

The Dynamics of Farm Practice Change

Introduction

Many studies have been conducted in the past fifteen years on the adoption of recommended farm practices. Most, however, have been restricted to one interview making it difficult to determine the changes actually occurring over a specific period of time. The turnover in the use of farm practices is not sufficiently taken into account in most studies of farm practice adoption.

Adoption is usually regarded as the use of certain specified practices in the year prior to, or at the time of, the study. This procedure often presents a rather static picture of farm practice change. In particular, the discontinuance of practices previously adopted is often neglected. An indication of the dynamic nature of farm practice change can be found in a previous study by Wilkening. In a sample of North Carolina farmers, he found that over one-fifth had discontinued the use of hybrid corn.¹ This group depended more heavily upon "other farmers" as a source of information than those who had not discontinued its use.

In 1957 Wilkening and Johnson reinterviewed a group of farmers previously interviewed in 1952. A portion of the restudy was devoted to an exploration of this dynamic aspect of farm practice change and provides the basis for this paper.

The Sample

The sample included 200 farmers in Rock County, Wisconsin who:

- (a) had owned their farms for three years or longer,
- (b) had at least one child 12 to 19 years of age,
- (c) made three-fourths or more of their income from farming, and
- (d) had no disabling physical conditions.

One hundred eighty, or 90 percent of the original sample, were reinterviewed in 1957. In addition, four sons who had assumed all

¹E. A. Wilkening, Acceptance of Improved Farm Practices in Three Coastal Plains Counties, North Carolina Tech. Bul. 96, 1952, p. 32.

managerial and operational functions on their fathers' farms were interviewed. These are excluded from most of the analysis, in addition to four farmers who were reinterviewed, but who were renting their farms to non-relatives. This left a sample size of 176, or 88 percent of the original 200. Others lost from the sample included those who had moved from the county, those who had retired or entered other occupations, and those who were deceased.

This sample appears fairly homogeneous and stable. The 12 percent loss in five years is evidence of its stability. Also, the effects of family cycle, off-farm occupations, tenure, and physical disabilities on adoption are controlled to a large extent.

Expected Trends and Hypotheses

Below are listed some expectations at the time of the restudy design:

1. Adoptions will outnumber discontinuances for all recommended farm practices. The proportion of the population using each practice will increase.
2. Due to the homogeneity of the sample, reasons stated by farm operators for adopting practices will not show much variation. The same will be true of reasons for discontinuing practices.
3. If reasons vary, they will be dependent primarily on the adoption status of the farm operators making the changes. That is, reasons will vary according to whether the farmer is a high adopter or low adopter.
4. Information sources used in adopting and discontinuing practices will be dependent on the adoption status of the farm operator.

Rates of Change

In addition to an analysis of the above hypotheses, three rates of change were calculated for each farm practice to help determine the dynamic nature of farm practice change. First, a five-year net change rate shows the percentage of the sample making a change with regard to the use of a specified practice over the five-year period:

$$5 \text{ YR. N.C.R.} = \frac{\text{number of adoptions of practice in 5 year period} + \text{number of discontinuances of practice in 5 year period}}{\text{number of farms for which practice is applicable}} \times 100$$

This is a net rate because it takes into account only the situation at the beginning and end of a specified period of time. A gross change rate would include all changes within the five-year period, and it would vary from the net rate because of the possibility of any practice being adopted and discontinued more than one time by a farm operator. Because this information was not obtained, it was not possible to calculate gross change rates in this study.

The second rate calculated, the gross adoption rate, is the percentage of farm operators adopting a specified practice in the five-year period:

$$5 \text{ YR. G.A.R.} = \frac{\text{number of farmers adopting practice in 5 year period}}{\text{number of farms for which practice is applicable}} \times 100$$

Although this is termed a gross rate, it was calculated from information obtained at the beginning and end of the five-year period. It is not a true gross rate because of the possibility of a practice being adopted more than once by the same farmer during the period of time.

