	No.	%	No.	%	No.	%
Mass media	65	51	33	25	19	15	2	2	..	..
Agricultural agency	27	21	27	21	18	14	12	9	4	3
Informal sources	26	20	39	30	53	41	34	26	2	2
Commercial sources	8	6	23	18	22	17	59	46	1	1
Self	..	..	2	2	5	4	9	7	120	93
No response	3	2	5	4	12	9	13	10	2	2
Total number	129	..	129	..	129	..	129	..	129	..
Total percent	..	100	..	100	..	100	..	100	..	100

TABLE 2. SOURCES OF INFORMATION AT EACH STAGE IN THE ADOPTION OF ANTIBIOTICS.

Categorized source of information	Adoption stages									
	Awareness		Information		Application		Trial		Adoption	
	No.	%	No.	%	No.	%	No.	%	No.	%
Mass media	52	49	37	35	17	16	3	3	..	..
Agricultural agency	20	19	19	18	13	12	7	7	..	..
Informal sources	9	8	15	14	22	21	14	13	1	1
Commercial sources	26	24	35	33	54	50	72	67	..	..
Self	..	..	..	..	..	..	3	3	101	94
No response	..	..	1	1	1	1	8	7	5	5
Total number	107	..	107	..	107	..	107	..	107	..
Total percent	..	100	..	100	..	100	..	100	..	100

2. At the information stage, there was a more equal importance of each of the four categories of information sources.

3. At the application stage, one category of sources of information was mentioned by over 40 percent of the respondents — informal sources in the case of 2,4-D weed spray, and commercial sources in the case of antibiotics.

4. At the trial stage, commercial sources were mentioned most frequently.

5. At the adoption stage, the individual's satisfaction with the trial was by far the most important "source" of information.

The categorized sources of information for the two farm practices show a number of general trends through the five stages (tables 1 and 2).

1. The importance of mass media sources decreased from the awareness to the adoption stage.

2. The importance of informal sources increased from the awareness to the application stage and then decreased through the trial and adoption stages.

3. The importance of commercial sources increased from the awareness through the trial stage.

4. Agricultural agency sources of information were most important at the awareness stage, then tended to decrease through later stages.

Commercial sources of information were more important in the case of antibiotics at all stages in the process than in the case of 2,4-D weed spray.

PERSONAL AND IMPERSONAL SOURCES OF INFORMATION

On the basis of the categorization of personal and impersonal sources of information, we might expect certain information sources to be of different importance at the different adoption stages.

Two-way communication is one characteristic of

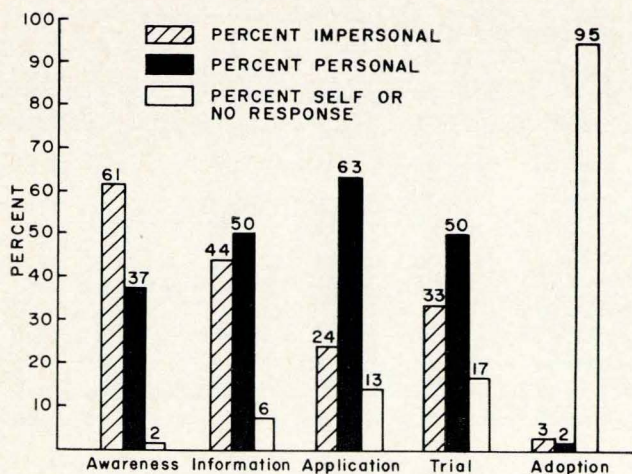


FIG. 1. PERSONAL AND IMPERSONAL INFORMATION AT EACH STAGE IN THE ADOPTION OF 2,4-D WEED SPRAY.

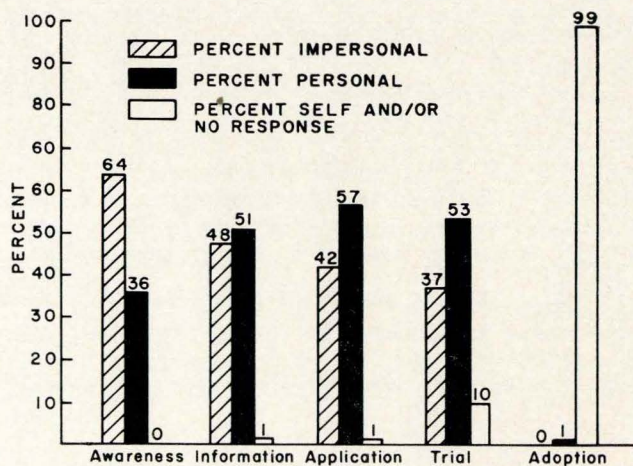


FIG. 2. PERSONAL AND IMPERSONAL INFORMATION AT EACH STAGE IN THE ADOPTION OF ANTIBIOTICS.

personal informational sources. This type of communication would allow questions of evaluation and of clarification to be asked and answered. This would probably be most important at the application stage, when the farmer is attempting to decide whether or not the new farm practice will apply to his farming situation. Past research workers have generally found neighbors, friends and other personal sources to be most important at this stage.

At the awareness stage, the farmer may not be actively seeking information because he may not know of the existence of the new practice. His exposure at this stage may be quite by accident. Impersonal informational sources, with their wide range of coverage and high degree of chance or accidental contact with the receiver, would be more likely to be important at the awareness stage.

Personal and impersonal sources of information did seem to be used in varying degrees at the different stages in the adoption process. This is indicated in figs. 1 and 2. The sources of information for both 2,4-D weed spray and antibiotics varied, by adoption stage, more than could result from chance alone.⁸

A general trend for both farm practices, was for personal sources of information to be most important at the application stage and least important (when the adoption stage is dropped from the analysis) at the awareness stage. Personal sources were more important than impersonal sources at all but the awareness stage. Impersonal sources were most important at the awareness stage.

A COMBINED FUNCTIONAL AND PERSONAL-IMPERSONAL ANALYSIS

In addition to categorizing all sources of information on a personal-impersonal basis, it was possible to subdivide each of the functional categories of com-

mmercial and agricultural agency sources as to personal or impersonal. For example, agricultural agency sources were divided into personal and impersonal subcategories. The former would include, for example, direct personal contact with the county agent or vocational agriculture teacher, and the latter would include extension service bulletins and pamphlets. A subdivision of mass media and informal categories could not be made because mass media sources are totally impersonal, and informal sources are completely personal. Hence, six categories of information sources resulted, in addition to "self" and "no response" categories.

Tables 3 and 4 present the importance of each of these categories of information by stage in the adoption process for both farm practices.

It appears (tables 3 and 4) that agency-impersonal sources are more important than agency-personal sources at the information stage for both practices. At the other stages, however, there is no consistent trend for impersonal agency sources to be more or less important than agency-personal sources.

Commercial-personal sources are more important than commercial-impersonal sources at the information and application stages. Greatest use of commercial sources of information is made at the trial stage where both commercial-personal and commercial-impersonal sources are used but differ by practice; impersonal being more important for 2,4-D, and personal more important for antibiotics. The commercial-impersonal sources at the trial stage were mainly instructions accompanying the product. This finding suggests that commercial-impersonal sources play an important role when the farmer is deciding upon the specifics of how to use the new product and when to use it.

Perhaps farmers place a low degree of credibility in commercial-impersonal sources at the information and application stages because they are aware that the company is trying to sell a product. When this information is personalized through a dealer or salesman, however, it may be more acceptable to the farmer. The relative importance of *commercial-personal*

⁸ In the case of 2,4-D weed spray, Chi Square is 31.54 which is more than the 11.34 required for significance at the 1-percent level with three degrees of freedom. In the case of antibiotics, Chi Square is 12.66 which is more than the 11.34 required for significance at the 1-percent level.

TABLE 3. SOURCES OF INFORMATION AT EACH STAGE IN THE ADOPTION OF 2,4-D WEED SPRAY.

Categorized source of information	Adoption stages									
	Awareness		Information		Application		Trial		Adoption	
	No.	%	No.	%	No.	%	No.	%	No.	%
Mass media—impersonal	65	51	33	26	19	15	2	2	..	..
Agency—personal	14	11	7	5	9	7	8	6	..	..
Agency—impersonal	13	10	20	15	9	7	4	3	4	3
Informal—personal	26	20	39	30	53	41	34	26	2	2
Commercial—personal	7	5	19	15	19	15	23	18	1	1
Commercial—impersonal	1	1	4	3	3	2	36	28	..	..
Self	0	0	2	2	5	4	9	7	120	92
No response	3	2	5	4	12	9	13	10	2	2
Total	129	100	129	100	129	100	129	100	129	100

TABLE 4. SOURCES OF INFORMATION AT EACH STAGE IN THE ADOPTION OF ANTIBIOTICS.

