AN ASSESSMENT OF FARMER ATTITUDES TOWARDS WINTER WHEAT PRODUCTION IN SOUTHWESTERN MANITOBA

By

P. Joan Poor

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Abstract

The production of winter wheat in southwestern Manitoba has associated with it a number of advantages in terms of economics and soil conservation, and a number of disadvantages including disease problems and winter kill. The objectives of this study were to assess farmer attitudes towards winter wheat production as a soil and water conservation technique in southwestern Manitoba; to analyze the economic feasibility of winter wheat production; to determine what farmers feel are the major limitations associated with winter wheat; and to determine its future role within Manitoba's agricultural sector.

These objectives were achieved by carrying out a series of interviews with farmers and Provincial Agricultural Representatives throughout southwestern Mantioba. A total of thirty farmer interviews were conducted throughout this region during July, 1986. Twenty of these farmers had experience with winter wheat production and ten had none. Soil and water conservation awareness was strong among those farmers interviewed, in that 90% had made changes to their farming practices over the last ten years because of soil problems. The average years of experience growing winter wheat among the twenty winter wheat farmers interviewed was 2.65 years. The average yields of winter wheat ranged from

25 bushels to 60 bushels per acre, representing an average yield advantage over hard red spring wheat crops of 4.53 bushels per acre. In terms of dollar costs/savings per acre of winter wheat over hard red spring wheat, the average saving per acre was $10.00 among these winter wheat farmers.

Each of the thirty farmers interviewed was asked what the major problems were that inhibited them from growing more winter wheat. Problems with rust and winter kill were most commonly cited. Of the thirty farmers interviewed, 70% felt they would grow additional winter wheat if a new, more rust resistant variety was developed.

Nine Provincial Agricultural Representatives throughout southwestern Manitoba were interviewed. They felt the major problems associated with winter wheat production in Manitoba were rust, lack of knowledge, seeding equipment costs and trash management of the previous crop. All of the agricultural representatives felt that a more rust resistance variety would increase production. However, such increases would occur more so among those farmers already experienced with winter wheat production in Manitoba.

This study resulted in twelve recommendations to Manitoba farmers, farm organizations, government and other agencies interested in winter wheat production in Manitoba.

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INTRODUCTION

1.1 PREAMBLE

Winter wheat production on the Canadian Prairies has been limited historically to Alberta, where warm Chinook winds have a moderating effect on climate, preventing winter kill. In Manitoba the practice of winter wheat production is therefore relatively new, since the risk of winter kill under conventional tillage practices was too high to make winter wheat production economically viable. However through use of zero tillage crop production, winter wheat may be protected from harsh winter temperatures. The stubble maintained through zero tillage traps and holds snow. A uniform snow cover moderates soil temperatures to a level above that which causes winter kill (Stobbe and Rourke, 1981).

The degradation of Canadian agricultural land has been recognized as a serious problem. In 1984, a federal government Standing Senate Committee on Agriculture, Fisheries and Forestry, concluded in its report Soil at Risk, that a major commitment to conserving Canadian soil was required immediately if Canada is to prevent losing a large portion of its

agricultural capability. In terms of soil conservation, conventional tillage practices generally leave the soil bare and subject to erosion. Zero tillage associated with winter wheat, anchors the soil and thus reduces its susceptibility to erosion by both wind and water. Another soil conservation feature of fall seeded winter wheat, is that nitrogen leaching drops significantly. Soil nitrogen is often leached from soils during spring rains, winter wheat utilizes soil nitrogen early in the spring, before heavy rains arrive. Also, the use of chemical herbicide for both wild oats and wild millet (green foxtail) may not be required in the production of winter wheat because of its early vigorous spring growth capable of competing strongly against these weeds (Lyster, 1984).

Economic benefits for the farmer may be increased under successful winter wheat production. Benefits include reduced chemical costs and yields of 15 to 25 percent more than hard red spring wheat seeded under similar conditions (Stobbe and Evans, 1979). Also under zero tillage, machinery, fuel and labour requirements are reduced (Stobbe and Evans, 1979). In addition, because approximately 75 percent of the world wheat production each year is winter wheat, large markets have already been developed (Fowler, 1983).

At present the factors inhibiting wide scale winter wheat production in Manitoba the most, are associated with the recommended (Manitoba Department of Agriculture) culti-

var, Norstar. New cultivars are currently in the development stage at the University of Manitoba's Plant Science Department which aim to be more resistant to lodging and diseases, and have a higher grain to straw ratio than Norstar (Rourke and Stobbe, n.d.). Norstar was developed by M.N. Grant in Lethbridge, Alberta, where stem rust is not a problem. In Manitoba this susceptibility could eliminate any increased yield potential (Stobbe and Evans, 1979). However through the use of a new anti-rust fungicide known as Dithane M45 or Mancozeb, farmers throughout southern Manitoba, not just in selected areas of southwestern Manitoba, will be able to control rust to the extent that the Manitoba Crop Insurance Corporation has agreed to insure winter wheat throughout the whole of southern Manitoba beginning in the fall of 1986 (Vininsky, 1986).

1.2 PROBLEM STATEMENT

In Manitoba, successful winter wheat production is highly dependent on adequate snow cover which moderates soil temperatures and reduces winter kill. Therefore, the Manitoba Department of Agriculture recommends that winter wheat should be seeded directly into zero tilled fields where standing stubble acts to trap snow. Zero tillage in turn promotes soil and water conservation through reduced erosion. In Manitoba, winter wheat production increased from 10,500 harvested acres (4,200 ha.) in 1982 to 34,500 (13,800

ha.) in 1984 (Canadian Wheat Board data 1984), with an estimated seeded area of 120,000 acres (48,000 ha.) (Manitoba Department of Agriculture) in 1984. The Manitoba Department of Agriculture estimates that 1985 yields averaged 40-45 bushels per acre (2.7-3.0 tonnes per hectare).

In 1984, 87 percent of Manitoba's winter wheat production was located in the drier southwestern region of the province, reflecting winter wheat's efficient utilization of available moisture. It is within this area that seeding of winter wheat has increased substantially. The primary question this study will address is, what are the attitudes of farmers towards the future production of winter wheat within the southwestern agricultural region of Manitoba, as a soil and water conservation crop given the advantages and disadvantages associated with its production.

1.3 RESEARCH OBJECTIVE

The overall objective is to assess farmer attitudes towards winter wheat as a soil and water conservation crop in southwestern Manitoba. Such an assessment will include the following objectives:

1. To analyze the economic feasibility of winter wheat production, taking into consideration the advantages and disadvantages associated with its production.

2. To determine what the individual farmer feels are the major limitations associated with producing winter wheat on his particular farm.
3. To determine the future role of winter wheat as a soil and water conservation technique in southwestern Manitoba if such limitations were overcome.
4. Based on the findings from the above analysis, conclusions and recommendations will be drawn as to the future significance of winter wheat production in southwestern Manitoba.

1.4 BASIC METHODS

Essentially the methods used within this research project include a literature review and personal interviews with 30 farmers and nine Provincial Agricultural Representatives throughout the southwestern region of Manitoba. Figure 1 illustrates the study area in which interviews were conducted. This study area consists of approximately 7,653 farms or 26% of all Manitoba farms and approximately 6 million acres (204 million hectares) or 32% of total provincial farm area (Statistics Canada, 1981).

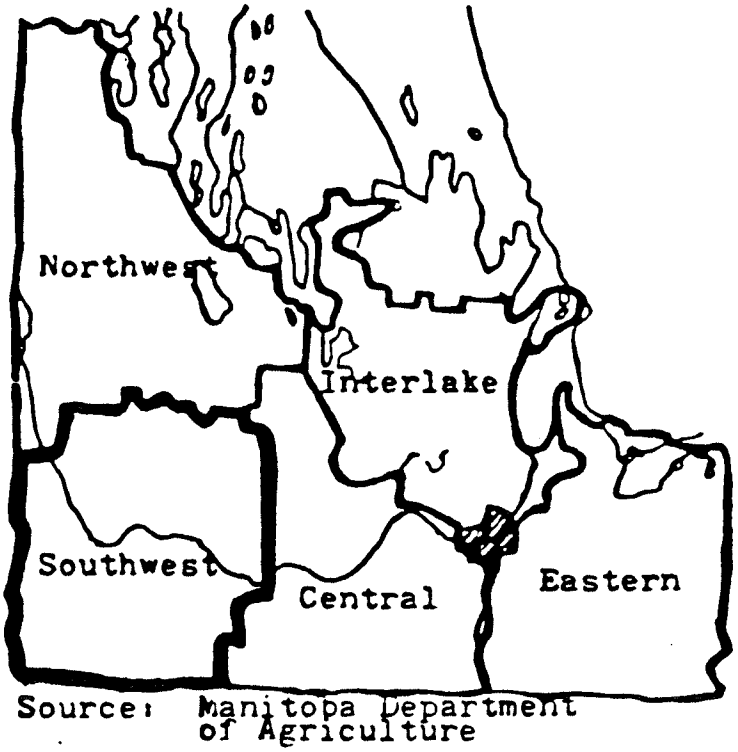

Figure 1: Agricultural Regions of Southern Manitoba

1.5 DEFINITION OF TERMS

In order to clarify the meanings of three terms which are integral to this study, the definitions of winter wheat, in a Manitoba context, zero tillage and farmer are found below.

1. Winter Wheat: In Manitoba, winter wheat is defined as a fall seeded wheat crop which grows for approximately six weeks prior to winter months, then remains

dormant over the winter and resumes growth in the early spring and is harvested in late summer/early fall (Rourke and Stobbe, n.d.).

2. Zero Tillage: Zero tillage is a crop production system involving planting a crop with minimum soil disturbance, directly into a seedbed left untilled since harvest of the previous crop (Ducks Unlimited,n.d.).
3. Farmer: In this study a farmer refers to an agricultural producer who considers his primary occupation to be farming.

1.6 ASSUMPTIONS

Assumptions pertain particularly to the farmer interviews and include:

1. The farmers being interviewed are expressing their own opinions and attitudes.
2. Farmer interviews were conducted based on the names received from Provincial agricultural representatives. The names are assumed to be non-biased in terms of their selection.