The third rate calculated, the net adoption rate, shows the difference in the adoption status of a practice at the end of the time period in comparison to its status at the beginning of the period:

$$5 \text{ YR. N.A.R.} = \frac{\text{number of adoptions of practice in 5 year period} - \text{number of discontinuances of practice in 5 year period}}{\text{number of farms for which practice is applicable}} \times 100$$

The net adoption rate is the percentage of farmers using a practice at the beginning of a period of time minus the percentage of farmers using the same practice at the end of the period of time. Because discontinuances may outnumber adoptions, the net adoption rate may be negative.

The three rates of change for the practices considered in this study are shown in Table 6. The data used in calculating the rates are shown in Table 1.

The rates are simple in definition and calculation, but they will not be used in any complex statistical treatment at this time. Their purpose is primarily exploratory, and some generalizations will be made from an examination of them.

Methods of Study

In 1957, the farm operators were asked about the use of the same farm practices included in the 1952 study. Also, each interview schedule was pre-coded so the interviewer would know which practices the respondent was using in 1951. He could then easily determine what changes the respondent had made over the 5 year period.

Due to the time element in the interviewing situation, interviewers were instructed to ask additional questions on a maximum of three changes, adoptions if possible. If the farm operator had not adopted three new practices in the five year period, the interviewer completed the three sets of questions by making inquiries about discontinuances. Information obtained on farm practice change included reasons for adoption or discontinuance or practices and information sources used in making changes. To determine reasons, the following open-ended questions were asked: "What did you like about this practice that sold you on the idea of trying it?" and "Could you explain why this practice was dropped?"

As shown in Table 1, fairly complete information was obtained on the adoption of the hay chopper, the hay baler, 2, 4-D weed spray, the bulk milk tank, the electric milk cooler, and the milking machine. Most information on discontinuances was obtained for the chopper, the baler, 2, 4-D weed spray, soil testing, nitrogen side-dressing, fertilizing pasture seeding, and use of grass silage.

Reasons For Adopting Practices

Although time does not permit an extended discussion of the reasons given for adopting various practices, Table 2 shows the unexpected wide variation in types of reasons given. It had been hypothesized that the type of reason might vary according to whether the respondent was a high or low adopter. In general, the results do not tend to confirm this hypothesis, with the exception that 15 percent of the responses by high adopters pertain directly to increased economic returns, in comparison to 6 percent of the responses by low adopters. This difference in monetary goals expressed by high and low adopters is supported by research findings in a previous Farm and Home Development Study in Wisconsin.²

An easy rationalization for adopting a practice is "it works," as indicated by the large percentage of responses in the "effectiveness of practice" category in Table 2. Low adopters are slightly more prone to give this response.

The results here are dependent upon a successful categorization of responses. Some difficulties arose in categorizing and coding this information, in part because of the length of the interview schedule, and the resulting lack of probing in many cases. Also, farmers vary greatly in ability to verbalize and in the degree of abstractness of response.

Usually the questions were answered in terms of (a) the effectiveness or qualities of the practice, (b) special farm conditions, (c) availability of resources as capital, and (d) information sources used in making the change. When a question was answered in one of these terms, usually no information on the other aspects was obtained, which limited the success of comparable coding on all questions. The findings, however, should aid in the formulation of structured questions in future studies of farm practice change.

²E. A. Wilkening and Donald E. Johnson, "A Case Study in Decision-Making Among a Farm Owner Sample in Wisconsin," a paper read before the Rural Sociological Society, Pullman, Washington, August 25, 1958.

Reasons For Discontinuing Practices

It was hypothesized that high and low adopters would vary in the type of reasons given for discontinuing practices. Table 3 shows the wide distribution of types of responses.

At least two patterns can be discerned. First, high adopters discontinued practices because of low economic returns to a greater extent than did low adopters (seventeen percent high adopter responses vs. eleven percent low adopter responses). While this difference is not great and would not be statistically significant, the pattern is the same as that found in the reasons for adopting practices.

Second, fourteen percent of the low adopter responses listed a change in production plans as a reason for discontinuing farm practices, compared to only four percent of the high adopter responses. This may indicate low adopters more frequently make changes in production plans. High adopters are more prone to use long range planning. Returning to Table 2 and the reasons for adopting practices, another slight indication of this relationship can be found. Six percent of the low adopter responses indicated practices were adopted to meet some immediate problem, compared to one percent of the high adopter responses.