Categorized source of information	Adoption stages									
	Awareness		Information		Application		Trial		Adoption	
	No.	%	No.	%	No.	%	No.	%	No.	%
Mass media—impersonal	52	49	37	34	17	16	3	3	0	..
Agency—personal	5	5	7	7	3	3	1	1	0	..
Agency—impersonal	15	14	12	11	10	9	6	5	0	..
Informal—personal	9	8	15	14	22	21	14	13	1	1
Commercial—personal	25	23	33	31	36	33	41	38	0	..
Commercial—impersonal	1	1	2	2	18	17	31	30	0	..
Self	0	0	0	0	0	0	3	3	101	94
No response	0	0	1	1	1	1	8	7	5	5
Total	107	100	107	100	107	100	107	100	107	100

TABLE 5. NUMBER OF FARM OPERATORS AT THE AWARENESS, TRIAL AND ADOPTION STAGES FOR 2,4-D WEED SPRAY BY YEAR.

Year	Awareness stage			Trial stage			Adoption stage		
	Number	Cumulative number	Cumulative %	Number	Cumulative number	Cumulative %	Number	Cumulative number	Cumulative %
1944	5	5	3.9	0	0	0.0	0	0	0.0
1945	15	20	15.9	7	7	5.6	5	5	3.9
1946	12	32	25.4	7	14	11.2	7	12	9.3
1947	27	59	46.8	14	28	22.4	13	25	19.4
1948	20	79	62.7	20	48	38.4	18	43	33.3
1949	14	93	73.8	16	64	51.2	9	52	40.3
1950	22	115	91.2	20	84	67.2	26	78	60.5
1951	6	121	96.0	14	98	78.4	15	93	72.1
1952	4	125	99.2	15	113	90.4	15	108	83.7
1953	1	126	100.0	3	116	92.8	6	114	88.4
1954	0	126	100.0	7	123	98.4	7	121	93.8
1955	0	126	100.0	2	125	100.0	8	129	100.0
Total*	126	..	..	125	..	..	129	..	..

* Totals for the three stages differ because data were not obtained from three adopters as to their time of awareness and four adopters as to their time of trial.

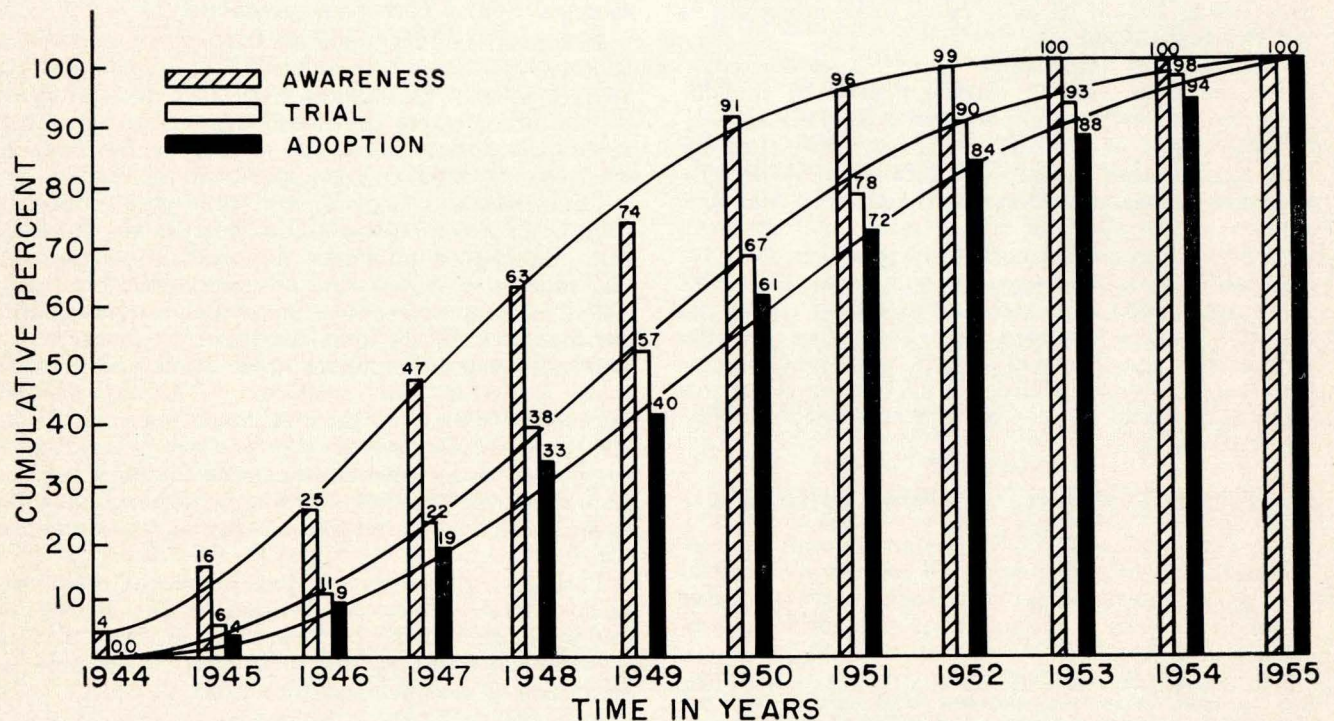


Fig. 3. Cumulative percentage of farm operators at the awareness, trial and adoption stages for 2,4-D weed spray by year.

sources of information should be of interest to commercial change agents. Their role as an important source of information increases from awareness to trial. The role of the dealer, salesman and other commercial change agents is one that merits further intensive research.

THE NORMAL ADOPTION CURVE

Most change agents recognize that new ideas and practices are not adopted by all individuals at the same time. The tendency to be late rather than an early adopter of a new idea is probably a reflection of a pattern of characteristics of the individual who indicates a tendency to be resistant to technological

change. Findings from past studies indicate that these later adopters of new practices generally tend to read fewer magazines and bulletins, have smaller sized farms and belong to fewer formal organizations.

Past findings also indicate that the adoption of a new farm practice follows a bell-shaped curve over time. This type of distribution is "S" shaped when plotted on a cumulative basis. There is first a slow, gradual rate of adoption, then a more rapid rate of adoption and, finally, a leveling off in the rate of adoption.

If adoption curves are not only bell-shaped but also normal, it would be possible to predict the amount of time necessary for complete adoption as soon as 50 percent of the farmers in a population have adopted.

TABLE 6. NUMBER OF FARM OPERATORS AT THE AWARENESS, TRIAL AND ADOPTION STAGES FOR ANTIBIOTICS BY YEAR.

Year	Awareness stage			Trial stage			Adoption stage		
	Number	Cumulative number	Cumulative %	Number	Cumulative number	Cumulative %	Number	Cumulative number	Cumulative %
1941	1	1	1.0	0	0	0.0	0	0	0.0
1942	0	1	1.0	0	0	0.0	0	0	0.0
1943	0	1	1.0	0	0	0.0	0	0	0.0
1944	4	5	4.8	0	0	0.0	0	0	0.0
1945	1	6	5.7	4	4	4.3	4	4	3.8
1946	4	10	9.5	3	7	7.5	3	7	6.7
1947	5	15	14.3	1	8	8.6	1	8	7.6
1948	6	21	20.0	6	14	15.1	6	14	13.3
1949	10	31	29.5	1	14	15.1	1	15	14.3
1950	29	60	57.1	10	24	25.8	9	24	22.9
1951	19	79	75.2	22	46	49.5	18	42	40.0
1952	19	98	93.3	18	64	68.9	25	67	63.8
1953	5	103	98.1	15	79	84.9	21	88	83.8
1954	2	105	100.0	10	89	95.7	5	93	88.6
1955	0	105	100.0	4	93	100.0	12	105	100.0
Total*	105			93			105		

* Totals for the three stages differ because data were not obtained from 12 adopters as to their time of trial.

