Chapter 17

ADOPTION PROCESSES AND EXTENSION STRATEGIES FOR CONSERVATION FARMING

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Early settlers in Australia opened up the country by clearing, burning and ploughing. A proud pioneering heritage was developed and confidence was high for future farming. Agricultural practices that overcame the problems of labour scarcity and exploitation of new areas were adopted. Tillage practices evolved as a consequence of decisions about soil-surface and crop-residue management, and water and weed management. Both agronomists and farmers, using the 'wisdom of hindsight', realised the impact of tillage practices on soil erosion and crop productivity. Since the 1960s, innovative conservation farming methods have been developed by agronomists and some farmers. Other farmers have started to examine and evaluate these innovations. In brief, the present methods of crop production and soil-erosion control have a long history of producers' traditions of 'trial and error' and of innovative learning to adjust to new problems and future potentials.

This chapter deals first with the process of innovation adoption by farmers and delineates some of the socioeconomic and psychological factors that influence the adoption process. The principles and strategies of transferring conservation farming technology to farmers are subsequently considered.

PROCESS OF ADOPTING INNOVATIVE PRACTICES

Selective acceptance of innovation

For various reasons farmers do not adopt all innovations related to farm production. Not all innovations developed by scientists and agribusinesses are relevant to all farming systems. Furthermore, farmers tend to select, from the package of practices developed by scientists, those that are consistent with their needs, economic conditions and attitudes towards different practices.

Farmers have to make many decisions during the agricultural production cycle, keeping potential problems and alternate solutions in view. Some of these decisions are for immediate survival, while others are made in view of anticipated long-term benefits. All innovations can be classified broadly into commercial or environmental practices. Commercial innovations are designed to increase productivity in a relatively short period. They have immediate visible effects, which appeal to the legitimate desires of farmers to increase returns, reduce hard work, or increase social prestige. Environmental innovations are designed to protect the environment and maintain long-term productivity. Environmental innovations include conservation-farming practices that are intended to prevent soil erosion and maintain

productivity. These innovations are more complex with less visible immediate gains. There can clearly be overlap between these practices where, for example, a soil-conserving practice such as stubble retention can also increase productivity through improved efficiency of fallowing (Chapter 3).

The adoption of commercial innovations for immediate survival and viability in the short term, and concern for conservation of resources in the long term, are the two important aspects of management decision-making. The relative importance of these concerns will influence the adoption of commercial practices and conservation farming methods.

Chamala *et al.* (1982) provided evidence from a study in Queensland that farmers who adopted commercial innovations did not necessarily adopt all or even a majority of soil conservation practices. The results suggested, however, that there is a degree of overlap between the adoption of some commercial and some soil conservation practices. Selective relationships also occurred between various practices. For example, farmers who were innovative with machinery were more likely to buy or modify stubble machinery, herbicide applicators and rod weeders.

The positive relationship between purchase of new machinery and the adoption of reduced tillage could indicate either that the people willing to adopt reduced tillage are also intrinsically interested in new machinery, or that people see new machinery as being required for reduced tillage, and only those in a position to buy new machinery are adopting reduced-tillage techniques.

However, it is not clear whether those who are buying equipment for reduced-tillage farming are doing so because of environmental attitudes, or because they see short-term advantages, such as energy savings, through adopting these practices. Studies in the United States indicate that increased adoption of no-till is due to immediate energy savings.

The use of fertiliser and pest and disease control measures correlated significantly with the overall soil conservation index, contour banks, waterways, and contour cultivation, but there was not significant relationship with stubble mulching and reduced tillage. This could mean that there are many careful managers who take steps to maximise yields and who perhaps take pride in a well organised farm, and who are not yet convinced that stubble mulching and reduced tillage are the ways to achieve this (Chamala *et al.*, 1982).

Adoption process with conservation-farming practices

The selective acceptance of conservation farming differs in many ways from previous traditional studies on commercial innovation adoption and diffusion. Conservation farming involves the adoption of a complex array of practices including modifications to or changes of machinery, herbicide and fertiliser use, and rotations, rather than a single practice such as the change of a particular crop cultivar.

The human behaviour dynamics involved in a change process from one practice to another - say conventional tillage to conservation farming - is described variously as the innovation-adoption process (Pareek, 1968; Rogers and Shoemaker, 1971); problem-solving model (Havelock and Havelock, 1973); and purposeful learning process (Klausmeier and Goodwin, 1969). Table 17.1 provides a brief summary of different stages described in these models.

The summary of steps involved in the models provides an insight into the conceptual ways a farmer goes through various stages in changing a conventional practice. While there are

Table 17.1 The adoption process—a review of models of innovation decisions, problem-solving or learning process