Information Sources

An examination of the data failed to corroborate the relationship between "other farmers" as a source of information and the discontinuance of farm practices,³ as found in Wilkening's North Carolina study. For both high and low adopters, neighbors and commercial dealers were the most important sources of information in adopting new practices. "My own experience" was the information source most used by both groups in discontinuing practices.

³Data are not included in this paper, but may be obtained on request.

Relationship Between Change and 1956 Adoption Index Score

Although some discontinuances were expected at the time of the restudy, the high number was completely unexpected. Of the total of 521 changes, 255, or 49 percent, were discontinuances of previously adopted practices. There is no significant difference between the proportion of adoptions and discontinuances, even if changes from electric milk cooler to bulk tank were considered as adoptions (explained in a footnote of Table 1).

The high number of discontinuances led to some additional thinking about the relationships between adoptions, discontinuances, and adoption index scores. The writers had assumed, and it has been indicated in some studies, that low adopters are low because they do not adopt, or are slow to adopt, recommended farm practices. The evidence here indicates they may be low because they discontinue previously adopted practices.

Tables 4 and 5 give some indication this is true. It must be kept in mind that the 1956 adoption scores are dependent on both adoptions and discontinuances.

The criteria used for selecting practices for these tables were both a high gross adoption rate and a high discontinuance rate.

There is little difference between high and low adopters in the number of practices adopted. On the other hand, discontinuances by low adopters were twice that of the high adopters. The 1956 adoption score appears to be dependent to a greater extent on discontinuance of practices than it is on adoption of practices.

Net change Rates

It is apparent from Table 2 that we cannot assume stable use of a practice merely because there is no significant difference in the proportion of the population using that practice at two different points in time. The extreme case is soil testing, used by 80 percent of the farm operators in both 1951 and 1956. However, the net change rate indicates 26 percent of the sample made a change in the five year period, with discontinuances balancing adoptions. There may be a special reason for the high net change

rate for soil testing, which will be noted in a later section.

Twenty-four percent of the farm operators made a change with respect to the hay chopper, although there was no significant increase or decrease in the use of a chopper by the population as a whole. The same is true of alfalfa-brome pasture mixture (20 percent making changes), and D.H.I.A. membership (14 percent making changes).

Fewest changes occurred with practices relating directly to milk production, with the exception of the bulk milk tank which was introduced in the area in the interval between the two studies. Boards of Health and various Grade A milk companies promoted the bulk tank, with the latter paying a milk price premium for its adoption. The use of artificial insemination also increased greatly in the five year period due to the fact that it was an early-phase practice in 1951, as explained in a following section.

Gross adoption Rates

Two generalizations can be made with regard to gross adoption rates:

Gross adoption rates are low for practices in a late phase of adoption. By arbitrarily defining practices used by 50 percent or more of the sample in 1952 as practices in a late phase of adoption, we find that all have a gross adoption rate of five or less, with the exception of the hay baler and soil testing. Although it was mathematically possible for all late phase practices to be adopted by more than 5 percent of the sample, evidence from other studies indicates a declining rate of adoption as the use of the practice approaches 100 percent.⁴

The converse of the above generalization is: Gross adoption rates are high for practices in an early phase of adoption.

⁴North Central Regional Publication No. 1 of the Agricultural Extension Services, How Farm People Accept New Ideas, Agricultural Extension Service, Iowa State College, Ames, Iowa, November 1955, p. 10.

Early-phase practices are those used by less than 50 percent of the sample in 1951. In every case other than the exceptions previously mentioned these practices have a higher gross adoption rate than the highest late-phase practice, with a range of 6 through 31.

Two practices do not fit in the above generalizations. In the case of the hay baler, this may be due to special circumstances involving the ease of adoption. Much of the baling in the area is by custom hiring. No technical knowledge is required of the adopter, and no capital investment is involved.