1.7 RESEARCH JUSTIFICATION

This research project is required in order to assess individual farmer attitudes towards winter wheat production in southwestern Manitoba. Such an assessment is essential in determining winter wheat's future significance and role as a soil and water conservation technique in Manitoba's agricultural sector.

1.8 SUMMARY

The previous sections have briefly discussed winter wheat in Manitoba, to the extent that it is not a traditionally grown crop, in terms of soil and water conservation, and other advantages associated with its production. The research problem statement has been presented along with the research objectives, basic methods and assumptions. The remaining chapters consist of a literature review to examine what winter wheat research has been done particularly in Manitoba, a methods chapter outlining in more detail the methodology used in this research project, a chapter analyzing the interview results and a concluding chapter containing conclusions and recommendations based on the interview results.

Chapter II

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

The growing concern of preserving Canada's agricultural land base has prompted immediate action on behalf of governments and producer organizations to maintain and enhance soil quality. Methods in achieving such goals include reduced tillage, elimination of summerfallow and the incorporation of forages into crop rotations. However the early 1980's has been a time where surmounting financial pressures have acted to restrict farmers from purchasing zero tillage equipment and from growing less marketable crops such as forages. In Manitoba there are aspects associated with the production of winter wheat under zero tillage such as the reduced production costs and reduced soil erosion under zero or reduced tillage and increased yields, that make successful production appear more favorable to producers.

In order to put Manitoba winter wheat production into perspective, related literature must be reviewed and assessed with the intent of determining what information is available and where research currently stands. This chapter will discuss winter wheat production from a historical per-

spective in western Canada, followed by more specific information in relation to Manitoba's production in terms of cultivars and marketing. Advantages and disadvantages will be determined based on the literature in order to assess the feasibility of winter wheat production in Manitoba. It is essential that conclusions based on the literature be drawn so that they may be compared with farmer attitudes from the interview results.

2.2 HISTORICAL BACKGROUND

The production of winter wheat in Canada dates as far back as 1914 - 1918, where in Ontario during these years a total of nearly 500,000 tonnes was produced. In Western Canada, Alberta has also had a long history of winter wheat production dating back over 65 years (Grant et.al., 1976). The traditional winter wheat producing area on the Canadian Prairie encompasses southwestern Alberta and a small area below the Cypress Hills in southwestern Saskatchewan, areas that receive the greatest temperature moderating effects from chinook winds (Stobbe and Evans, 1979). Smaller acreages were produced throughout the rest of the prairies. However the frequency of winter kill prevented the establishment of winter wheat as a viable crop option outside of the traditional producing areas.

Until a few years ago winter wheat production was almost entirely on summerfallow or tilled stubble fields. Di-

rect seeding into standing stubble has proven to be a successful method of reducing the risk of winter kill, and the widespread adoption of this practice has dramatically increased production in Saskatchewan (Fowler, 1983). With the acceptance of this management technique, winter wheat can be overwintered throughout the prairie provinces.

2.3 PRODUCTION IN MANITOBA

Studies conducted under the supervision of Dr. E.H. Stobbe at the University of Manitoba's Plant Science Department during the late 1970's show that winter wheat cannot be grown in Manitoba without undue risk when conventional tillage practices are used. Plant scientists believe that varieties of winter wheat with greater winter hardiness than Norstar are not likely to be developed due to lack of new sources of genetic variability. Thus, changes in agronomic practices from conventional tillage to zero tillage crop production are essential to ensure successful and consistent winter wheat production in areas such as Manitoba where harsh winter temperatures exist (Stobbe and Rourke, 1981). Research conducted by Dr. Stobbe from 1978 to 1980 clearly shows the advantages of zero tillage winter wheat production. In 1978, winter wheat yielded 22% more under zero tillage than under conventionally tilled soil. That is, yields under conventional tillage were 1,981 kilograms per hectare (29.5 bushels per acre), while under zero tillage

treatment yields were 2,419 kilograms per hectare (36.0 bushels per acre). Study results in 1980 continued to emphasize the significance of zero tillage in winter wheat production. Yields in 1980 demonstrated a 37% advantage for zero tillage with an average yield for conventionally tilled plots of 1,287 kilograms per hectare (19.1 bushels per acre), whereas zero tilled plots averaged 1,766 kilograms per hectare (26.3 bushels per acre). Essentially zero tillage winter wheat production is imperative in Manitoba to ensure successful production. Other recommendations to ensure successful winter wheat production in Manitoba have also been determined by the University of Manitoba's Plant Science Department (Stobbe and Rourke, 1981). This list includes the following:

1. Seed Variety: Norstar is the recommended variety for Manitoba due to its better yield performance than other varieties tested by the University of Manitoba, even though problems with Norstar still exist. The current available winter wheat varieties were developed at Lethbridge, Alberta, and do not have satisfactory disease resistance to be grown on a wide scale in Manitoba and Saskatchewan (Stobbe and Evans, 1979). At present plant scientists at the University of Manitoba are working on the development of cultivars more resistant to stem and leaf rust (Stobbe and Evans, 1979). In addition, current varieties were

developed for dry regions. Thus in sub-humid areas of Manitoba and Saskatchewan, these varieties tend to grow tall and have a problem with lodging (Stobbe and Evans, 1979). The University of Manitoba's Plant Science Department tested the performance of cultivars of winter wheat grown under two micro-climates at Minto, Manitoba in 1982. Figure 2 illustrates the test results. The higher yields were from the most cold hardy varieties such as Norstar (Stobbe and Rourke, n.d.). When comparing Norstar to Sundance and Winalta, Norstar is higher yielding, has superior winter hardiness, is more shatter resistant than Sundance and is more resistant than Sundance to lodging (Saskatchewan Pool Farm Service, 1983).

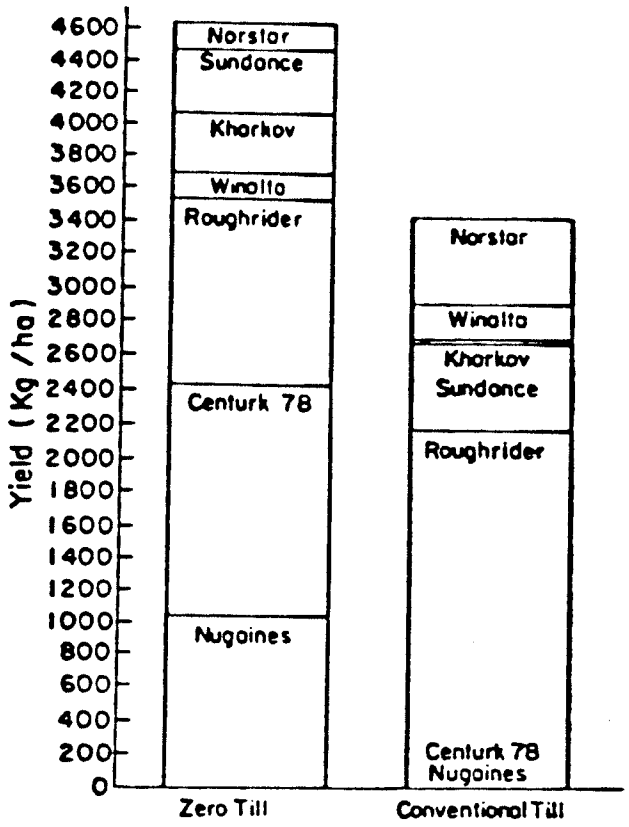

Figure 2: 1981-82 Winter Wheat Variety by Tillage Trial

2. Previous Crop: Early maturing varieties of oilseeds such as flax and canola are prefered to cereals. It is important that the preceding crop be harvested early enough to allow winter wheat seeding to be on schedule (early September) and that the previous crop leaves an upright stubble of between 8-12 inches in height (20-30cm.) to ensure that 6 inches (15cm.) of snow cover can be maintained over the plants. The straw and chaff from the preceding crop should be

finely chopped and distributed uniformly over the field directly from the combine. Spreading the residue at this time avoids the need for harrowing and reduces the amount of stubble trampled.

3. Seeding Equipment: Specialized seeding equipment capable of seeding directly into stubble should be used. Seed drills must be able to penetrate into undisturbed soil and place the seed into moist soil to ensure rapid germination. Dry land conditions usually exist in the fall and thus limit the usefulness of some types of drills. Hoe drills or narrow point air seeders have the ability to penetrate hard dry soil and fresh straw in a more positive manner than disc type drills.

4. Seeding Date, Rate and Depth: Winter wheat should be seeded in Manitoba between approximately August 26 to about September 15. Delayed seeding may result in significant declines in crop yields. Winter wheat should be seeded at a rate of 70-100 kilograms per hectare (60-90 lbs./acre). Late plantings should be seeded at higher rates due to the smaller tiller production. The seeding depth of winter wheat should be as shallow as possible, normally between 2.5 and 4 centimeters (1 to 1.5 inches). Shallow seeding results in plants which develop faster and are more resistant to freeze-out. Deep seeding late in the season often results in poor crop stands.

5. Fertility Management: In order to maximize winter survival and yield of winter wheat, adequate levels of nitrogen and phosphorus are necessary. Fields may also be deficient in potassium and sulphur, depending on their location in Manitoba. Therefore, soil testing should be undertaken to determine the nutrient status of a particular field. It is generally recommended that phosphate fertilizer be applied with the seed in the fall. Nitrogen can also be applied at seeding, so long as the amount does not exceed the amount of phosphate applied. Additional nitrogen should be applied in the spring when growth resumes.

6. Weed Control: Fields selected for winter wheat production should have no problems with perennial weeds such as quack grass, Canadian thistle and dandelion, because these weeds will flourish in the absence of tillage. Winter annual weeds such as stinkweed and flixweed are controlled in the fall with low level application of 2,4-D. Volunteer crop plants are normally not present in densities which would warrant a herbicide treatment, however heavy infestations can be controlled with the zero-till rate of Roundup. Winter wheat resumes growth in early spring and as a result competes very well with spring germinating annual weeds such as wild oats and green foxtail. Therefore herbicide application is not necessary to control these spring annual weeds. Occasionally spot

treatments may be required to control spring annuals, where partial winter kill or flood damage has occured.