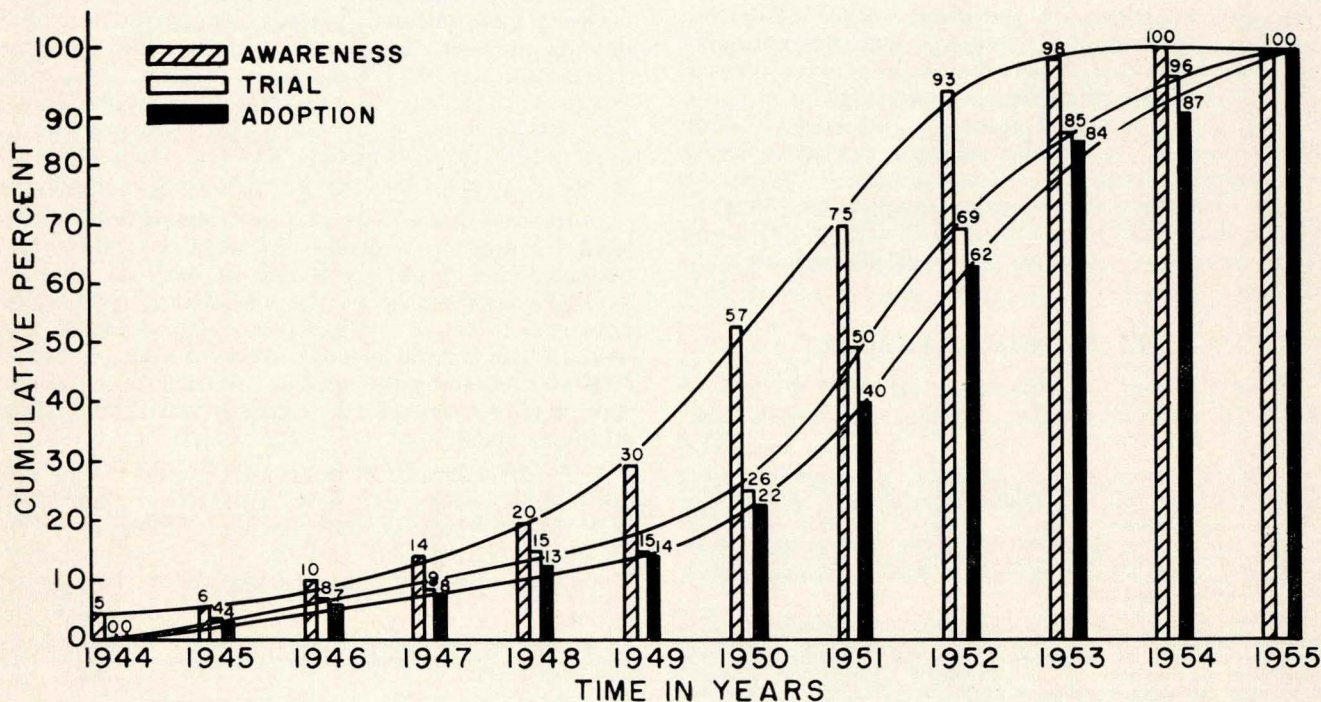


Fig. 4. Cumulative percentage of farm operators at the awareness, trial and adoption stages for antibiotics by year.

There is some reason to expect that the time distribution over which farmers become *aware* of a new practice would also be bell-shaped and perhaps normal. The same might be said of the time at which farmers try out a new practice (the trial stage).

To determine the normalcy of the awareness, trial and adoption distributions, the 148 farm operators in the study were asked: (1) When did you first hear about the use of antibiotics (or 2,4-D)? (2) When did you first decide to try out antibiotics (or 2,4-D) on your own farm? (3) When did you decide to continue using antibiotics (or 2,4-D) and actually adopt it?

Table 5 shows the number of farm operators who went through the awareness, trial and adoption stages in adopting 2,4-D weed spray each year. These same data are shown in fig. 3 on a cumulative basis. A normal frequency curve would appear as an "S-shaped" or ogive distribution when plotted on a cumulative basis.

Table 6 shows the number of farmers who passed through the awareness, trial and adoption stages in adopting antibiotics by year. These data are shown on a cumulative basis in fig. 4.

It can be seen that the time distributions for awareness, trial and adoption for both 2,4-D and antibiotics are essentially S-shaped. On a frequency, rather than a cumulative basis, these six distributions would appear to be bell-shaped. This would mean that, at first, only a few farmers become aware of (or try out or adopt) a new practice; then more and more farmers pass through the particular stage (awareness, trial or adoption) each year until half of the farmers, are aware. The number each year then decreases with each succeeding year.

Although it has been shown that these distributions are bell-shaped, it has not yet been determined if they are also normal. A statistical method called the Smirnov goodness of fit test was used to determine the probability that the six distributions were normal. The 2,4-D distributions for awareness, trial and adoption (fig. 3) were all found to be normal.⁹ The distribution of the number of farm operators trying antibiotics by year (fig. 4) was found to be normal.

The awareness and adoption distributions for antibiotics, however, were found to deviate significantly from normality, although they approached normality.¹⁰

THE ADOPTION PERIOD

From the time lag appearing between the curves in figs. 3 and 4, it can be seen that a certain amount

⁹ For the 2,4-D spray awareness distribution, the maximum deviation from normality is 14.45 (in 1949) which is less than the allowable deviation of 15.27 at the 5-percent level of significance. The maximum deviation from normality is 3.54 for the 2,4-D spray trial curve which is much less than the 15.20 allowable at the 5-percent level. For the 2,4-D spray adoption distribution, maximum deviation from normality is 12.49 (in 1949) which is less than the allowable deviation of 15.43 at the 5-percent probability.

¹⁰ For the antibiotics awareness distribution, the maximum deviation from normality is 23.18 (in 1949) which is more than the allowable deviation of 16.70 at the 1-percent level of probability. The trial distribution for antibiotics is not significantly different from a normal distribution. Maximum deviation is 10.50 (in 1951) which is less than the 12.54 allowable at the 5-percent level. For the antibiotics awareness distribution, maximum deviation is 18.93 (in 1950) which is more than the 16.70 allowable at the 1-percent level of significance.

TABLE 7. AVERAGE TIME PERIODS REQUIRED, IN YEARS, FOR TWO FARM PRACTICES.

Period	Average time required 2,4-D spray	Average time required antibiotics
Awareness-trial period	1.58	1.43
Trial-adoption period	0.48	0.18
Adoption period (awareness to adoption)	2.06	1.61

of time is required on the average for an individual to pass through the five stages from awareness to adoption. This period required for an individual to pass through the awareness to the adoption stage is termed the *adoption period*.

Farm operators seem to vary widely as to the length of time required for the adoption process to take place. In this study, for example, some farmers reported that they adopted a new practice within 1 year of the time at which they first became aware of its existence. Other farmers reported an adoption process of 10 years from awareness to adoption. The length of the adoption period would seem to offer some measure of the degree to which an individual was reluctant or resistant to make technological changes; i.e., to adopt new farm practices.

Data were available from each farm operator as to the length of the adoption period (year of adoption minus year of awareness), the awareness-trial period (year of trial minus year of awareness) and the trial-adoption period (year of adoption minus year of trial) for both new farm practices. The average number of years required for each of these time periods is shown in table 7.

INTERRELATIONSHIPS

An attempt was made to determine the relationships between these different periods. The correlation coefficients between the awareness-trial period and the trial-adoption period were computed for both farm practices. It might be expected that an individual who was reluctant to try out a new farm practice (a long period from awareness to trial) would also be reluctant to adopt the new practice after trying it.

In the case of 2,4-D weed spray, there is not a significant relationship between the length of the awareness-trial period and the length of the trial-adoption period.¹¹ In the case of the adoption of antibiotics, however, there is a significant relationship.¹² This would mean that farmers who require a longer period to pass from the awareness to the trial stage also require a longer time period to pass from the trial to the adoption stage.

The correlations for both 2,4-D weed spray and antibiotics, were very low, suggesting that these two time periods in the adoption process — the awareness-trial period and the trial-adoption period — may not be very closely related. For this reason,

¹¹ Correlation is -0.117 which is less than the 0.176 required for the relationship to be significantly different from zero at the 5-percent level when $N=125$.

¹² Correlation is $+0.210$ which is more than the 0.195 required for the relationship to be significantly different from zero at the 5-percent level when $N=97$.

it might be concluded that the total adoption period (awareness-adoption) is the best single index of reluctance to adopt a new farm practice. The two component parts of this adoption period, the awareness-trial period and the trial-adoption period, were not themselves interrelated to any high degree.

It was hypothesized that those adopters with a shorter number of years required for the adoption process would be less conservative in nature and less reticent to make changes in their farming enterprises. These same individuals would be likely to be quicker to adopt new farm practices (i.e., adopt at an earlier date). It was expected that a positive relationship would be found between the year in which a farmer adopted a farm practice and the number of years that would be required for him to move from the awareness to the adoption stage. In other words, it was expected that the later the year of adoption, the greater the time lag between awareness and adoption.

In the case of both 2,4-D weed spray¹³ and antibiotics, this relationship is highly significant.¹⁴ As expected, the farm operators who were the first to adopt these two farm practices required fewer years to pass through the adoption process from awareness to adoption.

AWARENESS DATE AND LENGTH OF THE ADOPTION PERIOD

Adopting a farm practice is "purposive" behavior on the part of the individual. It is planned behavior and, as such, the date of adoption is not a chance or random occurrence. Adoption behavior may reflect certain aspects of the individual's personality, attitudes and values.

An individual, however, may become *aware* of a new farm practice quite by accident. It may be "non-purposive" behavior. For example, a farmer may just happen to learn of 2,4-D weed spray while watching his television set, listening to his radio, or while reading a farm publication. The data that were presented in tables 1 and 2 offered evidence of the preponderance of mass media sources of information at the awareness stage.

