

FARMER ACCEPTABILITY AND ATTITUDES  
TOWARDS ZERO-TILLAGE

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Barrie Campbell Forbes

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BARRIER CAMPBELL FORBES

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ABSTRACT

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Farmer acceptability and attitudes towards zero-tillage were studied using a combination of mail and telephone questionnaires. A mail questionnaire was used to determine the personal and demographic characteristics of a sample of 500 Manitoba farmers. These characteristics were in turn used to determine if prediction models, based on combinations of the personal and demographic characteristics, could be developed to predict successfully whether an individual was an adopter or a non-adopter of zero-tillage.

Seven prediction models were developed and tested. Three were capable of predicting with at least 80% accuracy whether an individual was an adopter or non-adopter of zero-tillage. The prediction accuracy of the remaining four models ranged from 49% to 78%.

A series of four marketing treatments, designed to persuade an individual to adopt zero-tillage were mailed to one-half of the original sample of 500 farmers. The marketing treatments did not persuade the recipients to adopt zero-tillage although they did have an effect on the way in which they perceived the attributes of zero-tillage.

A telephone survey was used to determine how each farmer perceived the attributes of zero-tillage. These perceived attributes were analysed to determine if a prediction model could be developed that could

successfully predict whether an individual was an adopter or non-adopter of zero-tillage. Two such models were developed and tested. One model achieved a prediction accuracy of 63%, while the other was 71% accurate. These classification levels were considered useful although they were not statistically acceptable.

The perceived attribute questionnaire was not so good a predictor as the personal and demographic survey. The former, however, utilized substantially fewer questions (19 vs. 97 questions) to develop the prediction model and as such was considered to be more efficient.

A personal and demographic profile was developed for the adopting farmers. Only one characteristic showed a significant relationship between adopters and non-adopters, i.e., farm location. A larger proportion of adopters than non-adopters were located in Northwestern and Northern Manitoba. There was also a larger percentage of non-adopters than adopters in North Central and Southeastern Manitoba.

Although the differences were not significant, adopters tended to be older, have more years of farming experience, less education, a higher gross farm income, and larger farms than non-adopters.

The marketing treatments affected the way in which farmers perceived some of the characteristics of zero-tillage. They were effective in altering how a farmer perceived the advantages of zero-tillage, the amount of risk involved in the adoption of zero-tillage and the observability of zero-tillage.

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## INTRODUCTION

Zero-tillage crop production has been a widely accepted agricultural practice in the United Kingdom for decades, and more recently in the United States. In Canada, however, it has not gained popularity and can be considered one of the most recent agricultural innovations.

Zero-tillage crop production research in Manitoba began in 1969. Donaghy (1973) showed that the production of small grains and oilseed crops was feasible in Manitoba using zero-tillage. Chinsuwan (1976) designed an adaptation for a double disc press drill so that the drill could be used for zero-tillage. Nelson (1975) and Taylor (1977) investigated a number of herbicides that could be used for pre-seeding weed control. The consensus among these research scientists, and others, was that zero-tillage was at a technological stage whereby it could be successfully practiced in Manitoba, and for that matter in Western Canada.

The objectives of this study were to determine (1) if adopters of zero-tillage could be identified with 80% accuracy based on their personal and demographic characteristics; (2) if adopters of zero-tillage could be identified with 80% accuracy based on the way in which they perceived the attributes of zero-tillage; (3) if marketing treatments developed to persuade individuals to adopt zero-tillage were effective, and (4) if a profile of an adoption type could be developed using their psychographic and demographic characteristics.

their thoughts about the attributes of zero-tillage. The prediction accuracy of the two questionnaires was then compared. The final mail questionnaire was issued to determine which farmers had adopted zero-tillage.

Marketing treatments were developed to persuade one-half of the group to adopt zero-tillage. An evaluation of the persuasiveness of the marketing treatments was conducted. In addition, the effectiveness of the marketing treatments in altering how the farmers perceived zero-tillage was evaluated. Finally, the psychographic and demographic characteristics of the adopting farmers were compared with the non-adopters in an attempt to develop a profile of an adopter.