7. Harvesting: Harvesting techniques for winter wheat are the same as for spring wheat. However, harvest begins some two to three weeks earlier than spring crops, making better use of warm dry August weather.

In addition to the above recommendations, winter wheat does not tolerate spring flooding and because zero tillage can worsen any existing excessive moisture problems, it should only be grown on land not prone to flooding unless the land has exceptionally good drainage.

Winter wheat production statistics for Manitoba as provided by the Canadian Wheat Board are listed below in Table 1.

Trends in production are clearly shown as increasing over time as agronomic practices change from conventional to minimum or zero tillage and as producers increase their knowledge of the management techniques involved with winter wheat production in Manitoba. However, the area of winter wheat harvested is still relatively small in Manitoba. This rising trend will fall during the 1986-87 crop year due to wet unfavorable fall weather in 1985, resulting in a reduc-

TABLE 1

Winter Wheat Production in Manitoba

Crop Year	Production (tonnes)	% of Total Manitoba Wheat Production
1981-82	8,000	0.3
1982-83	9,000	0.3
1983-84	16,000	0.5
1984-85	28,000	0.8
1985-86	138,000	2.8

Source: The Canadian Wheat Board.

tion in seeded area due to poor access to fields and reductions in yield due to late seeding.

Table 2 shows a comparison of average yields of winter wheat and Hard Red Spring wheat grown in Manitoba for the crop years 1982-83 through 1984-85.

In analyzing the data presented in Table 2 it becomes apparent that the three year average yield of winter wheat did not exceed the average yield of hard red spring wheat in Manitoba. However the data from the southwest region of the province is significant because in 1984-85 it has been estimated by the Manitoba Department of Agriculture that approximately 30,000 acres (12,140.7 hectares) of the 34,500 har-

TABLE 2

Yields of Winter Wheat and Spring Wheat in Manitoba

Crop Year	Winter Wheat Ave. Yield (bu./ac.)	Hard Red Spring Wheat Manitoba Ave Yield (bu./ac.)	Hard Red Spring Wheat S.W. Region (bu./ac.)
1982-83	31.5	34.0	33.4
1983-84	26.5	27.3	27.3
1984-85	29.8	30.5	*24.6
3 Year Ave.	29.3	30.6	28.4

*estimate, Manitoba Department of Agriculture.
Source: Manitoba Department of Agriculture.

vested acres (13,961.8 hectares) of winter wheat in Manitoba were located in this region. In comparing the 1984-85 average yields of winter wheat in the southwest region and of hard red spring wheat, winter wheat shows a yield advantage of 5.2 bushels per acre (0.35 tonnes per hectare). This comparison reflects the ability of winter wheat to resume growth early in the spring and utilize spring moisture more effectively than spring seeded wheat.

2.4 MARKETING

Canadian western red winter wheat (CWRWW) is a harder wheat variety characterized as having higher protein levels than soft wheat varieties. Hard wheat varieties produce the "strongest" and most desirable bread wheat-flours (Faculty of Agriculture, University of Manitoba, 1977). Although

CWRWW has a slightly lower protein content than hard red spring wheat, of approximately 1% to 2%, it is still considered to have excellent milling characteristics. Winter wheat in Canada is marketed through the Canadian Wheat Board. The top three CWB grades based on protein levels, of CWRWW are No.1, 2 and 3 respectively.

Winter wheat is a major crop produced throughout the world accounting for approximately 75% of the wheat grown in the world each year (Fowler, 1983). This production has resulted in large world-wide market opportunities for winter wheat exports. In more recent years as the production of winter wheat in Canada has expanded beyond the bounds of southern Alberta, the Canadian Wheat Board has made a concerted effort to develop an export market for this commodity (Fowler, 1983). Table 3 lists delivery quotas by crop year for both Canadian Western Red Winter Wheat and Canadian Western Red Spring Wheat in Manitoba.

Table 3 clearly shows that delivery opportunities for winter wheat are increasing when compared with spring wheat. As of March 11, 1986, winter wheat quotas were greater than for spring wheat. In general quotas during the last few

TABLE 3

CWB Delivery Quotas for CWRWW and CWRSW in Manitoba

Crop Year	CWRWW Quotas (bu./ac.)	CWRSW Quotas (bu./ac.)
1981-82	13.1	52.2
1982-83	31.0	44.6
1983-84	20.0	OPEN
1984-85	OPEN	OPEN
1985-86*	3.6	2.9

* at March 11, 1986, regular quotas only.
Source: Canadian Wheat Board.

years have been more than sufficient to allow producers the opportunity to deliver all of their winter wheat crops before the end of the crop year. As winter wheat production increases in Canada delivery quotas can be expected to decrease somewhat. However, because of its world-wide production, any opportunities for spring wheat exports also represent opportunities for CWRWW.

Returns per tonne or bushel for winter wheat are comparable to spring wheat and are expected to remain so in the future. Table 4 lists total payments for CWRWW No.1 and CWRSW No.1 for the crop years 1981-82 to 1984-85. Initial prices for 1985-86 are also listed.

TABLE 4

Total Payments for CWRWW No.1 and CWRSW No.1 by Crop Year

Crop Year	Price CWRWW No.1 (final) ($ per tonne)	Price CWRSW No.1 (final) ($ per tonne)
1981-82	194.00	200.00
1982-83	180.00	192.00
1983-84	179.00	194.00
1984-85	172.00	186.00
1985-86*	145.00	160.00

* initial prices for the crop year 1985-86.
Source: Canadian Wheat Board.

In general, in terms of marketing, sufficient quotas and good prices for winter wheat make it an excellent crop choice where climatic conditions or cultivation practices allow for it's successful production.

2.5 ADVANTAGES AND DISADVANTAGES OF WINTER WHEAT PRODUCTION

Successful winter wheat production through the use of zero tillage cropping practices holds many advantages for producers over spring wheat using conventional tillage practices. Listed below are the advantages to Manitoba farmers with successful winter wheat production using zero tillage, followed by the disadvantages.

2.5.1 Advantages

1. Increased growing season. Winter wheat grows for approximately 40 days in the fall and 105 days beginning in the following spring for a total growing season of 145 days, compared to 100 days for spring wheat. The longer growing season can result in more extensive root development, vegetative development and reproduction capacity (Rourke and Stobbe, n.d.).
2. Redistribution of farm labour and equipment. Winter wheat allows for seeding in the fall and harvesting before any spring seeded crops are mature (Stobbe and Evans, 1979).
3. Increased competition with weeds particularly wild oats. Winter wheat initiates growth early in the spring before weeds emerge and thus competes sufficiently to keep weeds in check, reducing the herbicide costs. Under zero tillage less weeds germinate compared to tilled fields because most annual weeds require tillage before they will germinate (Stobbe and Evans, 1979).
4. Early maturity avoiding problems with late summer drought or early fall frosts. Also early maturity permits harvesting during the dry summer period before the late summer rains begin. Early harvest may result in better quality grain, since there would be less chance for weathering and sprouting of grain in the swath (Stobbe and Evans, 1979).

5. Early harvest implies less crop depredation by migratory birds, because harvesting occurs before bird migration begins (Stobbe and Evans, 1979).
6. Higher yield potential than spring wheat. Preliminary studies in Manitoba have shown a 30% yield increase when growing winter wheat as compared with spring wheat (Stobbe and Evans, 1979).
7. Zero tillage reduces soil erosion by wind and water. Tillage buries straw and stubble, and breaks downs soil aggregates. Exposed soil is subject to erosion (Stobbe and Evans, 1979).
8. Zero tillage improves crop germination. Tillage allows moisture loss to the depth of the tillage zone. Seed sown into tilled soil is subjected to soil with a lower water potential than seed sown directly into stubble (Stobbe and Evans, 1979).
9. Zero tillage improves winter survival. Standing stubble results in a more uniform snow cover, thus under zero tillage winter temperatures in the surface soil are more moderate than on tilled or summerfallow land (Stobbe and Evans, 1979).
10. Zero tillage reduces machinery, fuel and labour requirements since less operations on the field are required (Stobbe and Evans, 1979).
11. Earlier harvest, given quotas, allows earlier marketing and initial cash payments (Harvey, 1983).

12. If an exceptional winter results in complete kill, there is still time for seeding a spring crop in an effort to minimize losses (Harvey, 1983).

2.5.2 Disadvantages

1. The recommended cultivar Norstar is susceptible to stem and leaf rust, which could eliminate any yield potential (Stobbe and Evans, 1979).
2. Current winter wheat varieties were developed for dry regions. In the sub-humid area of Manitoba, these varieties tend to grow tall and have a problem with lodging (Stobbe and Evans, 1979).
3. Perennial weeds such as quack grass, Canada thistle and dandelion will flourish in the absence of tillage (Manitoba Agriculture, n.d.).
4. Winter wheat is as susceptible to late spring frosts as spring wheat (Fowler, 1983).
5. Cost of zero or minimum tillage seeding equipment.

It is clear that even though there are advantages associated with winter wheat production under zero tillage, if rust eliminates any yield gains and if the costs of fungicides cancel out any herbicide savings, all economic advantages to the farmer in terms of increased yield and reduced herbicide costs are lost. Therefore, when plant breeders overcome the disadvantages inherent in the present cultivars, winter wheat production under zero tillage will appear

more attractive to farmers. Therefore, successful winter wheat production is essential in order for farmers to reap any potential economic gains. For farmers not presently engaged in zero or minimum tillage farming, the costs of zero tillage seeding equipment could offset any immediate economic benefits with winter wheat in terms of herbicide savings. In addition, to a zero tillage farmer who's winter wheat crop is infested with rust, the economic benefits of reduced herbicide costs are eliminated through increased fungicide costs and thus, to such a farmer other higher priced crops would be more economic to grow. However in the drier southwestern region on Manitoba, in areas where soil and water erosion are major problems, and where rust is less of a problem, winter wheat may be seen as more economic in terms of alternate cover crops such as fall rye, currently used to prevent erosion. From a societal viewpoint, the biological requirements of winter wheat production mesh closely with the physical benefits and opportunities of soil conservation in crop production objectives (Harvey, 1983).