On the basis of this reasoning, it is not expected that the number of years required for an individual to pass through the five stages of the adoption process would be highly related to the date at which he became *aware* of the practice. This was found to be the case for both 2,4-D spray and antibiotics. The relationship between date of *awareness* and the number of years required for the adoption period is lower than the similar relationship between date of *adoption* and the number of years required for the adoption period in the case of 2,4-D weed spray.¹⁵

¹³ Correlation is +0.627 which is more than the 0.230 required for the relationship to be significantly different from zero at the 1-percent level when N=126.

¹⁴ Correlation is +0.421 which is more than the 0.254 required for the relationship to be significantly different from zero at the 1-percent level when N=104.

¹⁵ Correlation between date of awareness and length of the adoption period for 2,4-D weed spray is +0.210, while the correlation between date of adoption and length of the adoption period is +0.627.

The findings were similar in the case of antibiotics.¹⁶

These findings for both farm practices are consistent with our proposition that awareness behavior tends to be nonpurposive or accidental, while adoption behavior is purposive or planned.

For both 2,4-D weed spray and antibiotics, however, there is a significant relationship between awareness date and the length of the adoption period. A partial explanation of this finding may possibly be found in the relationship that exists between date of awareness and date of adoption. Adoption certainly cannot take place until the individual is aware of the new farm practice. A highly significant relationship was found between 2,4-D weed spray awareness and adoption dates¹⁷ and also between antibiotics awareness and adoption dates.¹⁸

Hence, we might conclude that some of the relationship between length of the adoption period and the awareness date might result from the high relationships that both of these items have to a third factor, the adoption date.

It is possible to determine the time relationship between the awareness date and the length of the adoption period while controlling on the effect of the adoption date. The statistical technique of partial correlation was utilized to control or hold constant the effect of the adoption dates.¹⁹

By controlling on adoption dates by partial correlation techniques, the relationship between awareness dates and length of the adoption period becomes negative rather than positive in the case of 2,4-D weed spray.²⁰ In the case of antibiotics, controlling on the effect of the adoption dates changed the relationship between awareness dates and length of the adoption period to a correlation that was not significant.²¹

In other words, there was no positive relationship between awareness dates and length of the adoption period when we controlled on the effect of adoption dates. This means that the first farmers to become aware of a new practice will require just as long an adoption period as those farmers who happen to be among the last to become aware of a new practice.

The first farmers to adopt a new practice, however, require a much shorter period of years to pass through the adoption period. This finding suggests that the first farmers to adopt a new practice do so,

¹⁶ Correlation between date of awareness and length of adoption period for antibiotics is +0.354, while the correlation between date of adoption and length of adoption period is +0.421.

¹⁷ Correlation is +0.612, which is more than the 0.230 required for the relationship to be significantly different from zero at the 1-percent level when N=129.

¹⁸ Correlation is +0.704, which is more than the 0.254 required for the relationship to be significantly different from zero at the 1-percent level when N=104.

¹⁹ For a description of partial correlation techniques, see: George W. Snedecor, *Statistical methods*, Iowa State University Press, Ames, 1946, pp. 357-358.

²⁰ By controlling on adoption dates, the relationship changed from +0.210 to -0.282. A correlation of -0.282 is more than the 0.230 required for the relationship to be significantly different from zero at the 1-percent level when N=124.

²¹ By controlling on adoption dates, the relationship changed from +0.354 to a +0.089. A correlation of +0.089 is less than the 0.195 required for the relationship to be significantly different from zero at the 5-percent level when N=107.

not because they become aware of the practice much sooner than their neighbors, but because they require fewer years to move from awareness to adoption. For example, the 2,4-D spray innovators averaged an adoption period of 0.40 year while the laggards averaged 4.65 years (table 10). The antibiotics innovators averaged an adoption period of 1.50 years and the laggards averaged 4.12 years. A more detailed analysis of the characteristics of the early and late adopters of a new practice is contained later in this report.

If an attitude toward a new farm practice is one part of a general attitude toward change in farm technology, it would be expected that an early adopter of 2,4-D weed spray would also tend to be an early adopter of antibiotics. This might be expected even though the two practices were widely different in nature.

There is a highly significant relationship between the adoption dates for the two practices.²² Farmers who were relatively early in their adoption of 2,4-D weed spray were also early in their adoption of antibiotics. Later adopters for one practice were also later adopters for the other practice.

SUMMARY

In this section on the adoption period, we have found:

1. A considerable period of time was required for farmers to pass from awareness to adoption. The length of the adoption period was 2.06 years in the case of 2,4-D weed spray and 1.61 years in the case of antibiotics.
2. Individual farmers varied considerably as to the length of their adoption period. In the case of both practices, adoption periods varied from 0 to 10 years.
3. While adoption behavior is planned or purposive behavior, there is some evidence that a farmer does not purposely become aware of a new practice. This is more likely to be accidental or unplanned.
4. Early adopters of both new practices were found to require fewer years to pass through the adoption process than did later adopters.
5. No positive relationship was found between the date at which farmers became aware of the new practices and the length of their adoption periods. This finding suggests that the first farmers to adopt a new practice do so mainly because they require fewer years to move from awareness to adoption and not because they become aware of the practice any sooner than their later adoption neighbors.
6. Farmers who were early adopters of 2,4-D weed spray also were found to be early adopters of antibiotics. This finding suggests that an attitude toward a specific new practice is but one part of a more general attitude toward changes in farm technology.

²² Correlation is +0.329 which is more than the 0.230 required for the relationship to be significantly different from zero at the 1-percent level when N=131.

ADOPTER CATEGORIES

DESCRIPTION OF THE CATEGORIES

It has been pointed out that all individuals do not adopt a new practice at the same time. Farmer adoption for both 2,4-D weed spray and antibiotics occurred as early as 1945 for some farm operators and as late as 1955 for others. These earlier adopters were found to be different from later adopters on a number of personality, social and economic characteristics. They used different sources of information and have had different relationships with certain change agents.

Farm operators have been categorized on the basis of the time at which they adopt a new farm practice. The very first adopters of a new practice have been referred to as "innovators." Other categories of adopters have been labeled as: "early adopters," "early majority," "late majority" and "laggards." A description of these five adopter categories (although using slightly different titles for some categories) is contained in the publication by the Subcommittee for the Study of Diffusion of Farm Practices.²³

The farmers were divided into five adopter categories, by using the technique of standard deviations from the mean.

The division of farmers into these five adopter categories is only for purposes of providing an easier understanding of the diffusion process. The criteria of categorization (time of adoption) is a continuous variable, and its division into discrete adopter categories is similar to the division of socio-economic status into social classes.

Innovators are the first 2.5 percent to adopt a new farm practice. Past research has shown these innovators to be different from the average farm operator on such characteristics as education, size of farm, readership of farm magazines and newspapers, amount of capital and attitude toward change. Because they are so different from the average farmer, innovators probably do not serve as a "model" for the majority of later adopters. In fact, there is some evidence to support the hypothesis that innovators are not regarded by most farmers as valid sources of information about farming matters.

Early adopters are the next 13.5 percent of the population to adopt a new practice. These farmers seem to actually serve as "leaders" in the adoption of new practices to the extent that their adoption behavior is followed by other farmers. The position of the early adopters seems to be earned by their ability to be ahead of the average adopter but not so much earlier that they are not respected. These early adopters would seem to be a key target for the efforts of change agents.

The 68 percent of the population centered around the average date of adoption is divided into *early majority* and *late majority*. Thirty-four percent of the population is included in each of these two adopter categories.

The *laggards* are the last 16 percent of the population to adopt a new practice. Past research has found

²³ *op. cit.*

these farmers to be older, living on smaller farms and having less education than the average farmer. Laggards may be ridiculed by some of their neighbors because they are later to adopt new practices.

In addition to the five adopter categories described above, a part of the farm population may never adopt some farm practices. These *nonadopters* might in a sense be considered as a sixth category.

ADOPTER CATEGORIZATION BY TIME

It was shown earlier that the distribution of the adopters of both antibiotics and 2,4-D spray over time was essentially normal. Figure 5 shows how the five adopter categories would appear in relation to one another on the basis of time of adoption of some new farm practice.

The adopters of 2,4-D weed spray were categorized on the basis of their time of adoption. The exact percentage desired in each of the five adopter categories could not be exactly attained because of the crude nature of the measure of time of adoption (to the nearest year). The number of farmers in each of the five adopter categories is shown in table 8.

The number of farm operators included in each adopter category for antibiotics is shown in table 9. As in the case of 2,4-D weed spray, the desired number in each category could not be exactly obtained in each case. For example, 2.5 percent would ideally be included in the innovator category rather than the 3.8 percent actually included. Again, this is due to the crude nature of the measure of time of adoption.