Innovation-adoption process Stages	Problem-solving process Steps	Purposeful learning without instruction Steps
Stage 1: Awareness Farmer learns about new practice such as conservation farming but has no detailed information on solutions. Awareness of production problems on a continued basis.	1 *Perceiving the problem—need is felt* Farmer may perceive the difficulty of reduced yields in general terms.	1 *The learner becomes motivated* Once the learner is motivated he sets goals for learning.
Stage 2: Need stage Farmer evaluates its relevance to his problems/priorities. He must see soil erosion and weeds as problems and conservation farming as a solution.	2 *Problem diagnosis* Explores the situation. Mentally recognises the nature of problem and looks for causes.	2 *Appraises situation* Situational appraisal focuses on means–goal relationship.
Stage 3: Interest stage If he is convinced about the problem and the relevance of the solution, he takes interest and seeks more detailed information, otherwise he discontinues search.	3 *Gathering data* Farmer may collect data on why his yields are reducing, how the soil is lost and how much is lost. Collects data and may organise it. At this stage his attitude and perception of the problem and its causes are important. May need some guidance in collecting his farm data. Prescription of solutions will not help unless he diagnoses the problem correctly by himself.	3 *Tries to attain goal* Learner engages in productive thinking and physical activities.
Stage 4: Evaluation stage Farmer mentally evaluates the new idea in terms of its perceived cost/benefits. If it looks promising he will proceed to next stage.	4 *Searching for possible solutions* If the problem of soil erosion and its causes are recognised, he will be receptive to conservation-farming practices.	4 *Confirms/rejects responses* Learner drops inappropriate responses and improves perceived useful ones.
Stage 5: Trial stage Tries new practice if he is not fully convinced. At this stage farmer collects on-site evidence of its 'benefits' and 'costs'. This stage provides some insurance against potential failures.	5 *Choosing and implementing perceived best solutions* Farmer adapts and selects best combination of solutions. This could be on a small-scale level or level of full acceptance.	5 *Reach or does not reach goal* Depending on his learning skills either he reaches the goal or does not reach it.
Stage 6: Adoption/rejection stage Depending on the trial results he may use at full scale/ partially/or reject it permanently or temporarily.	6 *Measure effectiveness* Farmer monitors effectiveness of conservation farming and decides to continue to use or modify or reject it. Start with a new problem again.	6 (a) *Experience satisfaction* He remembers and applies learning; or (b) *Modifies goal* He may modify responses or withdraw from learning.

differences in the terminology used and in the sequence of steps in describing these various processes, closer examination indicates common steps in arriving at a change in practice in all these models. The first, crucial stage, is perception of the problem.

Perception of erosion by specialists and farmers

This concerns the way farmers identify problems such as soil erosion. There seem to be major differences in this respect between farmers and research and extension officers. In Queensland, for example, one survey found that 78% of farmers thought that 'soil loss in Australia is over exaggerated' (Chamala *et al.*, 1982). How do farmers and specialists measure erosion?

Measurement of soil erosion by scientists

Scientists use various techniques and instruments to measure runoff and sheet and/or rill erosion. Data are collected on a long-term basis and various computer analyses and models are used to predict average soil loss.

Despite these sophisticated measurements and extensive laboratory and field experimentation, scientists in a recent workshop on soil-erosion research techniques reported inadequacies in the measurement of various factors that influence soil loss (Anon., 1984). They noted considerable complexity of interaction between these factors, and difficulties in interpreting and generalising experiments.

While Australian soil scientists continue to develop better instruments and more appropriate models and methodologies to predict soil loss for various soil types and farming systems, estimates of soil loss are made on the basis of existing knowledge. Statements such as '51% of the total area used for agricultural and pastoral purposes in Australia requires treatment for land degradation if its productivity is to be maintained' (Anon, 1978) and 'For one tonne of wheat produced 13 tonnes of soil are lost', are accepted among the scientific community, field advisers and policy makers, but they produce mixed reactions from producers.

Situational analysis of erosion by field advisers

Field advisers working in some State departments prepare situational statements because the definition of land degradation is fundamental in planning soil conservation action programmes. Most of this situational analysis is carried out informally, regularly and regionally (Pauli, 1977). It is sufficient to state here that comprehensive procedures and criteria have been used in collecting data such as: forms of land degradation, their location, extent and severity; causes of the degradation (environmental and managerial); effects of the degradation, both local and transmitted; technical solutions and costs of implementation; and ranking of problems according to priority.

The important point is that an enormous amount of data, though sometimes subjective, has been collected in defining problems and priorities for action programmes on conservation; that is, the problem has been defined in terms of location, extent and severity of land degradation by the specialist officers. Educational programmes have been launched through mass media, group methods and individual contacts with producers. According to Chamala (1981), this prescriptive approach has been most useful to the producers who perceived the problem and are seeking information to solve it. However, the majority of producers may perceive the erosion problem differently, because they are not involved in problem definition.

Perception and measurement of soil erosion by farmers

Farmers conventionally use visual or intuitive methods to perceive the erosion problem. Evidence is visually noticed when there is severe gullying, massive stream siltation, silt build-up on

fence lines/lower paddocks, or there is restricted road access to tillage operations or transport. Off-paddock siltation is not usually noticed because it is washed away. Sheet erosion, which is measured by scientists with sophisticated instruments, is referred to many times by farmers as a 'bit of a wash'. Consequently, many producers conventionally perceive clinical cases of soil erosion as serious where physical effects are marked. Sub-clinical soil erosion is not generally perceived as erosion at all. Sub-clinical erosion may not be a serious problem for production on deep soils such as in parts of northern New South Wales and southern Queensland. It is a problem in southern Australia, however, where loss of even a few millimetres of topsoil can greatly reduce productivity (Aveyard, 1983).

Differences in the estimation of erosion on farms by producers and field advisers were reported by Chamala *et al.* (1983), where farmers tended to underestimate the erosion problem when compared with estimation of erosion by field advisers. Wilson *et al.* (1982) found that farmers estimated the affected area to be about one-third of their farms. On the other hand, Soil Conservation Officers from the Department of Primary Industries estimated the affected area, overall, at 75% of total farm areas. These differences may be due partly to the different methods used to estimate soil erosion by producers and specialists as described previously. There is a need to develop simple tools to measure erosion and moisture retention that can be used by farmers and farm advisers.

Another possible reason for conflicting perceptions of erosion between the landholders and professionals is that many land users do not see the whole problem until production declines or a major erosion event has occurred. They are less interested (understandably due to the cost-price squeeze or immediate survival) in the long-term and off-farm aspects of degradation.

The conflicting perceptions of the same phenomena, soil loss and conservation, could create communication problems in promoting technology to landholders (Chamala *et al.*, 1984).