2.6 SUMMARY

Winter wheat production does not have a very lengthy history in Manitoba largely due to climatic conditions experienced during winter months. However, changes in recent years to reduced tillage crop production have made it possible to successfully grow winter wheat in Manitoba. There

are a number of specific recommendations associated with growing winter wheat in Manitoba which include choosing the Norstar variety, seeding into a strong upright stubble of between 8-12 inches high, proper seeding equipment, seeding depth, seeding date and seeding rate, along with adequate and appropriate fertilizer and herbicide applications. In general, production in Manitoba has increased significantly during the 1980's and quotas and prices have been showing more favorable trends in recent years.

There are both disadvantages and advantages associated with growing winter wheat under zero tillage in Manitoba. If the crop is successful there are many advantages to the farmer both from a financial point of view and a soil conservation or quality point of view. However, if rust attacks the crop any yield advantages may be eliminated and the extra chemical costs to control the rust would reduce the savings associated with less herbicides. In addition, extra costs to a farmer who does not presently engage in zero or minimum tillage practices, may be too high to consider growing winter wheat, in particular, as a soil and water conservation technique during a time where the financial pressures associated with falling grain prices are of a greater concern to many farmers than conservation.

Upon reviewing related literature it becomes clear that most research and information to date in Manitoba deals with cultivars and required production practices, and has been

rather scientific in nature. Such research omits farmer opinions and attitudes towards and experiences with winter wheat production, in terms of winter wheat as a conservation crop and the economic feasibility of winter wheat.

Chapter III

METHODS

3.1 INTRODUCTION

Information previously assessed in Chapter II lacks farmer input and attitudes towards winter wheat as a conservation technique in Manitoba. Therefore, it is essential that interviews with farmers be conducted to determine their attitudes towards winter wheat production as a conservation crop. This chapter discusses the research methodology in terms of the farmer interviews and interviews with Provincial agricultural representatives located in southwestern Manitoba.

3.2 FARMER INTERVIEWS

Winter wheat in Manitoba is largely grown in the southwest region where soil moisture deficits occur. Therefore research included interviews throughout this region with farmers both experienced and not experienced with winter wheat production. The purpose of these interviews was to gain a better understanding of farmer attitudes towards winter wheat as a soil and water conservation technique.

The choice of farmers to be interviewed was based on names recommended by telephone, by nine Provincial Agricultural Representatives located throughout the study area. Sample selection was done by contacting each of the nine Agricultural Representatives and asking for the names of five or six farmers within their working areas, of which two or three are known to have had experience growing winter wheat. The Agricultural Representatives contacted were located in the following towns within the study area: Brandon, Boissevain, Carberry, Hamiota, Melita, Minnedosa, Shoal Lake, Souris and Virden.

Thirty farmers were interviewed of which twenty had experience growing winter wheat. Initial contact was made with twenty-four farmers by telephone in order to schedule appointments. The additional six farmers were contacted during travel either by telephone from the earlier obtained list of names or in person from directions received from the Agricultural Representatives. Personal interviews with farmers were conducted as outlined in the interview schedule shown in Appendix A, page 90. Letters introducing myself and describing the purpose of my research (Appendix B, page 95) were left with each interview participant.

Farmers were questioned with regard to:

1. What each farmer's attitude is towards winter wheat as a soil and water conservation technique.

2. What each farmer feels are the major problems or barriers associated with growing winter wheat on their farm.
3. Any additional acreages they may grow if a new variety was developed which alleviated problems associated with current varieties.

In addition, winter wheat producers were questioned on their cultivation practices and problems/successes encountered in winter wheat production. Information gained from these interviews is assessed in the following chapter and used in drawing the conclusions and recommendations of this study.

3.3 INTERVIEWS WITH PROVINCIAL AGRICULTURAL REPRESENTATIVES

Interviews were undertaken with Provincial Agricultural Representatives in southwestern Manitoba who have direct experience dealing with Manitoba's farm industry. Each of the nine Agricultural Representatives contacted was asked to discuss the characteristics of winter wheat producers in their immediate areas, the problems associated with winter wheat production and what effect an improved cultivar might have. Such information was then used to aid in drawing conclusions and recommendations.

3.4 DATA ANALYSIS

Selected data obtained from the farmer interviews was analyzed with the University of Manitoba's Main Frame Computer using a statistical program entitled 'SAS' developed at the SAS Institute Inc. in North Carolina, U.S.A. Histograms were generated using this program, and the General Linear Models Procedure was used for linear regression analysis.

3.5 SUMMARY

Chapter II has shown what research has been conducted on winter wheat, with particular emphasis on Manitoba. Shown is the need for farmer input in determining if winter wheat will in the future, play a more significant role in Manitoba's agricultural sector. In order to fulfill this need, a series of farmer interviews and interviews with agricultural representatives were conducted to obtain research results. The following chapter will analyze interview results in detail, in order to draw conclusions and set forth recommendations to both federal and provincial agricultural departments and to farmers or farmer organizations and other agencies who have a particular interest in winter wheat production in Manitoba.

Chapter IV

RESEARCH RESULTS AND DISCUSSION

4.1 INTRODUCTION

As outlined in Chapter III, interviews were conducted with 30 farmers and nine Provincial agricultural representatives. The interview schedule for each farmer, letters to each participant and a schedule of questions asked to each agricultural representative are located in Appendices A through C, respectively. This chapter presents the results obtained through interviews, accompanied by related observations and discussion.

4.2 FARMER INTERVIEWS

Interviews were conducted with 30 farmers located throughout southwestern Manitoba in accordance with the interview schedule shown in Appendix A, page 90. Each interview consisted of three sections entitled 'Farmer Profile', 'Soil Conservation Questions' and 'Winter Wheat Questions'. The third section dealing with winter wheat consisted of two parts. Part A questions were asked of farmers with experience in winter wheat production and Part B questions which were asked of all participants. The following three sec-

tions discuss the results and observations obtained from the interviews.

4.2.1 Farmer Profile

Each of the thirty participants was asked a short series of questions describing basic characteristics of themselves and their farming operations. The results of these questions are summarized in Table 5.

TABLE 5

Farmer Profile Results

Characteristic		Number of Farmers
A. Cultivated Acres:		
under 500		0
501 - 1500		16
1501 - 2000		2
2001 - 3000		8
above 3000		4
	Total	30
B. Farming Experience (years):		
0 - 9		2
10 - 29		18
30 - 40		5
above 40		5
	Total	30
C. Level of Education:		
under grade 9		4
grade 10 - 11		6
grade 12		12
post-secondary:		
University Diploma		4
University Degree		3
other (ie. college)		1
	Total	30
D. Age:		
20 - 30		2
31 - 40		11
41 - 50		9
51 - 60		6
over 60		2
	Total	30
E. Own all land farmed:		
yes		7
no		23
	Total	30

The average number of cultivated acreage per farm was approximately 1,991.4 acres (805.9 hectares). However, from Table 5 one can see that more than half of those interviewed farmed between 500 and 1,500 acres. Figure 3 illustrates the distribution of cultivated acreage per farm.

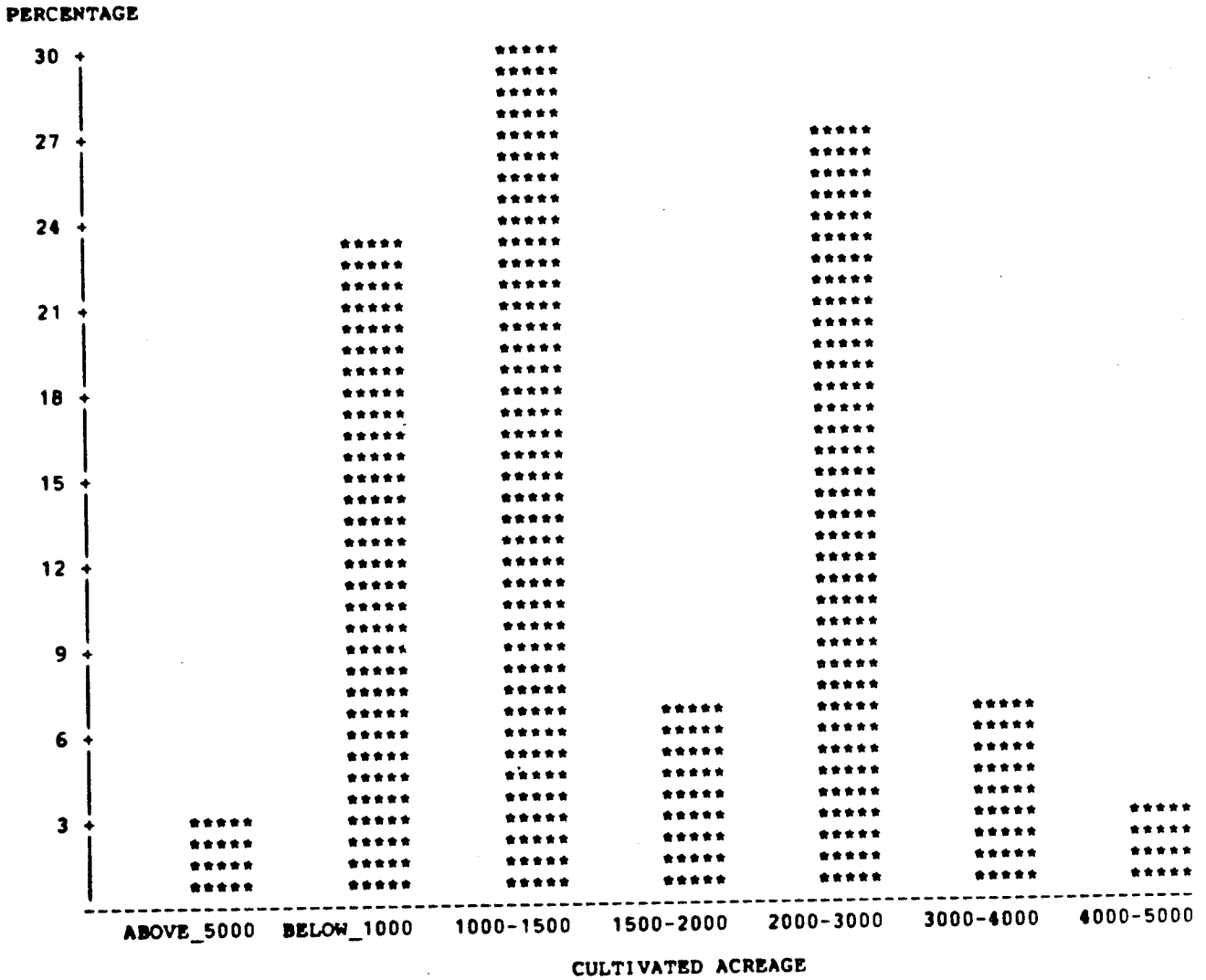

Figure 3: Distribution of Cultivated Acreage Per Farm

Of the thirty farmers interviewed, 18 or 60% had between 10 to 29 years of farming experience and 33% or 10 farmers, had 30 or more years of experience. The average length of experience was 24.3 years. Of the thirty farmers, twenty or 67%, had a grade 12 or higher level of education. Among interview participants, 11 were between 31 and 40 years of age and 9 were between 41 and 50 years. Together, these two age categories account for 67% of the total number of farmers interviewed. Figures 4, 5 and 6 show the distributions for farming experience, level of education and age among interview participants.