PERSONAL CHARACTERISTICS OF THE ADOPTER CATEGORIES

If change agents intend to concentrate their efforts on certain adopter categories, they will need to be able to identify these certain adopters from the total constituency with whom they work. Another reason for selecting and analyzing the characteristics of the adopter categories is that the change agent may use certain techniques for reaching selected audiences among his constituents. For example, perhaps early adopters attend many extension service meetings but

TABLE 8. CATEGORIZATION OF THE ADOPTERS OF 2,4-D WEED SPRAY ON THE BASIS OF TIME OF ADOPTION.

Category title	Number	Percentage of total adopters	Years of adoption
Innovators	5	3.9	1945
Early adopters	20	15.5	1946-1947
Early majority	27	20.9	1948-1949
Late majority	56	43.4	1950-1952
Laggards	21	16.3	1953-1955
Total adopters	129	100.0	

TABLE 9. CATEGORIZATION OF THE ADOPTERS OF ANTI-BIOTICS ON THE BASIS OF TIME OF ADOPTION.

Category title	Number	Percentage of total adopters	Years of adoption
Innovators	4	3.8	1945
Early adopters	11	10.5	1946-1949
Early majority	27	23.7	1950-1951
Late majority	46	43.8	1952-1953
Laggards	17	16.2	1954-1955
Total adopters	105	100.0	

do not read farm magazines and newspapers. This would suggest certain techniques to the change agent if he wished to concentrate his efforts upon the early adopters.

The characteristics of the adopter categories are discussed under four main headings: personal characteristics, communication usage, contact with change agents, and attitudes and opinions. It must be remembered that there are two sets of adopter categories, one for each of the two new farm practices. The characteristics of the adopter categories are summarized in tables 10 and 11.

PERSONAL CHARACTERISTICS

In the case of both the adopters of 2,4-D weed spray and antibiotics, the earlier adopters tended to be of older age than the later adopters. This finding would seem to provide evidence that older individuals are not necessarily more reluctant to adopt new farming practices. Perhaps the differences in age on the basis of time of adoption might be partly explained by the number of beginning (young) farmers that were later adopters.

The average size of farm tended to be smaller for

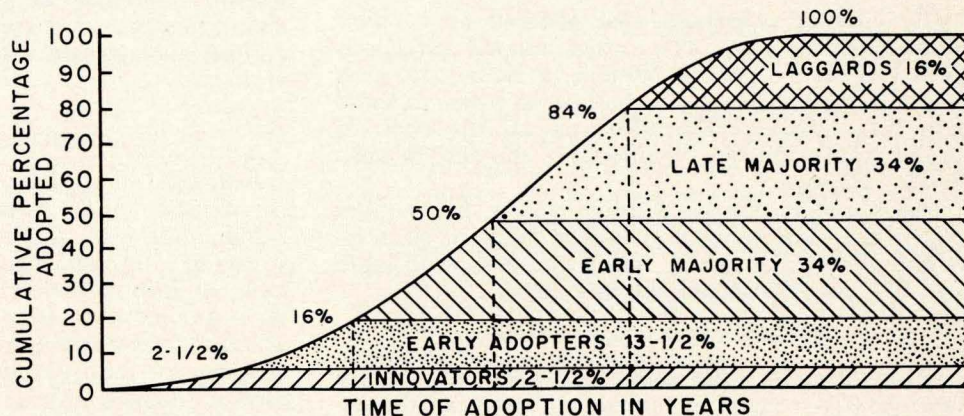


FIG. 5. ADOPTER CATEGORIES ON THE BASIS OF A CUMULATIVE ADOPTION DISTRIBUTION.

TABLE 10. CHARACTERISTICS OF 2,4-D WEED SPRAY ADOPTER CATEGORIES.

Characteristic	Average scores				
	Innovators	Early adopters	Early majority	Late majority	Laggards
Age (years) ^o	53.6	47.7	45.6	40.8	39.7
Size of farm (acres)	200.8	177.6	182.4	205.7	165.8
Newspapers (number)	3.40	3.25	2.96	3.04	2.45
Farm magazines (number)	4.40	3.85	3.54	3.57	3.00
Farm TV shows	2.00	4.30	3.65	3.40	4.11
Farm radio shows	4.40	3.35	3.21	2.98	3.20
Extension mass media score	11.40	13.80	7.29	6.95	12.00
Extension meetings score ^{oo}	3.40	1.85	0.86	0.86	0.80
Extension personal contact score ^{oo}	5.40	2.05	1.14	1.05	1.35
Extension knowledge score	12.40	9.65	9.46	9.04	8.75
Importance of adoption to income	3.40	3.00	2.75	2.79	3.00
Importance of adoption to prestige	2.80	2.35	2.21	2.38	1.90
Self-categorization on new practices	4.20	4.00	4.21	4.05	3.75
Self-categorization on major farm enterprise	2.40	2.65	2.64	2.82	2.75
Opinion of innovators	2.00	2.38	2.18	1.92	2.06
Length of adoption period (years) ^{oo}	0.40	0.55	1.14	2.34	4.65

^o Significant at the 5-percent level.

^{oo} Significant at the 1-percent level.

TABLE 11. CHARACTERISTICS OF ANTIBIOTICS ADOPTER CATEGORIES.

Characteristic	Average scores				
	Innovators	Early adopters	Early majority	Late majority	Laggards
Age (years)	53.0	50.4	42.1	40.9	39.4
Size of farm (acres)	213.0	216.5	192.7	178.9	166.2
Newspapers (number)	3.25	3.36	3.14	2.94	2.24
Farm magazines (number)	4.00	3.82	4.11	3.60	3.53
Farm TV shows	3.67	4.30	4.04	3.25	4.07
Farm radio shows ^o	4.00	5.45	3.29	3.02	2.59
Extension mass media score ^{oo}	10.75	19.09	6.36	5.06	7.59
Extension meetings score	3.00	2.00	0.93	0.72	1.41
Extension personal contact score ^{oo}	4.75	3.00	1.07	1.19	1.76
Extension knowledge score	10.25	11.27	9.79	8.72	10.29
Importance of adoption to income	3.50	3.00	3.00	2.74	2.94
Importance of adoption to prestige	3.00	1.73	2.25	2.38	2.29
Self-categorization on new practices	4.25	3.64	4.18	4.32	4.00
Self-categorization on major farm enterprise	2.75	2.55	2.54	2.79	2.76
Opinion of innovators	2.00	1.71	2.20	2.15	2.13
Length of adoption period ^{oo}	1.50	0.55	0.79	1.52	4.12

^o Significant at the 5-percent level.

^{oo} Significant at the 1-percent level.

laggards than for other adoption categories for both new farm practices.

COMMUNICATION USAGE

The adopter categories also differed as to their communication usage. The earlier adopter categories tended to read a greater number of farm magazines and newspapers. They also tended to listen to more farm radio shows. This difference on the basis of adopter categories was significant in the case of antibiotics adopters.

There were no apparent differences in the number of farm television shows watched on the basis of adopter categories. If anything, the laggards viewed more farm TV shows than did the innovators.

CONTACT WITH CHANGE AGENTS

Three different scales were constructed to measure the degree of contact an individual had with the extension service. The first of these was called an Extension Mass Media Scale. Points were awarded to a farm operator on the basis of the number of times

within the past year that he had: (1) read a circular letter sent out by the county agent, (2) read a newspaper article written by the county agent, (3) requested any form of written information such as a circular or bulletin from the county agent, (4) seen a TV program on which the county agent or extension workers talked about farming matters, (5) heard a radio program on which the county agent or other extension workers talked about farming matters.

Highly significant differences in Extension Meetings Scores were found among the adopter categories in the case of 2,4-D spray. The innovator category had the highest mean score, which indicated they attended more extension meetings. In the case of the adopters of antibiotics no significant differences were found; however, the innovators once again had the highest average scores.

The third scale measuring degree of contact with the extension service was the Extension Personal Contact Score. Points were awarded on the basis of the number of times within a year's period that a farm operator had: (1) visited the county agent's office, (2) had the county agent visit his farm, (3) talked about farming matters by telephone with the county agent, (4) allowed the county agent to use the respondent's farm for a demonstration or farm tour, (5) gone directly to Iowa State University to get information or to talk to someone about farming matters.

Highly significant differences in Extension Personal Contact Scores were found among the adopter categories in the case of both of the farm practices. The innovator category had the highest average score in both the case of 2,4-D weed spray and antibiotics.

An Extension Knowledge Scale was also constructed to measure the degree to which an individual possessed information about the extension service.²⁴ Points were awarded for: (1) having heard of the county extension program, (2) knowing the names of county extension workers, (3) knowing where the nearest extension office was located, (4) knowing what the county extension program was trying to accomplish (its goals), (5) knowing what kinds of information and assistance are available from the extension service, (6) understanding the relationship between the Farm Bureau and the extension service.

In the case of 2,4-D spray adopters, innovators tended to possess the greatest degree of knowledge about the extension service. Early adopters had the highest average score in the case of the adoption of antibiotics.