## REVIEW OF LITERATURE

### A. DIFFUSION RESEARCH

One of the most important causes of change in the farming community is technological innovation. New ideas are largely the result of the efforts of agricultural scientists, commercial companies and provincial and federal agricultural research stations. Change agents, such as the extension services, then communicate these innovations to rural audiences. The communication of these new ideas is called the diffusion process (Rogers and Shoemaker, 1971).

Diffusion is the way in which an innovation spreads among members of a social system and is a slow complicated process. Diffusion studies are primarily concerned with messages that embody new ideas. An innovation is an idea, practice, or object, perceived as new by an individual. An innovation may have initially been introduced several years earlier in a different social system. However, when brought to a new area it can be, and is, perceived as an innovation.

One of the early pioneers in diffusion research was Wilson (1927). He studied the ratio of innovations adopted relative to the cost of their diffusion. Sixteen years later, Ryan and Gross (1943) interviewed 259 farmers located in two small Iowa communities to determine their adoption of hybrid corn seed. The major findings of this study were:

(1) First use of hybrid seed followed a bell-shaped (but not exactly normal) distribution when plotted over time. Four adopter categories were classified on the basis of first use of hybrid seed. The social



characteristics, such as age, social status, and cosmopolitaness of both the earliest and the latest adopters were also determined.

(2) The innovation-decision period from first knowledge to the adoption decision average about nine years for all respondents. This finding lead to a clearer realization that the innovation-decision process involved considerable deliberation by most adopters, even in the case of an innovation with spectacular results.

(3) The typical farmer first heard of hybrid seed from a salesman but neighbours were the most frequent channel leading to persuasion. Salesmen were more important channels for earlier adopters, and neighbours were more important for later adopters.

The Ryan and Gross study provided the springboard for diffusion research. The field mushroomed during the 1950's and 60's to such an extent that Rogers and Shoemaker (1971), in attempting to collect all information regarding diffusion, found that there were 1,084 independent empirical publications available. The innovations studied ranged from the adoption of hybrid corn (Ryan and Gross, 1943) to the purchase of a rotary engine car (Feldman, et al, 1975).

Diffusion researchers have long recognized that an individual's decision about an innovation was not an instantaneous act. Rather it was a process that occurred over a period of time. The North Central Rural Sociology Subcommittee for the Study of Diffusion of Farm Practices (1955) (Rogers and Shoemaker, 1971) divided this process into five categories:

(1) Awareness stage - the individual learns of the existance of a new idea but lacks information about it.

(2) Interest stage - the individual develops interest in the innovation and seeks additional information about it.

(3) Evaluation stage - the individual makes mental application of the new idea to his present and anticipated future situation and decides whether or not to try it.

(4) Trial stage - the individual actually applies the new idea on a small scale in order to determine its utility in his own situation.

(5) Adoption/non-adoption stage - the individual uses the new idea continuously on a full scale or rejects the idea completely.

This adoption process will vary in length of time from the awareness to the adoption/non-adoption stage. While it may take an innovation such as fertilizer only 5 to 6 years to reach complete adoption in a community, another innovation such as artificial insemination of dairy cows may require decades to reach widespread use.

The innovation-decision process has been described as the mental process through which an individual passes from first knowledge of an innovation to a decision to adopt or reject and to later confirmation of this decision. Rogers and Shoemaker (1971) site an example of this innovation-decision process for a Thai farmer who adopted a new rice variety and can be seen in Table 1.

This particular farmer adopted the new rice seed in 1969, but discontinued its use the following year. However, the average farmer in his community adopted it in 1966. We can therefore say that our farmer was less innovative than the average farmer in his community. Innovative-ness is "the degree to which an individual is relatively earlier in adopting new ideas than the other members of his society."

TABLE 1. Adoption Process of Thai Farmer of New Rice Seed

Year	Stage	Process
1965	Awareness	Talked with extension worker.
1967	Interest	Interpersonal communication with neighbours.
1969	Trial and Evaluation	Planted total rice acreage in the new seed.
1970	Adoption/ Non-Adoption	Discontinued use of the seed.