SOCIOECONOMIC AND PSYCHOLOGICAL FACTORS INFLUENCING THE ADOPTION PROCESS

Attitudes of farmers towards the methods used in food production in general, and tillage systems in particular, are influenced by macro- and micro-level factors. Macro-level factors include government policies such as legislation, taxation policies, subsidies, availability of lower interest capital, cross-compliance, cost-sharing, import duties, demand for food and prices at international level and foreign exchange fluctuations. Some of these factors are considered by Pratley and Cornish in Chapter 18. This section concentrates on the important socio-psychological and information-exposure factors, as related to conservation farming.

Many theories have been enunciated by environmental psychologists and behavioural scientists (Bell *et al.*, 1978) and rural sociologists (Pampel and Van Es, 1977; 1984; Chamala *et al.*, 1982; 1983; Nowak, 1983a; 1983b; 1984; Heffernan, 1984) on factors that affect the behaviour of farmers towards the environment in general and in particular towards the adoption of innovative soil conservation practices.

There are few empirical studies dealing with adoption of either structural works or agronomic innovations that include conservation farming. Drawing from general theories and the few empirical studies available, a model has been depicted in Figure 17.1. A conservation farming decision-making model can be conceptualised as consisting of four major phases.

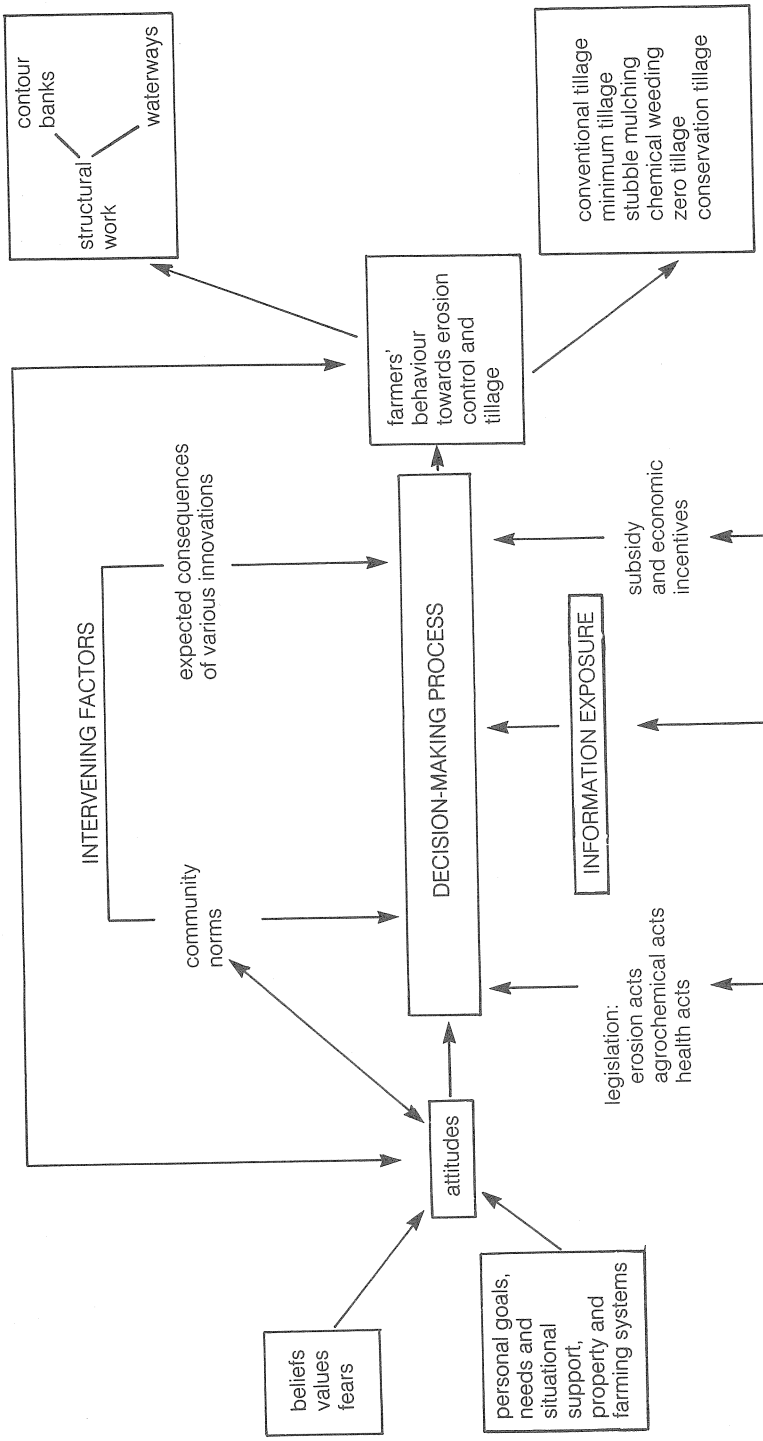

Figure 17.1 Fledgling model of conservation farming decision-making by farmers

The first phase consists of two distinct sets of variables. On the one hand are personal needs, goals, the family situation and current farming system. On the other are the farmer's beliefs, values and fears about the environment and farming methods.

In the second phase, these interact among themselves and produce a set of attitudes that are consistent with the farmer's farming system and family needs, beliefs and values. Personal attitudes have a major influence on the decision-making process.

In the third phase, it is conceptualised that a set of intervening factors such as community norms, legislation, incentives, and exposure to various innovations through different communication channels (mass media, group methods and individual contacts) influence the decision making process.

The final stage is the behavioural outcome towards erosion and weed control in terms of structural works (such as contour banks and waterways) and agronomic practices. The factors affecting the process of adopting innovations, according to the model, are briefly explained below.