ATTITUDES AND OPINIONS

A number of attitudinal items was also available for comparison on the basis of adopter categories. The respondents were asked how important they thought it was to a farmer's income to adopt the latest recommended farm practices. Responses were categorized on a 4-point scale from "not very important" to "an absolute necessity." Innovators tended to feel the adoption of farm practices was more important to a farmer's income than did the other adopter categories.

²⁴ Further detail on the construction of this Extension Knowledge Scale may be found in: Maurice E. Voland, Factors related to participation in an extension program. Unpublished M.S. thesis, Iowa State University Library, Ames, 1956.

The importance to a farmer's prestige of adopting new farm practices was categorized on the same basis as that just described. Innovators once again placed a greater importance on adoption of farm practices than did any other adopter category.

Farmers were asked to classify themselves as to keeping up with new ideas and practices. They were asked to check the most appropriate response: (1) I try anything new that comes along; (2) if I see or hear of a new idea and know a little about it, I'll try it; (3) I like to read up and pretty thoroughly understand an idea before I try it; (4) I like to talk over a new idea with some other people before I try it; (5) I like to actually see the idea work before I try it; (6) I just don't like to try new ideas.

No consistent trends were found on this attitudinal question. Innovators did not perceive a different self-role than did the laggards.

Farmers were also asked to categorize themselves as to how up-to-date on new farming ideas they were in their major farming enterprise: (1) quite a bit above average, (2) above average, (3) about average, (4) a little below average.

In the case of 2,4-D spray, the innovators tended to rate themselves above average. In the case of antibiotics the early adopters and early majority rated themselves above the other adopter categories on the average.

The farmers were questioned as to their opinion of innovators (which were defined for the respondents as those farmers who usually try new farming practices before anyone else). Responses were categorized as: (1) very favorable, (2) favorable, (3) neutral and (4) unfavorable.

As can be seen from table 11, the antibiotics early adopters had the most favorable opinion of innovators. In the case of 2,4-D spray, the late majority had the most favorable opinions, followed closely by the innovators.

Each adopter was questioned as to the time at which he first became aware of 2,4-D spray (and antibiotics) and the date at which he adopted the practice. The difference between these two dates measures the length of the adoption process and was previously referred to as the "adoption period." One might expect innovators to be more likely to adopt a new practice rapidly and hence require less time to pass through the adoption process. This might be a reflection of their more favorable attitude toward new farm practices.

The length of the adoption process is shown in years for 2,4-D spray and antibiotics in tables 10 and 11 on the basis of adopter category. The earlier adopters generally require a shorter adoption period. The exception to this trend is the innovators in the use of antibiotics. This may be accounted for at least partially on the basis of advanced publicity but lack of availability of antibiotics.

SUMMARY OF CHARACTERISTICS

In this section we have proposed a method by which the adopters of a new farm practice may be categorized into the five adopter categories of innovators, early adopters, early majority, late majority and laggards.

In contrast to later adopters, the early adopters have the following characteristics: older age, larger farm, more usage of agricultural communications, more contact and knowledge about the extension service, more favorable attitudes toward change and a shorter adoption period.

SOURCES OF INFORMATION BY ADOPTER CATEGORY AND ADOPTION STAGE

The sources of information utilized at each of the five stages in the adoption process for both antibiotics and 2,4-D weed spray were reported in an earlier section of this publication. The information sources were categorized on two bases: (1) mass media, agricultural agency, informal and commercial and (2) personal and impersonal. A combination of these two methods, which resulted in six categories of information sources was also used.

A deeper analysis of the sources of information used at stages in the adoption process was made possible by including an added dimension, that of adopter categories. Findings of this type might enable the change agent more accurately to direct an educational campaign at specific adopter categories to secure adoption of some new practice. For instance, by knowing that the early adopters get their initial knowledge (awareness) from mass media and that the laggards obtain their initial knowledge from informal sources (including the early adopters in these informal sources), the change agent has some clues as to what groups he might reach with different efforts.

The change agent might decide which communication techniques are most appropriate and most effective at each stage with each adopter category. For instance, he generally can decide whether to use personal or impersonal communication techniques.

The percentage of each adopter category utilizing each of the categorized information sources by adoption stage is shown in table 12 for 2,4-D weed spray and in table 13 for antibiotics.

A number of important findings are apparent from the data presented in tables 12 and 13.

The first analysis will be made from the point of view of the sources of information by adopter category and adoption stage.

2,4-D WEED SPRAY

INNOVATORS

At the *awareness* stage, government agencies accounted for 80 percent of the sources of information and mass media for 20 percent. At the *information* stage, agency sources were still most important, with 60 percent, and mass media were mentioned by the remaining 40 percent. At the *application* stage, agency sources again accounted for 80 percent of the responses and mass media for 20 percent. Agency and commercial sources each accounted for 40 percent of the sources at the *trial* stage.

EARLY ADOPTERS

Mass media was the most important source at the *awareness* stage with 45 percent, followed by agency

TABLE 12. PERCENTAGE REPORTING SOURCES OF INFORMATION BY ADOPTER CATEGORY AND ADOPTION STAGE FOR 2,4-D WEED SPRAY.

Categorized source of information	Awareness					Information					Application					Trial					Adoption				
	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards
	Mass media—impersonal	20	45	64	53	35	40	35	32	23	10	20	30	14	11	10	4
Agency—personal	40	5	7	14	5	..	..	4	9	5	20	..	4	9	10	40	5	7	5	..	..	..	..	..	..
Agency—impersonal	40	25	7	7	..	60	25	14	12	5	60	10	7	4	..	..	5	4	4	..	20	5	4	2	..
Informal—personal . . . . .	..	20	11	18	45	..	15	25	32	55	..	15	39	48	60	..	10	21	25	60	..	5	..	2	..
Commercial—personal . . . . .	..	5	7	4	10	..	20	25	9	15	..	30	18	12	5	..	30	25	16	5	..	5	..	..	..
Commercial—impersonal . . . . .	..	..	..	..	5	..	5	..	4	5	..	5	..	2	5	40	40	29	26	15	..	..	..	..	..
Self . . . . .	..	..	..	..	..	..	..	..	2	5	..	..	11	2	5	..	..	7	9	10	80	85	96	94	95
No response . . . . .	..	..	4	4	..	..	..	..	9	..	..	10	7	12	5	20	10	7	11	10	..	..	..	2	5
Number of individuals	5	20	28	56	20	5	20	28	56	20	5	20	28	56	20	5	20	28	56	20	5	20	28	56	20
Total percentage	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

TABLE 13. PERCENTAGE REPORTING SOURCES OF INFORMATION BY ADOPTER CATEGORY AND ADOPTION STAGE FOR ANTI-BIOTICS.

Categorized source of information	Awareness					Information					Application					Trial					Adoption				
	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards
	Mass media—impersonal	25	46	36	61	47	25	27	36	45	12	25	18	14	21	..	25	9	..	2
Agency—personal . . . . .	..	..	3	2	18	..	9	..	4	23	..	9	..	4	..	25	..	..	..	..	..	..	..	..	..
Agency—impersonal	50	9	29	8	..	25	..	21	11	..	25	..	14	9	6	..	..	7	9	..	..	..	..	..	..
Informal—personal . . . . .	..	9	3	6	23	..	9	18	13	18	..	18	21	15	41	..	18	7	13	23	..	..	..	2	..
Commercial—personal	25	36	29	23	6	50	46	25	25	41	50	27	36	30	41	25	36	46	36	35	..	..	..	..	..
Commercial—impersonal . . . . .	..	..	..	..	6	..	9	..	..	6	..	27	14	19	12	25	36	36	27	18	..	..	..	..	..
Self . . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	12	100	100	100	94	82
No response . . . . .	..	..	..	..	..	..	..	..	2	..	..	..	..	2	..	..	..	4	11	12	..	..	..	4	18
Number of individuals	4	11	28	47	17	4	11	28	47	17	4	11	28	47	17	4	11	28	47	17	4	11	28	47	17
Total percentage	100	100	100	100	100	100	100	100	100	100	100	99	99	100	100	100	99	100	100	100	100	100	100	100	100

sources with 30 percent, informal sources with 20 percent and commercial sources with 5 percent. At the *information* stage, there was a more general distribution of sources: mass media with 35 percent, agency and commercial each with 25 percent, and informal with 15 percent.

At the *application* stage, commercial sources were most important with 35 percent. Mass media were next with 30 percent, followed by informal with 15 percent and agency with 10 percent. At the *trial* stage, commercial sources accounted for 70 percent of the sources. Informal and agency sources were each named by 10 percent.

EARLY MAJORITY

Mass media was by far the most important source of information at the *awareness* stage. Sixty-four percent of the early majority named mass media sources. In fact, the early majority were the greatest users of mass

media at the awareness stage of any of the adoption categories. The remaining sources of information at the awareness stage were agency with 14 percent, informal with 11 percent and commercial with 7 percent.