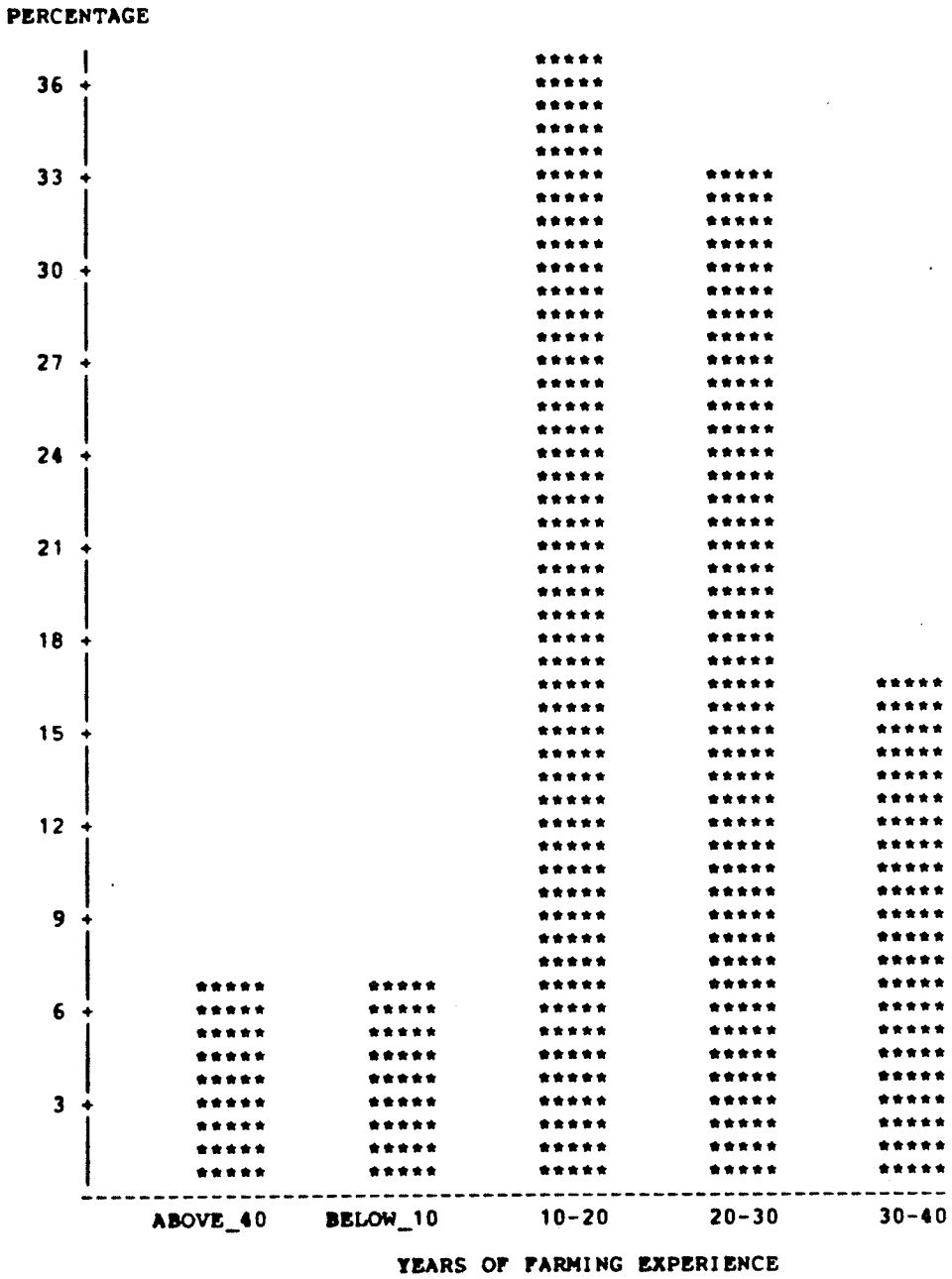

Figure 4: Distribution for Years of Farming Experience

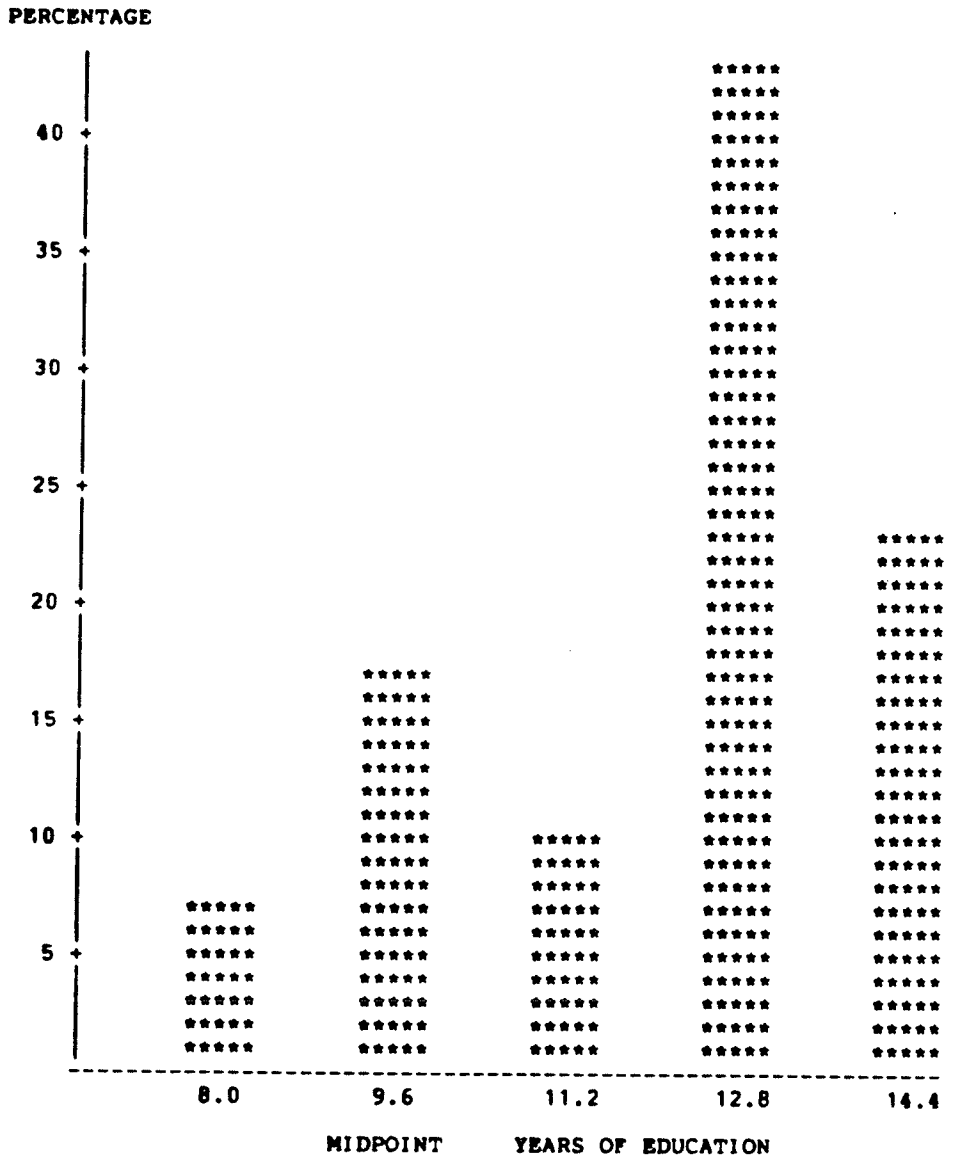

Figure 5: Distribution for Level of Education

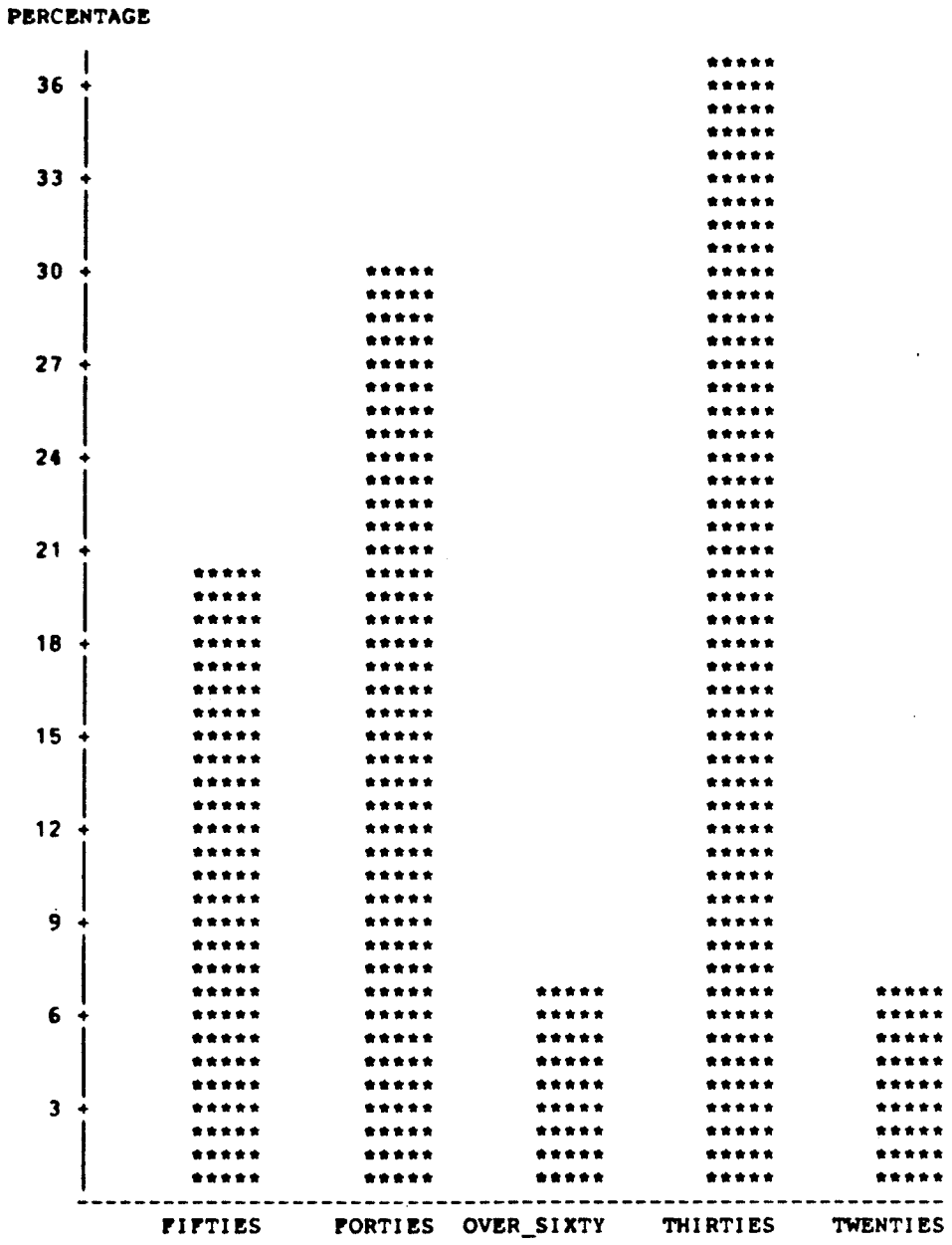

Figure 6: Distribution for Age of Interview Participants

Of the thirty farmers interviewed twenty-three or approximately 77% did not own all of the land in which they farmed. Of these 23 farmers, 17 or 74% have experience growing winter wheat. Thus, 77% of the participants interviewed rented a portion of their farming operation's cultivated acreage, as illustrated in Figure 7.

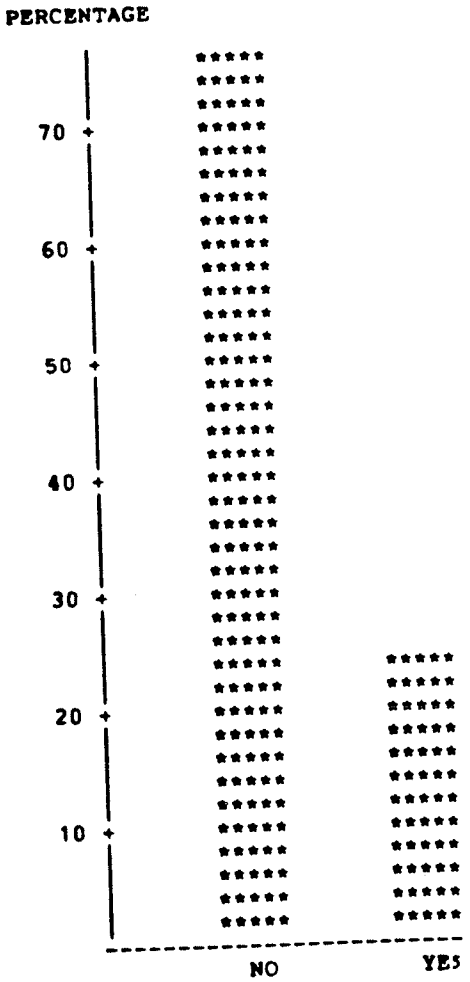

Figure 7: % of Participants Who Own All the Land They Farm

4.2.2 Soil Conservation Questions

Each interview participant was asked three questions relating to soil conservation as shown in Appendix A, page 90.

The first question asked each farmer if they had ever considered growing winter wheat as a soil and water conservation technique. Twenty or 67% of the thirty farmers interviewed said yes, they have considered growing winter wheat for this purpose. Sixteen of these twenty have experience producing winter wheat and four have never grown winter wheat. The four farmers who have not grown winter wheat cited a number of problems associated with winter wheat production that prevented them from incorporating it into their crop rotations. Two of these farmers said grain prices were not high enough to justify the cost of a special seeding drill, another said that problems with increased quack grass and heavy rainfall during the 1985 seeding period prevented him from actually growing winter wheat and the remaining farmer said that the risk of a new crop that he feels is being over promoted as corn was in the past, is too great for him to actually produce winter wheat. Of the 10 who have not considered growing winter wheat as a conservation technique, four have actual experience growing winter wheat. This suggests that four of those interviewed grew winter wheat for other reasons:

1. Higher yields or for economic reasons;
2. Wanted to try something new;
3. curiosity and to spread out work load; and
4. One farmer saw no connection between winter wheat and soil conservation.

The second question asked each farmer to specify any major soil problems that were present on their farm. Ten farmers expressed no major soil problems at present due to continuous cropping, reduced summerfallow and reduced or zero tillage practices. The remaining farmers' answers to this question are summarized in Table 6.