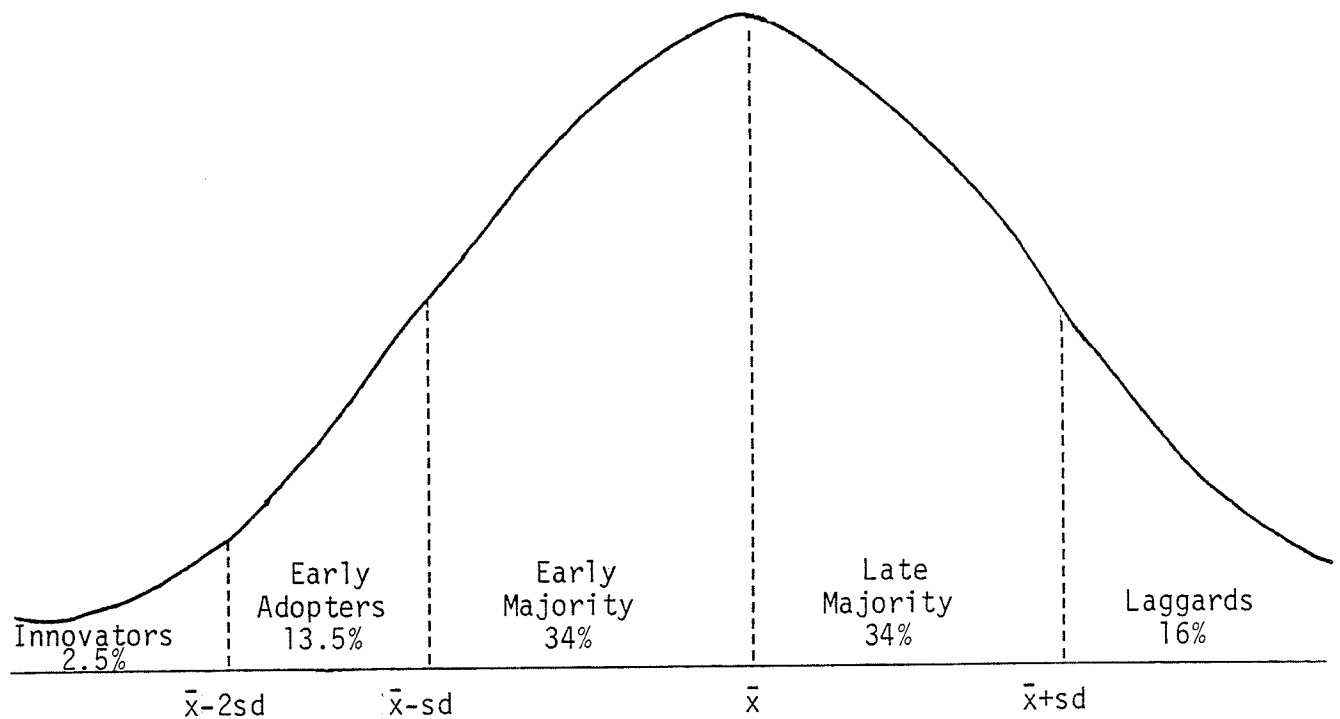
An individual's degree of innovativeness has become accepted as the criterion for adopter categorization. Jahoda, (1951) specified the characteristics which a set of categories should possess. Ideally, categories should (1) be exhaustive, or include all the respondents of the sample, (2) be naturally exclusive, or exclude from any other category a respondent who appears in one category, and (3) be derived from one classificatory principle.

Utilizing these characteristics and studies that demonstrated that adopter distribution closely approach normality, five adopter categories have been developed (Rogers and Shoemaker, 1971). Figure 1 shows the normal frequency distribution divided into five adopter categories: (1) Innovators, (2) Early Adopters, (3) Early Majority, (4) Late Majority, (5) Laggards. These categories were developed utilizing the mean time of adoption and the standard deviation or the amount of dispersion about the mean.