At the *information* stage, there was again a more general distribution of sources: mass media with 32 percent, commercial with 25 percent, informal with 25 percent and agency with 18 percent.

Informal sources were the most important at the *application* stage for 39 percent of the early majority. The remaining sources were: commercial with 18 percent, mass media with 14 percent, agency with 11 percent and, for the first time to any appreciable degree, "self" was named by 11 percent.

As was true of the other adopter categories commercial sources were most important at the *trial* stage, mentioned in 54 percent of the cases. Informal sources accounted for 21 percent and agency sources for 11 percent at the trial stage.

LATE MAJORITY

For the late majority at the *awareness* stage, mass media sources were most important. These sources of information were used by 53 percent of the late majority adopters. Agricultural agency sources were used by 21 percent, informal sources by 18 percent and commercial sources by 4 percent.

The late majority was the first adopter category to depend most on informal sources at the *information* stage, with 32 percent of the late majority mentioning this source. Mass media accounted for 23 percent, agency sources for 21 percent and commercial for 13 percent.

Informal sources continued to be most important at the *application* stage for 48 percent. The other information sources were utilized almost equally: commercial, 14 percent; agency, 13 percent; and mass media, 11 percent.

At the *trial* stage commercial sources were mentioned most frequently by 42 percent. Informal sources were mentioned by 25 percent, agency and "self" by 9 percent each and mass media by 4 percent.

LAGGARDS

The importance of informal sources for laggards is apparent even at the *awareness* stage where 45 percent mentioned informal sources. Thirty-five percent mentioned mass media; 15 percent, commercial; and 5 percent, agency sources.

At the *information* stage 55 percent mentioned informal sources, 20 percent utilized commercial, and mass media and agency sources were each mentioned by 10 percent.

Sixty percent used informal sources at the *application* stage. Mass media, agency and commercial sources were each mentioned by 10 percent.

At the *trial* stage informal sources were again mentioned by 60 percent. Twenty percent named commercial sources, and "self" accounted for the remaining 10 percent.

GENERAL TRENDS

Some general trends in information sources can be observed for adopter categories in the adoption of 2,4-D weed spray.

1. Mass media are by far the most important source of information at the awareness stage for the early adopters, early majority and late majority. Agricultural agency sources are most important for innovators at the awareness stage, and informal sources are most important for the laggards.

2. There is a more general distribution among the various sources of information at the information stage for the early adopters, early majority and late majority.

3. Innovators depend more on agency sources of information at the first four adoption stages than do other adopter categories.

4. The last three adopter categories are highly dependent on informal sources at the application stage. The early adopters are the greatest users of commercial sources at this stage.

5. The first four adopter categories are very dependent on commercial sources at the trial stage.

6. The laggards are by far the greatest users of informal sources at all stages.

7. The last three adopter categories more often reported "self" as an informational source in the later stages of adoption.

ANTIBIOTICS

INNOVATORS

Agency sources were mentioned by 50 percent of the innovators at the *awareness* stage. Mass media and commercial sources each accounted for 25 percent.

At the *information* stage commercial sources were mentioned by 50 percent of the innovators. Mass media and agency sources were each mentioned by 25 percent. The same percentages also apply to the *application* and *trial* stages.

EARLY ADOPTERS

Mass media sources were the most important source for the early adopters at the *awareness* stage. This source was mentioned by 46 percent of the early adopters. Commercial sources were listed by 36 percent, and agency and informal sources were each mentioned by 9 percent.

At the *information* stage, however, commercial sources were most important. They were named by 55 percent of the cases. The other sources mentioned were: mass media by 27 percent and agency and informal sources by 9 percent each.

At the *application* stage there were 54 percent who mentioned commercial sources. Mass media and informal sources were each mentioned by 18 percent and agency sources were mentioned by 9 percent.

Commercial sources were by far the most important source at the *trial* stage being reported by 72 percent. Informal sources were mentioned by 18 percent and mass media by 9 percent.

EARLY MAJORITY

There were three main sources of information at the *awareness* stage: mass media, agency and commercial named by 36, 32 and 29 percent, respectively.

Mass media sources were the most important source at the *information* stage. This source was reported by 36 percent. Commercial sources were mentioned by 25 percent, agency sources by 21 percent and informal sources by 18 percent.

Fifty percent used commercial sources at the *application* stage. Twenty-one percent depended on informal sources, and 14 percent each depended on mass media and agency sources.

Eighty-two percent of the sources of information at the *trial* stage were commercial. The remaining sources were equally divided between agency and informal.

LATE MAJORITY

At the *awareness* stage the late majority were the most dependent of any adopter category on mass media. This source was listed by 61 percent. Commercial sources accounted for 23 percent; agency, for 10 percent; and informal, for 6 percent.

Mass media was again the most important source at the *information* stage, being named by 45 percent. Commercial with 25 percent, agency with 15 percent and informal with 13 percent accounted for the other sources of information.

At the *application* stage, however, commercial sources were most important. This source was listed by 49 percent. Mass media was next most important with 21 percent, followed by informal sources with 15 percent and agency sources with 13 percent.

At the *trial* stage, commercial sources again were most important. They were mentioned in 63 percent of the cases. Informal sources were mentioned by 13 percent, agency by 9 percent and mass media by 2 percent.

LAGGARDS

Mass media was the most important source for the laggards at the *awareness* stage, being mentioned by 47 percent. Informal sources were mentioned by 23 percent, agency sources by 18 percent and commercial sources by 12 percent.

Commercial sources provided 47 percent of the information sources at the *information* stage. Agency sources accounted for 23 percent, informal sources for 18 percent and mass media for 12 percent.

Commercial sources were most important at the *application* stage for 53 percent. Informal sources accounted for 41 percent and agency sources for 6 percent.

At the *trial* stage commercial sources were mentioned by 53 percent. Informal sources were mentioned in 23 percent of the cases and "self" by 12 percent.

GENERAL TRENDS

General trends for adopter categories in the adoption of antibiotics are as follows:

1. Mass media was the most important source at the awareness stage for all adopter categories with the exception of innovators. Agency sources were most important for innovators.

2. Commercial sources were most important at the information stage for innovators, early adopters and laggards. Mass media was most important for the majority categories.

3. At the trial stage, commercial sources were by far the most important for all adopter categories.

4. The laggards are the most dependent on informal sources at all adoption stages. This is especially true at the application stage.

5. Agency sources played their most important role with the innovators.

GENERAL CONCLUSIONS

Some findings that were common in both the case of 2,4-D weed spray and antibiotics are as follows:

1. Mass media sources are very important for all adopter categories at the awareness stage. One exception is the innovators who depend more heavily upon agricultural agency sources.

2. The laggards are by far the most dependent upon informal sources of information at all adoption stages.

3. Commercial sources are very important at the trial stage for all adopter categories for both antibiotics and 2,4-D weed spray.

4. Commercial sources generally were more important in the case of antibiotics than in the case of 2,4-D weed spray.

5. Agricultural agency sources played a much more important role for 2,4-D spray than for antibiotics at both the awareness and information stages.

6. Informal sources were more important in the adoption of 2,4-D weed spray than in the case of antibiotics.

PERSONAL AND IMPERSONAL SOURCES

There might be very good reason to expect differences among adopter categories as to their usage of personal and impersonal communication.

Innovators may have few available informal informational sources of a personal nature. At the time the innovator passes through the adoption process, few, if any, of his neighbors have any experience with the new farm practice. About the only available personal source of information for the innovator is the agricultural change agent or other innovators.

By the time the laggards adopt a new farm practice, however, most of their neighbors will have had experience and knowledge about the new practice. Hence, we would expect laggards and other later adopters to make greater use of personal sources of communication and less use of impersonal sources.

A comparison of personal and impersonal sources of information by adopter category is presented in tables 14 and 15. The later adopter categories, especially the laggards, are dependent upon personalized sources of information.

Innovators and early adopters seem to have the ability to utilize impersonal sources of information, whereas the late majority and laggards seem to require more personalized sources of information. This evidence suggests that perhaps Lazarsfeld's concept of the "two-step flow of communication" may be an appropriate model for the diffusion of information about technological changes.²⁵ In their study of voting behavior in a presidential election, Lazarsfeld and others found that "ideas often flow from radio and print to the opinion leaders and from them to the less active sections of the population."

An appropriate modification of this two-step flow of communication in terms of the present findings would be: *Technological farming ideas often flow from the impersonal sources to the earlier adopters and from them (as personal communication) to the later adopters.*

Many change agents are already very aware of this two-step diffusion of technological information. For example, extension workers seek to concentrate their efforts upon and enlist the cooperation of "local leaders." Many change agents have referred to the two-step diffusion of technological information as the "trickle-down theory." Soil Conservation Service personnel have been urged to utilize "neighbor group

²⁵ Paul F. Lazarsfeld, Bernard Berelson and Hazel Gaudet. The people's choice. Columbia University Press, New York. 1948. p. 151.