TABLE 6

Major Soil Problems Among Interview Participants

Major Problem	Number of Farmers
Wind Erosion	14
Water Erosion	6
Salinity	5
Organic Matter Content	4
Flooding Lands	1

note: Some farmers expressed more than one problem. The total number of farmers responding to this question was 20.

Each farmer was then asked if they have made any changes in their farming practices in the last ten years because of soil problems. Of the thirty farmers twenty-seven said yes they had made changes. Table 7 shows a summary of the changes that have been made and the number of farmers that said they had made these specific changes.

TABLE 7

Changes in Farming Practices Due to Soil Problems

Type of Change	Number of Famers
Reduced or zero tillage:	16
Continuous Cropping:	13
Reduced Summerfallow:	8
Crop Residue Management:	8
Forage Production:	3
Shelter belts:	2
Winter Wheat Production:	2
Increased Chemical Weed Control:	1

note: Farmers may have made more than one change. The total number of farmers responding to this question was 27.

One farmer said he has made no changes in his farming practices due to soil problems and that he still tills his

land where he feels it is necessary. One of the concerned farmers who has made changes in order to conserve soil, said that he and many other farmers are in a dilemma, in that he would like to be more soil conservation oriented, however at present cannot afford to be, realizing the future costs of conserving may be even greater.

4.2.3 Winter Wheat Questions

Of the thirty farmers interviewed, twenty have experience with winter wheat production. These twenty farmers were asked to answer all of the questions in Parts A and B of this section of the interview schedule. The ten farmers with no winter wheat experience were asked only to answer Part B questions.

4.2.3.1 Part A

Each of the twenty farmers with experience growing winter wheat was asked the number of years in which they have grown winter wheat. The following table and figure summarize the years of experience growing winter wheat.

TABLE 8

Experience Growing Winter Wheat

Years of Experience	Number of Farmers
1	6
2	6
3	3
4	2
5	1
6	1
7	1
Total	20

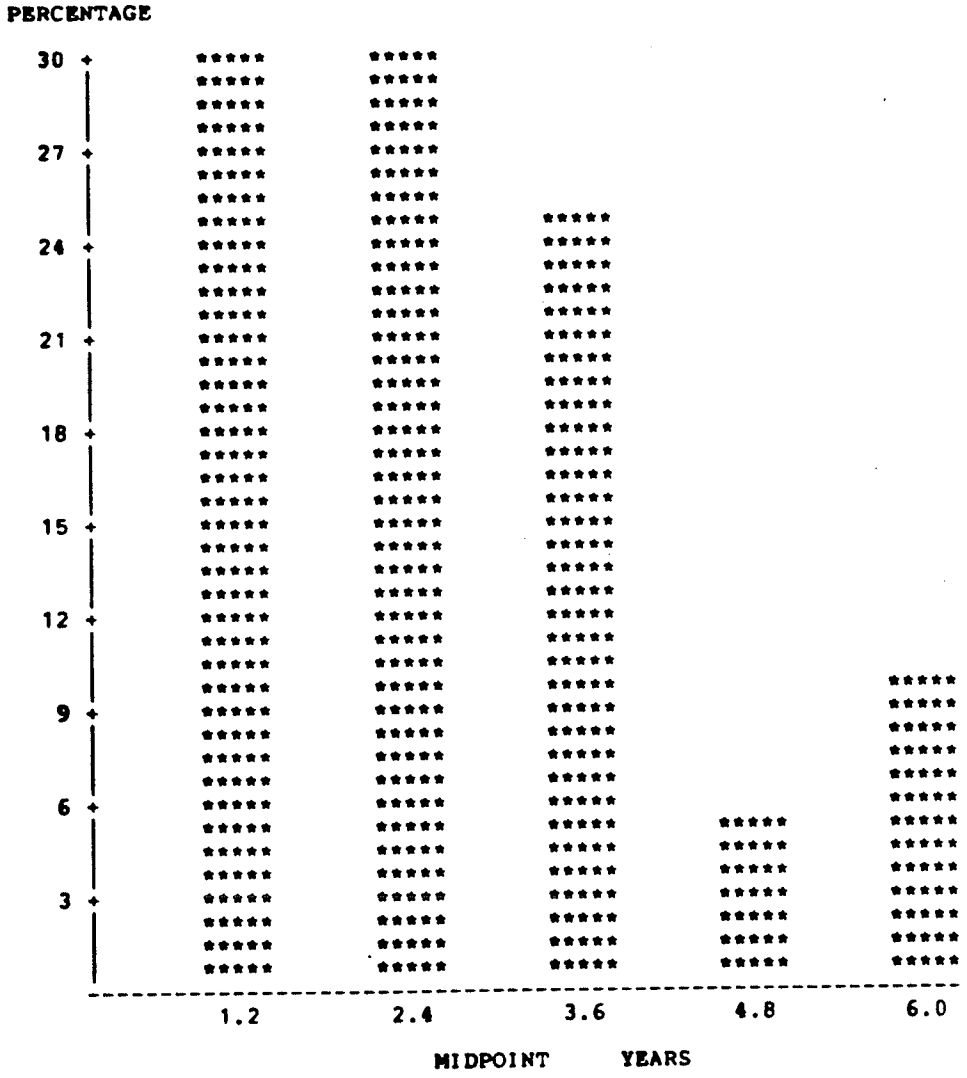

Figure 8: Distribution for Experience Growing Winter Wheat

The mean in years of experience growing winter wheat is 2.65 years. However, 12 of the 20 winter wheat farmers interviewed had only 1 or 2 years of experience, reflecting the fact that winter wheat is a relatively new crop in Manitoba.