FACTORS AFFECTING FARMER ATTITUDES

Beliefs, values and fears

In this context, beliefs can be defined as the knowledge and information that a person assumes to be true about the environment. Many beliefs may underlie a given attitude towards conservation farming or structural works to control erosion. Examples include: 'soil needs turning', 'can't afford more land for a waterway - my paddock is too small', 'can't stop gullies wandering all over the place anyway', 'using a reversible plough once a year throws the soil back up the hill', and 'legislation - no thanks, that will mean compulsory soil works', 'decisions for my farm are up to me'.

Value orientations are general feelings about what is desirable or undesirable. They give order and direction to the ever-flowing stream of human acts and thoughts as these relate to the solution of common human problems. Man-nature value orientations have been envisaged as subjugation to nature, harmony with nature, or mastery over nature. Some people brought up in a non-western culture have a 'subjugation to nature' value orientation. Consequently attitudes towards 'mother earth' are of reverence and great care, while some others may have a 'mastery over nature' orientation and exploit in the short term, believing that 'future technology' can fix problems. Similarly, value orientation towards the past, present or future will influence the attitude towards soil conservation practices. 'Fly now and pay later' type attitudes will emphasise the present, with little concern to 'save the soil for future generations'. The cost-price squeeze and fluctuations in commodity prices may influence farmers to focus their attention on present survival problems rather than future ecological concerns.

Knowledge of beliefs and values provides a better basis on which to develop strategies for influencing the attitudes of farmers.

Similarly, doubts and fears about certain practices arouse either favourable or unfavourable attitudes. Some common fears that have been reported in various surveys in Australia include: 'chemicals build up in soil', 'stubble mulching harbors disease and insects', 'stubble clogs machinery', 'I will need all new machinery for conservation tillage'.

Recent debates on effects of herbicides used in the Vietnam war, and a few cases of miscarriages in rural areas, allegedly due to spraying chemicals, have created fears and concerns in urban and rural communities. Hubbert (1982) in his comprehensive study of comparative rural and urban attitudes towards pesticides found, *inter alia*, that urban residents had more negative attitudes to pesticides like 2,4,5-T while primary producers had more positive attitudes towards these chemicals. He further states that 'given a conflict model of linkages of rural and urban environmental problems, this urban concern will have an effect on decision making, especially in regulatory functions, but also in extension strategies'. Some of these concerns and fears point to the need for long-term impact studies of the effects of these chemicals on environment and health. Meanwhile, they produce fear in the use of safety-tested chemicals. These fears may be due to lack of correct agronomic knowledge or lack of information on the positive role of agrochemicals in food and fibre production.

Concern and fear of running out of fossil fuel and the increase in petrol costs in the late 1970s triggered positive attitudes towards energy conservation. In the United States, for example, farmers are expanding the use of conservation farming methods, mostly for energy-saving costs and time-saving reasons.

Personal needs, family situation and farming system

So far it has been established that beliefs, values and fears will influence attitudes, which, in turn, are also influenced by personal needs, family situations and farming systems.

A farmer's personal goals or needs are defined by his early socialisation, present family situation and farming systems. Goals are set along three broad paths of farming: (1) farming is a way of life, and survival strategies suffice; or (2) emphasis is on increasing production either with long-term stabilisation or short-term productivity, without stabilisation; or (3) emphasis is on capital gain.

In real-life situations, goals could be a combination of the above categories depending on farm and family situations. According to Chamala *et al.* (1982), family factors such as number of years of farming, age of the farmer, age of children, situational support (which includes generations of family ownership of property) and participation by the farmer in community activities were all positively related to the soil conservation practices used. Similarly, property location, size, farming enterprises followed (such as crops, dairy or beef production) influenced his goal-setting process and, finally, his attitudes towards farming methods.

Farmers tend to have favourable attitudes towards various innovations or farming methods if they satisfy their non-monetary needs such as attention, acceptance or approval by other farmers; and praise, new skills and desire to excel. Similarly, attitudes are held to defend their ego or self-esteem. In general, people have a self-concept such as 'I am a hard-working person'. Any actions to threaten this concept will be protected by counter activities.

Belief system, value orientation and fear, as discussed in the previous section, will interact with the personal needs, family situation and farming system and produce a set of attitudes towards farming technologies. Understanding these beliefs, values, fears, personal needs, family situation and peculiarities of the farming systems, and their interaction will provide an insight into the attitude of a farmer towards conservation farming practices.

ATTITUDES TOWARDS CONSERVATION FARMING PRACTICES

Adoption of new conservation technology is rarely random and instantaneous. It is a purposeful decision-making process undertaken either consciously or unconsciously. One of the main catalysts for adoption of any innovation is the attitude of the farmer towards change. Negative attitudes isolate the individual from any information that is seen as inconsistent with beliefs, values and needs, whereas positive attitudes prompt an individual to seek new ideas and information. According to Katz (1960), 'attitude is the predisposition of the individual to evaluate some symbol or object or aspect of his work in a favourable or unfavourable manner'. Attitudes have three components: a **cognitive** component because it represents a person's knowledge, held with varying degrees of certitude; an **effective** component because of its capability of arousing effects of varying intensity; and a **connotative** or **action** component because of a response predisposition. Ajzen and Fishbein (1980) provided a recent commentary on understanding attitudes and predicting behaviour.

Some surveys have attempted to understand producers' attitudes towards conservation farming practices. Table 17.2 gives some examples of attitudes held by respondents in these surveys. Attitudes in each region will be different but the example given in Table 17.2 indicates the range of attitudes producers had regarding erosion problems and some of the methods to control it. It is essential to understand the attitudes held by producers as they will provide the basis for planning communication strategies to influence them.