TABLE 14. PERCENTAGE OF PERSONAL AND IMPERSONAL SOURCES OF INFORMATION BY ADOPTER CATEGORY AND ADOPTION STAGE FOR 2,4-D WEED SPRAY.

Categorized source of information	Awareness					Information					Application					Trial					Adoption				
	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards
Impersonal	60	70	71	60	40	100	65	46	39	20	80	45	21	17	15	40	45	33	34	15	20	5	4	2	2
Personal	40	30	25	36	60	..	35	54	50	75	20	45	61	69	75	40	45	53	46	65	..	10	..	2	..
No influence (self)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
No response	..	..	4	4	..	..	..	..	2	5	..	10	11	2	5	20	10	7	9	10	80	85	96	94	95
Number of individuals	5	20	28	56	20	5	20	28	56	20	5	20	28	56	20	5	20	28	56	20	5	20	28	56	20
Total percentage	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

TABLE 15. PERCENTAGE OF PERSONAL AND IMPERSONAL SOURCES OF INFORMATION BY ADOPTER CATEGORY AND ADOPTION STAGE FOR ANTIBIOTICS.

Categorized source of information	Awareness					Information					Application					Trial					Adoption				
	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards	Innovators	Early adopters	Early majority	Late majority	Laggards
Impersonal	75	55	65	69	53	50	36	57	56	18	50	45	42	49	18	50	45	43	38	18	..	..	..	..	..
Personal	25	45	35	31	47	50	64	43	42	82	50	54	57	49	82	50	54	53	39	58	..	..	..	2	..
No influence (self)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	100	100	100	94	82
No response	..	..	..	..	..	..	..	..	2	..	..	..	2	..	..	..	..	4	11	12	..	..	..	4	18
Number of individuals	4	11	28	47	17	4	11	28	47	17	4	11	28	47	17	4	11	28	47	17	4	11	28	47	17
Total percentage	100	100	100	100	100	100	100	100	100	100	100	99	99	100	100	100	99	100	100	100	100	100	100	100	100

leaders" in securing the acceptance of soil conserving practices.

IMPLICATIONS

There are many implications in the present findings for the change agent. Perhaps these implications should be prefaced with a few remarks about the ethics of technological change and the change agent. It is not the purpose of this publication to discuss the "rightness" or "wrongness" of technological change. There is some evidence that the total results of a technological change are not always completely favorable.²⁶ Nevertheless, the approach will be taken that the change agent's sponsor is responsible for the decision to diffuse the new practice to the change agent's constituents. Hence, it is simply the change agent's concern to carry out the most efficient program to diffuse the new practice.

In carrying out his activities, the change agent will want to be aware of the two-step diffusion of technological information described. To utilize this framework, however, the change agent will need to be able to identify and locate the earlier adopters among his constituents. Some of the personal characteristics of these earlier adopters have been indicated. Further research will certainly be needed to determine more precisely the personal and social characteristics of these innovators and early adopters.

Another important implication from this study is the importance of the agriculture agency publications and bulletins for the innovators and early adopters at the awareness, information and application stages. This suggests that the readership audience for these publications is not the average farmers. Actually, agency publications are probably one of few information sources available to the earlier adopters. A key question for later research studies would be to determine in a more extensive fashion what other sources of information are actually used by the earlier adopters.

In this study, it was found that the innovators and early adopters seemed to have the ability to utilize impersonal sources of information, whereas the later majority and laggards seemed to require more personalized sources of information. These personal sources were especially those of an informal nature, such as neighbors, friends and relatives. This implies a real challenge to the change agent. Can he, by working intensively with the laggards, change them into earlier adopters? The laggards, it was found, have relatively less contact with the change agents and perhaps do not regard them as a credible source of information. In terms of rapid adoption of agricultural technology, there is little question but that the later adopters have a greater need for the efforts of the change agent.

By working especially with the earlier adopters (which is apparently the present case), the change agent may be able to make the most efficient use of his available resources and abilities. These earlier

²⁶ Edward H. Spicer. Human problems in technological change. Russell Sage Foundation, New York. 1952.

adopters then seem to act as "secondary" change agents in the "trickle-down process" to the later adopters. Because of their earlier adoption date, however, the innovators and early adopters reap the "windfall profits" which accrue to earlier adopters.

There is some reason to believe that the role of the earlier adopter is a crucial one in the diffusion process. There is evidently such an abundance of impersonal technological information that the average individual cannot hope to assimilate and internalize

²⁷ This almost unlimited availability of impersonal communication is illustrated by the fact that 98 percent of the respondents had radios,

but a small percentage of that available.²⁷ By synthesizing this impersonal communication and passing it along as personal information, the earlier adopters perform a real service for the later adopters.

While the findings from the study suggest a number of specific implications for the change agent and others, future research studies will be needed to explore more adequately both the presently suggested areas and the additional hypotheses which may be developed.

91 percent had television sets and 97 percent subscribed to at least one farm magazine. The average farmer subscribed to 3.5 farm magazines.

SUMMARY

Data were secured from 148 farm operators residing in a central Iowa rural community as to the sources of their information and the time of adoption of two recent farm practices — the use of 2,4-D weed spray and the feeding of antibiotic swine supplements. It was found that the farmers passed through the five-stage adoption process as they accepted these two new practices. The first stage in the adoption process is the awareness stage, at which an individual first learns of the existence of the new idea. The information, application, trial and adoption stages follow.

The adopters were classified into five adopter categories: innovators, early adopters, early majority, late majority and laggards. The innovators are the first to use new practices, and the laggards are the last.

1. Certain sources of information are more important at some stages in the adoption process than at other stages. Specifically, (a) mass media sources are most important at the awareness stage, (b) informal sources (neighbors, friends and relatives) are most important at the application stage, (c) commercial sources play their most important role at the trial stage and (d) agricultural agencies (extension service, SCS, etc.) are most important at the awareness stage and decrease in importance through the later stages.

2. The most important source of information at the adoption stage is the results obtained from the trial of the new practice. This indicates that farmers are seldom directly "sold" on a new product by advertising or other mass media sources of information or by salesmen. A farm operator may be induced to try out the new product, however, and, if satisfactory, this trial may lead to adoption.

3. When sources of information were categorized on the basis of their personal or impersonal nature, it was found that personal sources were least important at the awareness stage but became increasingly important until the application stage was reached. Although impersonal mass communication may make a farmer aware that a new practice exists, it is the more personalized influence that motivates him to try out the new idea.

4. Commercial-impersonal sources (mostly commercial advertisements and information attached to new products) are more important at the application and trial stages than at the awareness and information stages, although this is counter to the general trend for the impersonal sources. This suggests that commercial-impersonal sources play their most important role when the farmer is deciding "how much to use," "where to get it," etc.

5. The adoption curve of both practices over time was bell-shaped and was normal in the case of 2,4-D weed spray and nearly normal for the antibiotics. The pattern for the trial of each of the two practices was found to be normal. The awareness pattern was normal over time for 2,4-D, but not for antibiotics.

6. The amount of time required for an individual to pass through the adoption process from awareness to adoption was found to vary from less than 1 year to more than 10 years. The average adoption period for 2,4-D weed spray was 2.06 years and, for antibiotics, 1.61 years. The innovators and early adopters tended to have shorter adoption periods than did the later adopters. For instance, the 2,4-D spray innovators had an average adoption period of 0.40 year while the laggards had an average adoption period of 4.65 years.

7. On the basis of the relationships between the awareness date, adoption date and length of the adoption period, there is some evidence that becoming aware of a new practice is nonpurposive (or accidental) behavior, while adoption of a practice is purposive. In this regard, it would be expected that the time of adoption of a practice would reflect the individual's personality, motivations and group pressures, while time of awareness would be less apt to do so.

8. When the personal characteristics of the adopter categories were analyzed, it was found that earlier adopters (innovators and early adopters) were older, had larger farms, read more newspapers and farm magazines, listened to more farm radio shows, had more contact with and knew more about the extension service and generally had more favorable attitudes toward new technological farming practices.

9. When sources of information were analyzed on the basis of adoption stage and adopter category, it was found that: (a) agency-impersonal sources (extension bulletins, research publications, etc.) are most important to the innovators and early adopters at the first three adoption stages, (b) informal sources (friends, neighbors and relatives) are generally more important for later adopters at the first four stages in the adoption process and (c) there was a definite trend for personal sources of all kinds to be more important for later rather than earlier adopters at each of the first four adoption stages.

10. A general summary statement of many of these findings is provided by the proposed two-step diffusion of technological information: Technological farming ideas often flow from the impersonal sources to the earlier adopters and, from them, as personal communication to the later adopters.