The area to the left of the mean time of adoption minus two standard deviations included the first 2.5% of the individuals to adopt an innovation -- the innovators. The next 13.5% to adopt the new idea were included

in the area between the mean minus one standard deviation and the mean minus two standard deviations; they were labelled "early adopters." The next 34% of the adopters, called "early majority," were included in the area between the mean date of adoption and minus one standard deviation. Between the mean and one standard deviation to the right of the mean were located the next 34% to adopt the new idea, the "late majority." The last 16% were called "laggards." This can be seen diagrammatically in Figure 1.

FIGURE 1. Adoption categorization on the basis of innovativeness.



This method of adopter classification was probably the most widely used in current diffusion studies. An outline of each category follows:

(1) Innovators: Venturesomeness is almost an obsession with innovators. This interest leads them out of a local circle of peers into more cosmopolitan social relationships. These individuals make little use of extension workers, preferring to go directly to agricultural scientists. Innovators are research minded and often read research bulletins. To be an innovator an individual must be in control of substantial financial resources and be able to understand and apply complex technical knowledge. They are generally characterized by high levels of education, large farms, and have high incomes. Innovators are seldom asked for their advice by their neighbours and are seldom regarded by their peers as opinion leaders. As one innovator said in a research interview, "Fifty percent of the farmers think I am crazy, and the other fifty percent are sure that I am." Approximately 2.5% of the population can be classified as innovators.

(2) Early Adopters: Early adopters are well integrated members of the local system. Early adopters are localites and are sought by their neighbours for information and advice. The early adopters are not too far ahead of the average individual in innovativeness, so they serve as role models. Early adopters are the embodiment of successful and discreet use of new ideas. Approximately 13.5% of the population will fall within the early adopter category.

(3) Early Majority: This adopter category adopts new ideas just before the average members of the system. The main social value of early majority farmers seems to be their deliberateness. They follow with deliberate willingness in adopting innovations but seldom lead. Their education, readership of farm magazines, participation in formal organizations,

and contacts with change agents are slightly higher than for the average farmer. The early majority is composed of 35% of the population.

(4) Late Majority: For this category, adoption occurs just after the average member of a social system. Adoption may be both an economic necessity and the answer to increasing social pressures. Innovations are approached with a skeptical and cautious air and these farmers are convinced only when the weight of community opinion definitely favours the new idea. This group comprises 34% of the population.

(5) Laggards: This category is the last to adopt an innovation. Its members possess almost no opinion leadership and their point of reference is the past. A laggard interacts primarily with others who also hold traditional values and tend to be openly suspicious of innovations, innovators, and change agents. Typically they have smaller farms, low incomes, and little formal education. This group contains the remaining 16% of the population.

Van der Ban (1960) also found that a system's norm affects one individual member's innovation-adoption behaviour. Norms are the established behaviour patterns for the members of a given social system. They define the range of tolerable behaviour and serve as a guide or a standard for the members of a social system.

Very often the most innovative member of a social system is perceived as a deviant and accordingly has very low credibility. His role in diffusion will be minimal. On the other hand, there are those who function as opinion leaders. These are thought to be early adopters.

Opinion leadership is the ability to influence informally an individual's attitudes or behaviour in a desired way with relative frequency. It is

earned and maintained by technical competence, social accessibility, and conformity to the system's norms. It is generally agreed that compared with their followers, opinion leaders were more exposed to all forms of communication about new ideas, were more socially accessible to their followers, were cosmopolite, had higher social status, and were more innovative (Rogers and Shoemaker, 1971).

Researchers have developed two methods which they feel can be used to predict the type of individual most likely to adopt an innovation. The first method is based on the belief that an individual's personal characteristics determine whether he is likely to adopt an innovation. The other field of research involves a prediction based on how the individual perceives the attributes of the proposed innovation (Ostlund, 1974).

a. Personal characteristics as a predictor of adoption

Many studies have been conducted to differentiate between adopters and non-adopters of new innovations. These studies have attempted to utilize the demographic and psychographic characteristics of an individual to predict whether he is an adopter or non-adopter.