INTERVENING FACTORS INFLUENCING INNOVATION DECISION-MAKING

The process of deciding to innovate (see Table 17.1) consists of many stages, in which the problem is first perceived and then purposeful learning takes place to arrive at the decision to change a practice or system of cultivation. Many factors intervene to determine the course of this process. The major factors are depicted in the model shown in Figure 17.1. They include legislation, subsidies and other economic incentives, community norms, exposure to various other innovations through the media and agribusiness service personnel, and the expected results of various innovations among producers.

Legislation, subsidies and other economic incentives will act in a classical 'carrot and stick' method of motivating producers. These factors are discussed in detail in Chapter 18 in terms of cost/effectiveness. Their effectiveness in permanently changing behaviour is questionable, however. Unless education programmes are provided to demonstrate the intrinsic value of conservation farming practices, the behaviour may revert once these incentives are withdrawn or legislation becomes inactive.

Community norms

Community norms are unwritten laws that influence the behaviour of farmers, and others. Reference-group and peer-group pressures and social norms are both general and specific expectations of behaviour by members of a group or a community. The person's beliefs, based both on perceived behaviour expected by others and his motivation, comply with the specific reference groups and leads to subjective norms (Ajzen and Fishbein, 1980). These operate in an informal setting when members engage in social interactions or informal chats. They influence crop-management activities such as mechanical weed control, clean finely tilled cultivations; straight rows or rotations. Untidy fields may be seen as reflecting the laziness of producers if the local norm is to have clean paddocks. According to Wylie (1982) 'only recently are some farmers beginning to accept the idea that leaving untidy layers of stubble on the soil surface

Table 17.2 Example of attitudes towards erosion and conservation practices (Chamala *et al.*, 1983)

Item	Response					
	SA %	Agree %	U %	Disagree %	SD %	Mean
Erosion as a problem and its control						
Soil erosion is a major problem around here	30	54	4	10	2	1.00
Eastern uplands soil in the Darling Downs are highly erodible	32	59	3	5	1	0.83
Soil erosion is only the farmer's problem	2	11	40	46	1	3.20
Erosion control is a problem for everyone in the community and nation	27	64	2	6	1	0.89
The loss of soil is exaggerated by people who are not farming	8	27	14	39	12	2.21
Conservation practices						
Burning stubble had declined because it increased erosion	23	65	4	5	3	1.07
Burning stubble has declined because it is expected to be banned by the Government	3	3	16	54	24	2.99
Contour banks do *not* effectively control soil erosion	4	33	5	43	15	2.35
Contour banks make farming more difficult	12	55	4	21	9	1.59
Waterways reduce crop yields due to the area taken	7	30	8	48	8	2.20
Ploughing most of the stubble under controls erosion better than leaving it on the surface	11	17	11	40	21	2.48
Using chemicals to control insects harms the environment	19	34	21	23	4	1.59
Using chemicals to control weeds harms the soil	5	33	29	26	6	1.97
The safe use of chemical weedicides is no problem for me	10	58	10	16	6	1.49
I use the best soil-conservation practices that I know of	24	56	3	17	1	1.16

SA = strongly agree.
U = undecided.
SD = strongly disagree.
Mean = mean values.

SA = 0.
A = 1.
U = 2.
D = 3.
SD = 4.

is an improved way to farm'. Opinion leaders uphold or create new norms in a community and it is important to locate them and then get them on side by providing them with information on new tillage technology. This approach will slowly create new norms and once supported by enough people will influence others to behave in a manner more consistent with the new norms. This sociological principle is being successfully used in many campaigns to stop drink driving or smoking.

Expected consequences of various innovations

Another factor that intervenes between personal attitude and behaviour is that, before farmers act, they weigh the economic and social consequences of that behaviour. The reward expectations are communicated through various electronic and print media and interpersonally.

There are two problems in creating favourable expectations of conservation farming methods. The first one is the important lack of socioeconomic benefit analysis of conservation farming in Australia. For example, conservation farming provides greater opportunities for double cropping or for increasing the area of cultivation (Chapters 2, 3 and 16). These advantages could be emphasised to those people who are increasing their cultivation or going into double cropping. Second is the lack of promotion of this technology compared with other innovations in agriculture. According to Chamala *et al.* (1982), 'farmers who had adopted a few soil conservation methods were exposed more to: (1) machinery information through media; (2) information on fertilisers; and (3) livestock information and market prices'. By contrast, exposure to information on crops, herbicides, and money management was significantly related to adoption of soil conservation methods. There is a need to produce market-tested information packages to assist field advisers in their attempts to direct the attention of farmers to new technologies in conservation farming. So far the major focus in the extension of soil conservation has been on structural works, particularly in Queensland and New South Wales (Chapter 18).

However, if the expected consequences of innovation adoption costs more to the farmer but benefits more to the public then it needs a different approach. Van Es (1984) defined costs and benefits in terms of perceived negative or positive consequences to the farmer or public at large. Farmers' costs deal with on-the-farm consequences such as loss in productivity, water and soil resources. Off-site costs (or 'externalities') do not normally enter farmers' calculations. However, the public will define erosion costs largely in terms of off-farm effects such as siltation of rivers, dams, roads, harbours, flooding of townships, dust storms, salting, and water quality. If the public is the major benefactor, the farmers could not be persuaded with any amount of communication or mandatory programmes. Incentives such as subsidies, guaranteed price, cost sharing by local beneficiaries, and tax benefits must be accompanied to make any technical services and educational programmes successful.