The average acreage sown to winter wheat per farm is summarized in Table 9 in relation to years of experience growing winter wheat.

TABLE 9

Average Acreage Sown to Winter Wheat

Years of Experience	Average Acreage per Farm for the Most Recent Production Year
1	111.0
2	271.7
3	240.0
greater than 3	396.0

Table 9 shows that among those farmers interviewed, as experience is gained in the production of winter wheat, the trend is for farmers to increase their seeded acreage. This could be attributed to a number of reasons. First, the initial years of producing a new type of crop in this case win-

ter wheat, are often viewed as experimental by farmers and thus they are not willing to risk sowing large acreages. However once knowledge of growing winter wheat for each particular farm is gained, risk to the individual farmer is reduced and seeded acreage increases. Second, because the farmers interviewed were located in the drier southwestern region of Manitoba where rust is not as much of a problem, the economic advantages associated with winter wheat production are more apparent, particularly by those zero or minimum tillage farmers interviewed.

Of the twenty winter wheat producers interviewed, eighteen sowed the seed directly on the stubble of the previous crop. The remaining two farmers who sowed only small portions of their winter wheat acreage on summerfallow (with the larger, remaining acreage on stubble), recognized the extra risk involved with this practice in terms of winter kill.

Seeding implements used among those interviewed include: hoe drills, disc type drills and air seeders. Hoe drills and air seeders are most effective in areas of hard dry soils and disc type drills work well on lighter soils. Of the twenty farmers interviewed eight used hoe drills and three have changed from a disc type drill to a hoe drill. Disc type drills were used by five of those interviewed. In addition, one farmer used an air seeder, while two others have switched to an air seeder, one from a hoe drill and the

other from a disc type drill. Due to differences in soil types one farmer interviewed uses both a hoe drill on hard soils and a disc type drill on lighter soils.

Each farmer interviewed used pedigreed seed either registered or certified, purchased at commercial seed plants or from seed growers. However, two of the twenty farmers used their own seed for one year in which they grew winter wheat.

The seed variety sown by each of the 20 winter wheat producers interviewed was Norstar, the recommended variety for Manitoba.

Each farmer with winter wheat experience was asked to approximate the seeding date of their winter wheat crop(s). A majority or 15, estimated the seeding date of their winter wheat crops to be between the first and second weeks of September. Of the remaining 5 winter wheat farmers interviewed, two estimated the seeding date to be during the last two weeks of August and three estimated the seeding date to be later than the third week in September. In addition four farmers explained that the abnormally wet fall of 1985 delayed seeding that year beyond the date in which they would have prefered to seed their winter wheat crop.

Fertilizers were applied to winter wheat crops by 18 of the 20 winter wheat farmers interviewed. Of those 18 farmers, 16 applied phosphate with the seed in the fall and nitrogen in the spring. Of the remaining two, one applied

only nitrogen in the spring and the other applied a nitrogen, phosphate and sulphur blend in the fall 1 1/2 days prior to seeding.

There were two farmers who applied no fertilizers to their winter wheat crop. One of these was an organic farmer and thus applies no chemical fertilizers. The other farmer grew lentils prior to winter wheat and therefore the soil fertility was at levels which did not warrant the additional application of fertilizers.

Sixteen of the 20 farmers interviewed had applied herbicides in the spring when necessary to control broad leaf weeds (ie. stinkweed, thistle, wild mustard, etc.).

Of the 20 winter wheat farmers interviewed, two were growing it for the first time and thus could not answer questions which involved yield estimates. Among the remaining 18 farmers, average yields of winter wheat per acre ranged from 25 bushels to 60 bushels with a mean of 42.83 bushels per acre. Twelve farmers estimated their average winter wheat yields per acre to be between 40 and 50 bushels per acre inclusive, two farmers estimated average yields per acre to be above 50 bushels and four farmers estimated their average yields per acre to be below 40 bushels. Figure 9 shows the distribution of average yield of winter wheat among the eighteen farmers interviewed.

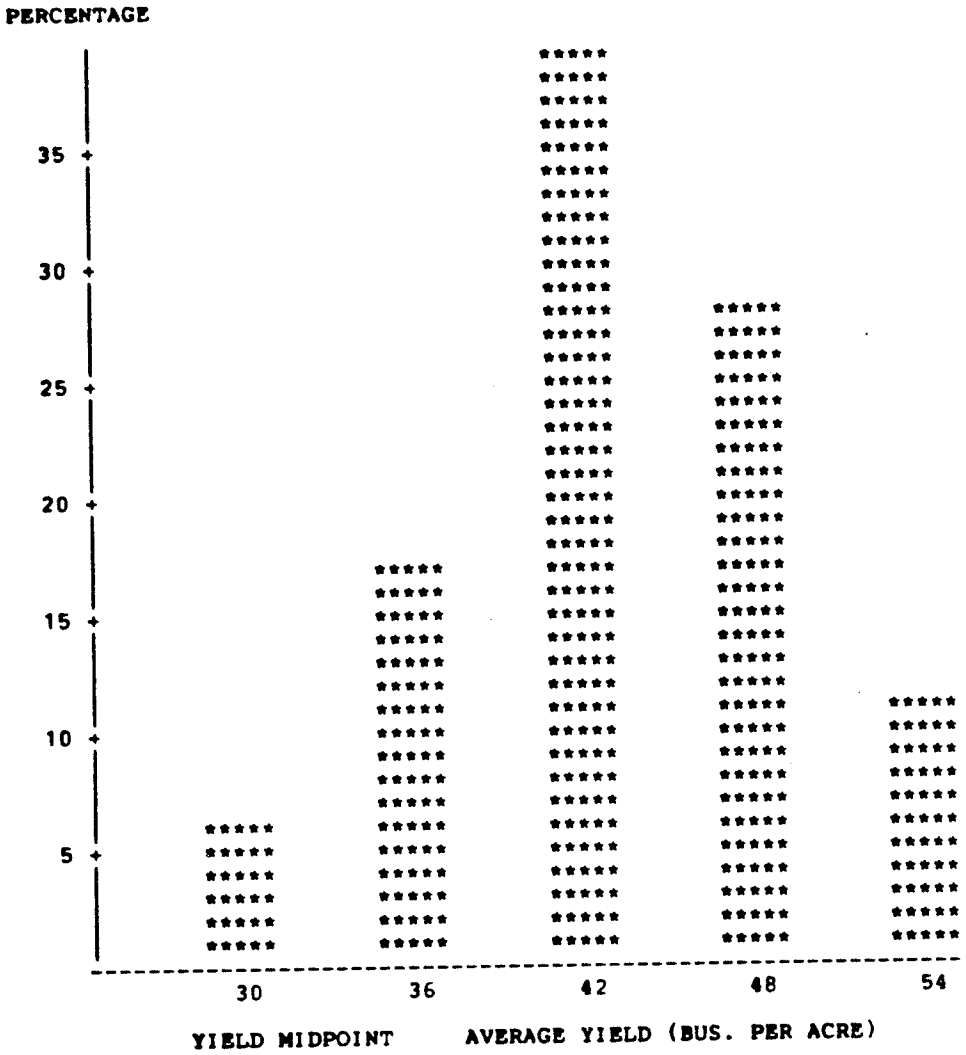

Figure 9: Distribution of Average Yield of Winter Wheat

When asked to compare winter wheat yields with hard red spring wheat, 11 farmers said their yields with winter wheat were above that of their spring wheat crops, ranging from 3 to 20 bushels per acre with an average of 8.5 bushels per

acre. Two farmers felt their spring wheat slightly out yielded their winter wheat by up to six bushels per acre and five farmers felt yields were similar. The range for difference in yield was between -6 and 20 bushels per acre, with a mean of 4.53 bushels per acre yield advantage for winter wheat over hard red spring wheat, as illustrated in Figure 10.