Soil testing is complicated because many adoptions are actually re-adoptions, due to the fact the farm operator may not actually discontinue the practice, but merely fail to test his soil at a recommended frequency. All farm operators who did not test their soil within the three years prior to 1952 were counted as non-adopters, even though they may have tested their soil many times previously. Soil testing was the only practice adopted by significantly more low adopters than high adopters (as measured by the 1956 adoption index). This also is an indication that adoption of soil testing is frequently re-adoption, occurring among low adopter farmers who do not test at regular intervals.

Net Adoption Rates

Nine of the seventeen farm practices changed significantly over the five year period, five with increased adoption and four with discontinuance. The most significant changes tended to occur with the early-phase practices.

Among the late-phase practices, fertilizing oats decreased with frequent complaints of rank growth and lodging. Here the problem may be the use of non-recommended oat varieties rather than over-fertilization. The use of 2,4-D weed spray also decreased significantly. Some farmers discontinued the practice because the spray also injured crops. However, some discontinuances occurred because custom sprayers were not available when needed.

Summary

There was no difference between the number of adoptions and the number of discontinuances of recommended farm practices, in a stable sample of farm owners in Rock County, Wisconsin. However, by examining various rates of change, individual practices were seen to have changed dramatically and significantly. The turn-over, or net change rate, was high for all but the well established practices which relate to the major enterprise.

The influence of information sources on adoption and discontinuance was not clear in this study. It appears logical that discontinuance could be explained by improper adoption and usage of practices caused by the use of unreliable information sources. The 1956 adoption index score appears to be influenced as much or more by discontinuances, as it is by adoptions. Finally, high adopters appear to be better managers, with long range planning and monetary goals.

The conclusions here must be regarded as highly tentative. A most obvious conclusion is: farm practice change is an extremely dynamic process, complicated by many factors which the investigator is not always able to foresee, control, or measure. Only a small portion of the study is presented here, and not all results are in final form.⁵ Such important variables as farm size, managerial ability, socio-economic status and education are not brought into this presentation. And finally, the study of changes in adoption index scores over a period of time, and the related variables, would be a major undertaking in itself.

⁵The information and analysis in this paper will be revised and included in a bulletin to be published late in 1959.

TABLE 1

Changes in Farm Practice Adoption and Discontinuance,
in a Sample of Rock Co., Wis., Farm Operators, 1951-1956.

Practice	Number farms on which prac- tice is appli- cable	Percent using practice		Adoptions in 5 yr. period		Discontinuances in 5 yr. period	
		1951	1956	Number	Number studied	Number	Number studied
Hay baler	176	78	86	22	21	9	8
Hay chopper	176	49	45	18	17	24	13
2,4-D weed control	176	87	80	7	5	19	14
Soil testing	176	80	80	23	13	23	17
Nitrogen side dressing on corn	176	10	20	29	25	11	10
Fertilizing oats	173	67	51	9	6	37	20
Fertilizing pasture seeding	174	74	47	7	5	53	21
Used alfalfa-brome pasture mixture	174	41	46	21	11	13	12
Used acceptable crop rotation	176	92	92	5	0	5	0
Grass silage	148	39	20	9	5	38	31
DHIA membership	148	27	24	10	5	14	2
Grade A milk	148	70	73	7	3	2	1
Clipping udders	148	85	86	6	4	4	2
Use milking machine	148	95	97	3	3	0	0
Electric milk cooler ¹	148	34	38	26	21	0	0
Bulk milk cooler	148	0	31	46	46	0	0
Artificial insemination	148	44	69	40	0	3	0
Totals				266	190	255	151

¹Because both the electric milk cooler and the bulk tank are considered acceptable practices, a change from the electric milk cooler to the bulk tank is not considered a discontinuance of the electric milk cooler. It is considered an adoption of the bulk tank for the purpose of calculating rates of change for the bulk tank. However, the 22 users of the electric cooler in 1951 who had adopted the bulk tank by 1956 are not included in the total number of adoptions, making the total 266 rather than 288.

TABLE 2

Reasons for Adopting Farm Practices, by High and Low Adopters,
Among a Sample of Rock County, Wis., Farm Operators.