Conflicting situations will emerge where farmers and the public actively pursue opposite outcomes. In the case of negative accommodation and conflict situations, it should thus be recognised that voluntary farmer behaviour to bring about change is not likely to occur. Mandatory programmes (legislative arm) could be used to attain behaviour change of any kind, but they are most frequently used in conflict situations. Monitoring and implementation of legislation in soil conservation is not easy and cost effective. Political will and community backing is essential to make the mandatory programmes work. In order to increase the effectiveness of legislative mandatory programmes, advisory group councils are created by involving community leadership at various levels. Western Australia, Victoria, South Australia and Queensland have these committees. The results of the first national study of District Soil Conservation Advisory Committees (Chamala and Maurer, 1985) indicated their contribution to district soil conservation programmes. They recommend to use these committees to increase involvement and commitment of local leaders in these programmes. It is generally stated that land holders do not like mandatory policies, although some legislative programmes in the dairy and meat industries and vermin and weed control programmes seem to have achieved some success but there are no published works on this aspect.

BEHAVIOURAL OUTCOME IN TERMS OF ACTION ON EROSION CONTROL AND CONSERVATION FARMING

Towards the end of the innovation-decision process, farmers engage in activities that lead to a choice to adopt or reject the innovations. For example, if the producer perceives the visually

dramatic evidence of gullies as erosion, he is more likely to adopt structural measures (contour banks, waterways) or he may combine some agronomic methods (reduced tillage or stubble mulching).

Most farmers have heard of the many innovations of conservation farming that they have not adopted. Reasons for non-adoption of innovations are numerous and vary according to the regions and agro-climatic conditions as well as socioeconomic characteristics of the farming community. The expected consequences of innovations will influence the decision to adopt or reject. The major common reasons for rejection include the following:

* not compatible with farming system, farmers' goals, and resources; technology is not appropriate;
* socioeconomic advantages are not attractive enough, and perceived fears of side-effects on health and environment could dampen the enthusiasm;
* information packages are too complex and their advantages are not easily observed;
* innovations cannot be tried on a small scale relative to their viability on their farms;
* innovations do not lend themselves to easy communication;
* general economic uncertainty of the country, industry or farm enterprise;
* inappropriate extension approach and communication strategy.

The non-adoption of an innovation may also result from a prescriptive approach to extension: scientists and advisers define the problem and prescribe solutions in a general form without really involving farmers in problem identification or understanding their values, beliefs, concerns and attitudes. Developing an awareness of the problem (by involving farmers in data gathering) should be followed up with a transfer of knowledge about the practices that solve the problems. Positive policies and technical assistance is then needed to help farmers in the successful application of conservation farming practices.

EXTENSION STRATEGIES FOR INCREASING ADOPTION OF CONSERVATION FARMING

COMMUNITY EXTENSION

State Departments of Agriculture and other research organisations (CSIRO and universities) have traditionally serviced farmers and the rural audience. In recent years, the demand for information has increased from various sectors such as 'small' farmers, hobby farmers, and backyard gardeners who live in semi-urban settings. Extension services are pulled in two directions. Some administrators hold the view that Departments of Agriculture should service the needs of producers of Australian food and fibre; others desire that extension make its educational programmes available to all segments of the public, regardless of their geographical, occupational or socioeconomic background. In view of the 'conservation farming model (Figure 17.1), it is argued that the audience for extension should be expanded, for two reasons. Firstly, it can be argued that research and extension should be available to all taxpayers in Australia. Secondly, but, more importantly, attitudes, social norms and government policies are debated and influenced by the majority of Australians, who live in urban areas.

With the broader audience approach in mind, it is impossible to provide a detailed extension strategy for increasing the adoption of conservation practices in general, or conservation farming practices in particular. Therefore, only major principles are delineated and discussed here, keeping the view that erosion control and conservation farming are closely related.

Identifying the target groups

The first discrimination in target grouping could be on the basis of geographic location - rural and urban. Urban groups could be further divided into school students, youth and adults. Similar targeting could be done within the rural audience.

Urban community awareness programme

Environmental concerns in urban centres have been concentrated mostly on issues such as rainforests, dams, protection of fauna and flora, and the Great Barrier Reef. Shifts in the approach of the Australian Conservation Foundation to soil erosion is a welcome sign, and more effort needs to be made by agricultural scientists to produce base materials (such as documents, films, videos, TV and radio programmes) to help national publicity programmes to promote an understanding of soil conservation or related conservation farming technology and its benefits to the community. Metropolitan and urban residents must be constantly reminded of the value to the whole Australian community of soil conservation and the use of well-tested new chemicals in farming. In the absence of this exposure, the media's emotive reporting of single incidents of the effects of chemicals may mislead and create fears in the urban community. Some positive examples of good educational programmes on television come from the ABC, such as 'Heartlands', 'Countrywide' and 'Four Corners' programmes on soil conservation. The commercial channels show some good documentaries but most of them are from overseas. Similarly *National Farmer* and other country papers and producer organisations publish articles discussing various issues related to soil conservation. 'Greening Australia' is another good example. There is need to continue these general educational programmes. Discussion and dissemination of scientific information on various issues is very important. Scientists speaking to various professional groups or service clubs (Rotary, Lions and Apex Clubs) and organised visits to research centres and conservation farms will hopefully reduce the contrast in attitudes between rural communities and urban consumers of food.

Education programmes for teachers, students and young farmers

The Standing Committee on Soil Conservation has initiated educational programmes through its national awareness programme involving various State Departments of Agriculture. However, its efforts need to be further augmented with increased funding.

Many community groups could also be formed to bridge the awareness gap between urban and rural communities on erosion and conservation. Toowoomba Erosion Awareness Movement was formed on the Darling Downs with landholders, community members and academics as its members. One of the aims of this movement is to create general awareness among the farmers and community members alike. Similar groups in other States could play an important role in creating awareness and seeking public support and commitment to the problem of erosion.