Donnelly and Ivancevich (1974) demonstrated that the social character of an individual acted as a good predictor of adopters of an innovation. Several researchers (Coleman, et al, 1966), (Rogers, 1960) have shown that earlier adopters generally have been found to be cosmopolite, younger, more gregarious and, with the exception of the first few percentage to adopt, are well adapted into peer social groups. Czepiel (1974) proved that early adopters exhibited greater opinion leadership with respect

to the innovation than did later adopters. The demographic and psychographic characteristics of adopters have been studied using the following parameters:

- (1) Socioeconomic status
- (2) Personality variables
- (3) Communication behaviour

(1) Socioeconomic status

The socioeconomic characteristics that have been studied include:

Age: Rogers and Shoemaker (1971) reviewed many research studies and hypothesized that early adopters were no different than later adopters in terms of age. About one-half of the studies show no relationship, 19% show that earlier adopters are younger, and 33% indicate that earlier adopters are older.

Education: Earlier adopters have more years of education than do later adopters. Rogers (1957), in analysing the innovative characteristics of 96 agricultural innovators found that compared to the average farmer, the innovators were more highly educated, especially in agriculture. Gross (1949) studied the differential adoption by 259 farmers of a new system to eradicate worms and neuro bacillus in hogs. He found that acceptors of this innovation were better educated than non-acceptors.

Size of Farm: A large percentage of those studies in which the size of units (farms) have been studied as a predictive variable have shown that earlier adopters have larger sized units than do later adopters. Gross (1949) examined the relationship between the size of farm and the adoption of two recommended agricultural practices - hybrid



corn and a hog sanitation system. The study revealed a significant correlation between the farm size (measured in acres) and the adoption of both these innovations. Havens (1965), examining the adoption of the bulk milk handling system, also found a significant correlation between size of enterprise and innovativeness. Havens, however, measured size by using the Productive Man Work Units method (PMWU). A PMWU is the amount of work performed in a 10-hour day by an average farm worker with typical methods and equipment. The PMWU has been considered a more accurate measure of farm size than are acres because it reflects the scope of both crop and livestock enterprises.

Credit: Earlier adopters have a more favourable attitude toward credit (borrowing money) than late adopters. Using a four-item scale as a measure of the individual's willingness to use credit, Havens (1965) found a significant relationship between the attitude toward the use of credit and the time of adoption of bulk milk tanks. An example of how this scale is handled is as follows: Farmers are given statements which they are asked to react to by indicating whether they strongly agree, agree, disagree, or strongly disagree. On the basis of their responses, they can be classified with regard to their attitude toward credit.

Typical statements might include:

- (1) Most farmers who enlarge their operations by borrowing profit more than farmers who have small operations free of debt.
- (2) Farmers should wait until they can accumulate their own capital rather than to borrow for farm production purposes.

### (3) Communication behaviour

Communication is the process by which messages are transferred from a source to a receiver. Communication behaviour involves the levels of the communication network to which an individual is attuned.

Factors that have been examined and found to be associated with innovative individuals are:

Cosmopolitanness: A cosmopolite person is one who is free from local, provincial, or national prejudices. Earlier adopters are more cosmopolitan than later adopters. An innovator's reference groups are more likely to be outside rather than within the social system. They travel widely and are involved in matters beyond the boundaries of their local system. Ryan and Gross (1943) found the Iowa hybrid corn innovators travelled more often to urban centres like Des Moines than did the average farmer. Medical doctors, who innovated a drug, were observed by Coleman et al (1966) to attend more out-of-town professional meetings than non-innovators. Chaparro (1955) concluded that Costa Rican innovators were amazingly cosmopolite. Over 84% had visited the U.S.A., 62% had travelled to Europe, and 65% had visited Mexico.

#### b. Perceived attributes as a predictor of adoption

Although a great number of studies have been conducted over the past years on the value of an individual's characteristics as a predictor of innovativeness, other researchers feel there is another avenue worth exploring.

Rogers and Shoemaker (1971) showed that in some studies the rates of adoption of innovations depended on the individual's perception of the characteristics of an innovation. In other words, there was a difference