(Possible range of adoption scores = 0 - 21)

Reason for Adoption	Per cent of reasons by high adopters (Score ≥ 12)	Per cent of reasons by low adopters (Score ≤ 11)
Effectiveness of practice	28	34
To meet some immediate need	1	6
Increased monetary returns	15	6
Quality of product	17	18
Ease, convenience; other personal considerations	13	12
Availability of capital, labor and other resources	9	8
Experiment	6	4
Recommendations of other persons	2	4
Part of a larger change	6	7
Other	1	-
No reason given	2	1
	100% (N = 110)	100% (N = 118)

A test of significance of differences between high and low adopters is not employed because the numbers of reasons obtained are not proportionally distributed according to the practices adopted. This is due to the method used in obtaining the information.

TABLE 3

Reasons for Discontinuing Farm Practices, by High and Low Adopters,
Among a Sample of Rock County, Wis., Farm Operators.

(Possible range of adoption scores = 0 - 21).

Reason for Discontinuance	Per cent of reasons by high adopters (Score \geq 10)	Per cent of reasons by low adopters (Score \leq 9)
Unfavorable results or characteristics	41	33
Low monetary returns	17	11
Too much risk involved	2	4
Change in prices	1	2
Change in production plan	4	14
Change in labor or family help	5	2
Change in other resources	9	5
Perceived as no longer needed	7	11
Replaced by a better practice	3	4
Other reasons	2	10
No reason given	2	3
	100% (N = 92)	100% (N = 100)

No test of significance of differences between high and low adopters is employed for the reason mentioned in Table 2. Also, high and low adoption refers to adoption status in 1956, in both tables.

Table 4. The Discontinuance of Selected Farm Practices, by High and Low Adopters,* 1951-1956.

Practice	Total number of discontinuances	Number discontinuances by high adopters (N = 82)	Number discontinuances by low adopters (N = 98)
Hay baler	9	1	8
Hay chopper	26	8	18
2,4-D weed spray	20	8	12
Soil testing	25	8	17
Nitrogen side dressing	11	6	5
Fertilizing oats	39	16	23
Fertilizing pasture seeding	53	16	37
Totals	183	63	120

Table 5. The Adoption of Selected Farm Practices, by High and Low Adopters,* 1951-1956.

Practice	Total number of adoptions	Number adoptions by high adopters (N = 82)	Number adoptions by low adopters (N = 98)
Hay baler	22	9	13
Hay chopper	18	11	7
2,4-D weed spray	7	6	1
Soil testing	22	9	13
Nitrogen side dressing	28	16	12
Fertilizing oats	10	4	6
Fertilizing pasture seeding	8	4	4
Totals	115	59	56

High adopters have an adoption index score of 10, and low adopters have an adoption index score of 9.

TABLE 6

Rates of Change of Recommended Farm Practices
Among a Sample of Rock Co., Wis., Farm Operators,
1951-1956

Practice	Per cent using practice in 1951	Net change rate	Gross adoption rate	Net adoption rate
EARLY-PHASE PRACTICES:				
Bulk milk tank	0	31	31	31***
Nitrogen side dressing	10	23	16	10**
DHIA membership	27	14	7	- 3
Electric milk cooler	34	18	18	18***
Grass silage	39	32	6	-18***
Alfalfa-brome pasture	41	20	12	3
Artificial insemination	44	29	27	25***
Hay chopper	49	24	10	- 3
LATE-PHASE PRACTICES:				
Fertilizing oats	67	27	5	-16***
Grade A milk	70	6	5	3
Fertilizing pasture seeding	74	32	4	-27***
Hay baler	78	18	13	7*
Soil testing	80	26	13	0
Clipping udders	85	7	4	1
2,4-D weed spray	87	15	4	- 7*
Acceptable crop rotation	92	6	3	0
Use milking machine	95	2	2	2

*Indicates change in population significant at .05 level of probability.

** " " " " " " " .01 " " " " "

*** " " " " " " " .001 " " " " "

The McNemar test is used as the test for significance of changes. See: Sidney Siegel, Nonparametric Statistics (New York: McGraw-Hill Book Company, 1956), pp. 63-67.