Posters and stickers have been produced for schools and for other community activities by the Victorian and New South Wales Departments of Agriculture. The Soil Conservation Service Branch

of the Queensland Department of Primary Industries appointed a full-time information services officer only in 1979. The information services project, as in many other States, has produced games, pamphlets, posters, stickers, folders, show-display material, caravan displays, films, and videos for general publicity (Hepworth, 1982). This material is very useful for geography teachers and students alike. Displays in agricultural shows and regional shows are essential for general public awareness. Most of this material has been focused only on erosion while the role of pesticides and herbicides has been omitted. The role of well-tested chemicals in modern agriculture needs to be communicated in a subtle manner. Similarly, most school textbooks emphasise only negative aspects such as build-up of chemicals in birdlife. There is a need to incorporate modern conservation cultivation concepts in school books. This monograph is a start in the right direction. The role of judicious use of chemicals in efficient production of food and fibre could also be incorporated.

The involvement of marketing consultants, tertiary institutions and school teachers in the development of this material would further enhance its quality, relevance and use. The Commonwealth Department of Primary Industry, under its National Soil Conservation Programme, has taken the lead and provided funds to achieve these goals. Major objectives of these educational and awareness programmes should include development of broader conservation ethics, including energy conservation, the cost of interaction to prevent erosion and a balanced view on the role of chemicals in modern agriculture.

There is a need to develop external courses in soil conservation such as that offered by The Darling Downs Institute of Advanced Education to help young farmers, agricultural teachers and students.

Despite the importance of the urban audience, however, the immediate need is to communicate conservation farming to producers.

METHODOLOGY OF COMMUNICATING CONSERVATION FARMING TO PRODUCERS

Establish a conservation farming information centre (CFIC)

There is a need to establish a centre based on American models such as the Conservation Tillage Information Centre, as a cooperative effort between agricultural scientists, extension services, soil conservation services, agribusiness and various producer associations. This CFIC would act as a clearing house for information on conservation farming. This is happening on a small scale with the Northern No-Tillage Project Team and the Southern Conservation Farming Group based at Tamworth and Wagga Wagga, New South Wales, respectively. The Erosion Research Newsletter from the Conservation Commission of the Northern Territory and publications such as *Chemicals in Agriculture* are some other examples of the attempt to disseminate information. A national CFIC would publish newsletters, provide lists of resource people and share literature, slides, films and extension experience. It would take up national conservation farming adoption surveys, farmer attitude surveys, and provide a conservation farming publication abstract library.

Planning a communication strategy

The principles listed below are important when planning a communication strategy to promote conservation farming.

1 **Categorise the producers into target groups** In the past, extension workers used adopter categories based on adoption of one or more innovations. They were broadly classified into five adopter categories, namely: innovators, early adopters, early majority, late majority, or laggards (Rogers, 1962). This categorisation influenced field advisers to follow a 'trickle down' extension strategy, that is, to first reach the innovative farmer and then assume that new technology will flow down to others. This approach certainly has some advantages, but it is not adequate as the sole strategy for target groups. (For detailed discussion see Chamala *et al.*, 1980 and Chamala and Keith, 1984.)

The first step is to collect data from informed persons in the district about general farming methods, and the beliefs and attitudes of farmers. On the basis of this, farmers could be categorised into a few groups, for example farmers who cultivate more than the average number of times, farmers who use or don't use herbicides, stubble mulching versus stubble incorporating groups, or an advanced group that is seeking more information about stubble mulching or no-till.

Similarly, a sub-group of producers going into cropping or expanding the area cropped can be defined. For example, in Queensland every year an extra 70 000 ha go into cropping. Who are these farmers? How can they be reached with the conservation farming message before erosion damage is done?

These homogeneous sub-groups will be target groups for extension programming. Selection of an appropriate package of technology and communication methods (personal visits, written literature, videos, films, farm walks, field days, or other group-discussion methods) can be made to suit each sub-group.

This method ensures that those groups that do not seek information are reached, and prevents working with innovative farmers only.

2 **Identify communication networks and reference groups** Once homogeneous sub-groups within the district are defined, it is important to understand their social and communication networks. Simple questions should be asked, such as who talks to whom, who are the respected influential producers in the group, whose opinions create new attitudes, who is sought for information on farming methods, what information sources are used?

The answers will provide enough information to locate the opinion leaders who influence these groups of producers through their social interaction, as well as the media or information source used. By providing conservation farming information to these leaders of opinion in each sub-group, and to other sources (e.g. newspapers, radio) that reach these groups, it should be possible to hasten the process of changing beliefs, attitudes and finally tillage practices.

3 **Use group influences** Using discussion groups to promote conservation farming is not only cost effective but provides opportunities for farmers to share accumulated experience in relation to their approach to weed control through cultivation, herbicide use and other related issues. It has been found that group discussions are an effective way of changing attitudes and beliefs. The group with which farmers identify will have an influence on their beliefs, attitudes and behaviour towards conservation farming. Individuals need approval and acceptance from others. Such an approach was used by the ICI company in encouraging the adoption of direct drilling in Western Australia.

In general, people believe that they make rational decisions based on well remembered data. However, many of the data are not well recorded and are generally drawn from vague memory. When

people examine their own reasons for, say, weed control they are not usually related to a clear set of facts. Their reasons are based on traditions or accumulated experience, likes and dislikes, or other fears and beliefs or the type of machinery they have. The individual farmer often has no data to compare systematically with the experience of others. The main aim of group discussion, therefore, is to generate data from the experience of other individuals present. If all the members of a given group practise mostly traditional cultivation methods, it is important to invite others from the region who use the modern technology of conservation farming.

Using groups and conducting discussions calls for certain skills and understanding of social and psychological concepts of group dynamics. Most of the soil conservation advisers, and some agricultural extension officers, are not given much formal training in this area.

4 **Adopt a market research approach to develop information materials** This is an information era, where new information is communicated every minute through various media. These messages are developed by marketing specialists trained in behavioural science and backed by big budgets. They study their audience and package the information to change beliefs and attitudes favourable to their product or policies. However, most agricultural information packages or support materials such as films, posters, stickers and pamphlets are produced by head office and distributed to various regions. This approach can be very successful when promoting a single or non-controversial innovation. Where a systems concept is being promoted or where sensitive innovations such as the use of herbicides are involved in the overall concept of conservation farming, it is important to understand, for all the different target groups, the current fears, concerns and attitudes towards these practices. One such attempt was made in Queensland (Chamala *et al.*, 1984a; 1984b) to develop an information package on conservation cropping, consisting of two video programmes, one pamphlet and an extension officers' guide using market research methodology to pre-test the materials with the intended users such as extension officers, farmers and high-school students. This approach should enhance the relevance of the material presented.

5 **Use microcomputers and VCRs in technology transfer** Traditional technology-transfer systems (e.g. technical assistance, extension, education) may soon need to be examined as many farmers start using video cassette recorders and microcomputers for entertainment, for electronic mail, teletex and videotex, information bulletins as well as problem-solving software for subjects such as crop pest management, crop production, farm finance and marketing.

These can be used for training staff or educating children with simulated games as well as for transferring knowledge more efficiently to producers, especially in the more remote areas. This will result in a less 'adviser-intensive' service to the more progressive farmers and more service to other farmers. Videotex development in conservation farming should be tested and used to supplement other methods of transfer technology. A detailed discussion on electronic technology is given by Delaney and Chamala (1985).

6 **Provide staff training and coordination of services at community level** Soil conservation officers, agricultural extension officers and machinery advisers are located in different branches of the same State Department such as in Queensland, Western Australia, South Australia, and under different departments in Victoria and New South Wales. Their level of knowledge and expertise in areas necessary for the extension of conservation farming, from using group discussions to handling boom sprays or herbicides, varies.

7 **Provide educational programmes for the intermediate audience who service producers** Numerous organisations and individuals provide goods and services to rural producers. They play

an important role in influencing the decision-making process of farmers. This intermediate audience could include bankers, stock and station agents, farm-management consultants, contractors, producer associations such as grain growers' associations, graziers' associations, other cooperative groups and various commercial companies such as chemical firms promoting herbicides or machinery firms selling no-till planters, rod weeders or boom sprayers. These may be actively involved directly or indirectly in promoting conservation farming in the district. Field agronomists and conservation advisers could 'plug' into their communication networks - either mass, group or individual. The important principle in communication is that if the same message comes from various sources and in different forms, the chance of changing farmers' attitudes and behaviour towards conservation farming will be greater. The intermediate audiences with this well-knit communication network could be very useful allies in the campaign to achieve conservation farming.

This chapter cannot meet the training needs of staff in Australia, but some of the major limitations of the soil conservation staff include the following:

* They do not have skills in working with groups but are good at working on a one-to-one basis.

* Since there are some overlaps of responsibilities among extension officers in Departments or branches of Agriculture, there is a need to help them to train in a teamwork approach. Cross-referencing and collaboration need to be developed.

* Many do not take the 'whole farm' or 'whole community' approach to planning; programme planning, team building and conflict-resolution skills need to be developed. Involvement of community leaders in various stages of planning, implementing and monitoring is an essential skill for the success of the programme and needs to be developed.

* There is also a need to provide technological information on aspects such as chemicals, machinery, weeds, rotations.

In relation to the last point, above, there is a need to provide training for conservation officers and others in the use of technology because they have been traditionally oriented towards structural works. A successful case of staff training occurs in Queensland where soil conservation officers have been given 'hands-on' experience with farm machinery and herbicide use. If they are confident of their practical knowledge, the officers will promote this technology boldly or aggressively. Another useful way of increasing their knowledge is to encourage them to conduct local trials on conservation farming in collaboration with local machinery and commercial agents. Coordination between various government departments and commercial agencies at various levels helps to orchestrate the campaign to promote conservation farming.

The negative consequences of lack of 'hands-on' training and liaison with commercial distributors were confirmed by a recent study. According to Burnett (1984), consultants and advisers do not come to grips with agro-chemicals because of (1) a fear of failure due to lack of 'hands-on' experience; (2) attitude that 'all this is ephemeral' and that 'tomorrow we'll be back to normal'; (3) fear of being 'used up' by multinational chemical companies and losing credibility in the farmer's eyes; (4) fear that professional liability could be an issue and that a mistake could lead to a production loss with consequent recovery of damages.

Burnett (1984) also indicated that lack of adequate service to farmers and contractors results in: (1) too many farmers being injured by chemicals; (2) too much environmental pollution by

way of inadequate container disposal; and (3) too many mistakes in selection of correct chemicals, rates or timings. This, according to Burnett, is probably costing farmers 10-15% of their annual chemical bill. (Currently, $150 million is spent annually on herbicides throughout Australia.) These considerations have to be built into training programmes, and organisations need to have clear policies on these issues.

CONCLUSIONS

Because conservation farming is a systems concept involving changes in farm machinery, use of herbicides in controlling weeds, changing crop rotations, and animal management in some areas, it is conceptually complex to the producers to use, and emotionally sensitive to urban consumers. While there is a need to conduct more research into the side effects of herbicides on the environment, their build-up in the food chain and effect on consumers' health, planned comprehensive programmes based on understanding of farmers' needs, concerns and adoption processes as explained will help to get this complex and sensitive message to producers and consumers.

ACKNOWLEDGEMENT

The author wishes to thank Mr Howard Briggs, Director, Land Resources Branch, Department of Primary Industries, for reading the draft and providing helpful suggestions.

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