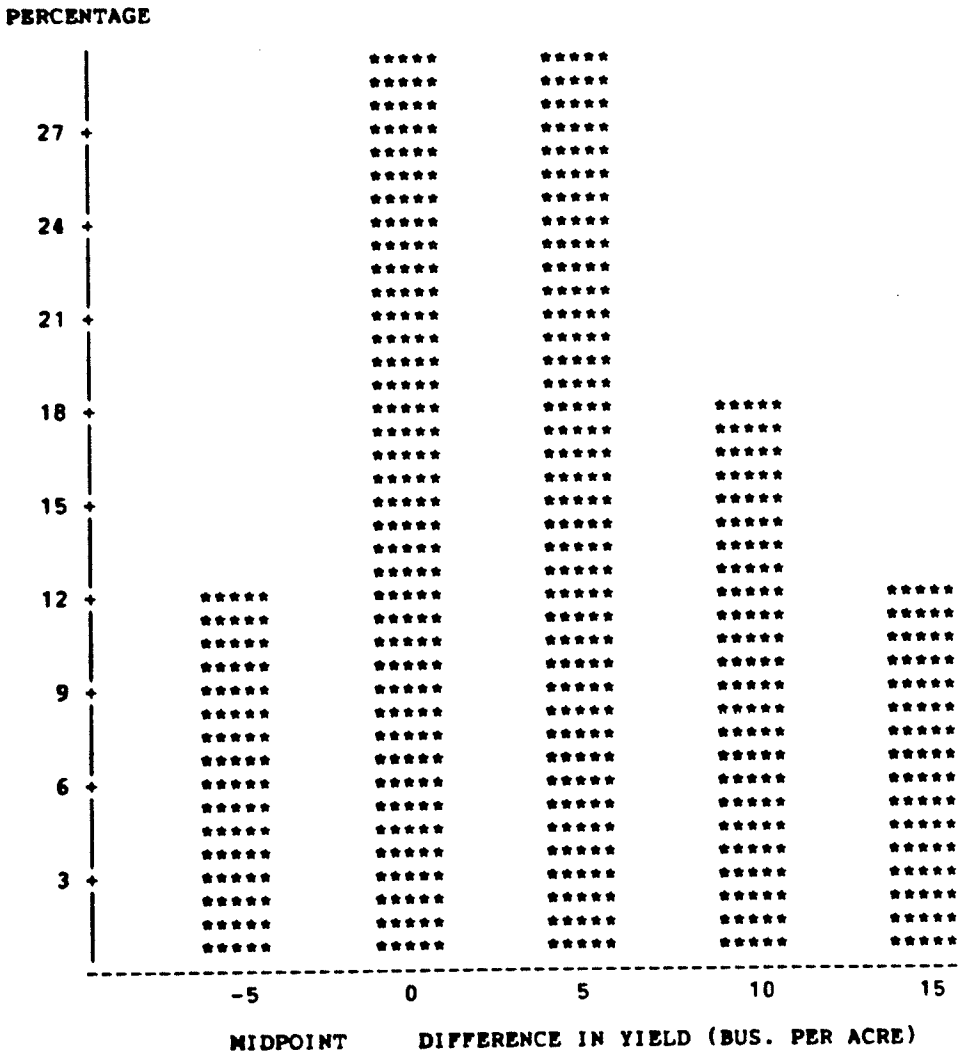

Figure 10: Difference in Yield Between Winter Wheat and Hard Red Spring Wheat

Each winter wheat farmer was asked to estimate any extra costs or savings per acre of winter wheat relative to hard red spring wheat. In terms of chemical costs, 17 of the 20 farmers realized a herbicide saving in that spraying for wild oats and wild millet was not required. Of these 17 farmers, 13 were able to quantify this saving in dollars per acre. The average saving being approximately $11 per acre. The other three of the twenty winter wheat farmers felt chemical costs for winter wheat were about the same as for hard red spring wheat and 2 of these 3 winter wheat farmers realized extra fungicide costs of $15 and $16 per acre to control rust with winter wheat as opposed to rust resistant spring wheat varieties.

In terms of equipment costs, 18 of the 20 farmers interviewed used the same equipment for both their spring and winter wheat crops and thus estimated their equipment costs for these two crops to be the same. The remaining two farmers realized extra equipment costs with winter wheat relative to spring wheat. One realized extra costs of about $3 per acre or $1000 per year to rent a hoe drill. The other farmer had to purchase a hoe drill and estimated the annual amortized depreciation costs to be $1600. Thus, if winter wheat production for a particular farmer requires additional equipment costs, such costs could eliminate any economic advantages such as reduced herbicide costs or higher yields.

Each of the 20 winter wheat farmers interviewed felt seed costs per acre to be relatively the same for both winter and spring wheat crops.

Eleven of the 20 winter wheat farmers interviewed felt that reduced tillage with winter wheat crops resulted in savings in terms of labour and fuel, relative to spring wheat. Six farmers felt the labour costs were the same for both spring and winter wheat crops and two farmers felt there were extra costs in the fall with winter wheat relative to spring wheat in terms of tuning up seeding equipment at the same time they were harvesting most of their other crops. The one remaining winter wheat farmer interviewed realized a labour saving with winter wheat because he straight combined his crop.

Additional costs associated with winter wheat production above those of spring wheat were mentioned by two farmers. One farmer realized extra costs in terms of straw removal and the other noted extra costs in dealing with volunteer winter wheat the following year. Among those winter wheat producers interviewed, net savings were quantifiable for nineteen of the twenty producers. The production savings of winter wheat over spring wheat ranged from $-11 per acre (ie. extra costs) to $36 per acre with a mean of $10 per acre. The three winter wheat producers interviewed that realized extra costs of $11, $6 and $4 per acre, illustrate the additional cost risks associated with winter wheat

production. Figure 11 illustrates the range and distribution of total dollar savings per acre with winter wheat as compared to hard red spring wheat.

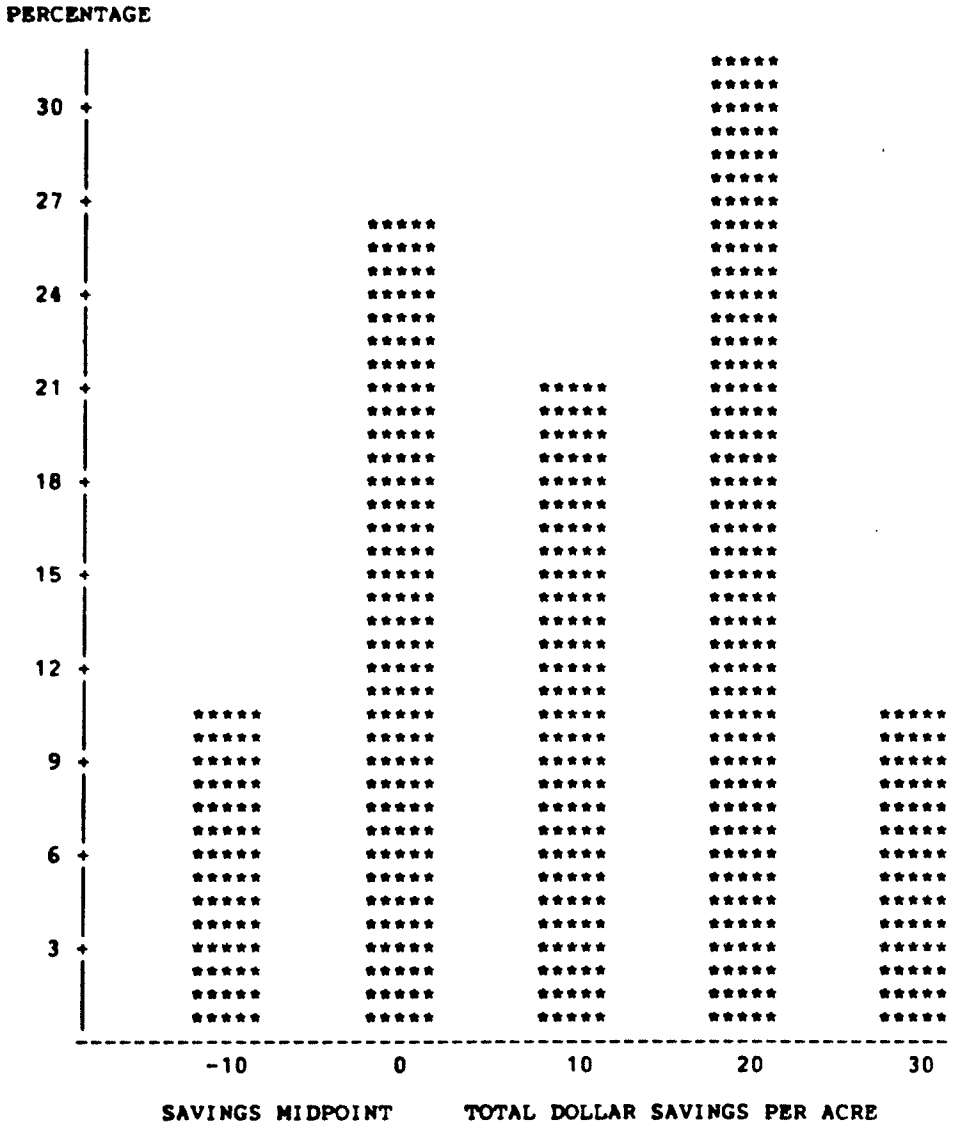

Figure 11: Total $ Savings Per Acre of Winter Wheat Over Hard Red Spring Wheat

In an attempt to determine if any significant relationships exist, the following linear regression model was run using SAS General Linear Models Procedure:

AVERAGE ACREAGE OF WINTER WHEAT GROWN PER FARMER = f(DIFFERENCE IN YIELD OF WINTER WHEAT AND HARD RED SPRING WHEAT, YEARS OF EXPERIENCE PRODUCING WINTER WHEAT, NET $ SAVINGS PER ACRE OF WINTER WHEAT OVER HARD RED SPRING WHEAT);

where the 'AVERAGE ACREAGE OF WINTER WHEAT GROWN PER FARMER' is the dependent variable explained by the independent variables:

1. DIFFERENCE IN YIELD OF WINTER WHEAT OVER HRSW
2. YEARS OF EXPERIENCE PRODUCING WINTER WHEAT
3. NET $ SAVINGS PER ACRE OF WINTER WHEAT OVER HRSW

In mathematical terms, this model is stated as follows:

$$Yi = B_0 + B_1 X_1 i + B_2 X_2 i + B_3 X_3 i + \text{error term}$$

$i = 1,2...,18$ winter wheat farmers.

Where 'Y' is the dependent variable which is explained by X_1, X_2 and X_3. Upon completion of the linear regression analysis, the following estimated equation resulted:

$$Yi = 170.64 - 6.58X_1 + 34.48X_2 + 2.67X_3$$

According to this equation, on average, there is a 6.58 acreage decline in average acreage of winter wheat grown per farmer for every one bushel per acre difference in yield of winter wheat over Hard Red Spring Wheat. This result is due to the fact that seven of the winter wheat farmers interviewed felt that either there was no difference in yield between their winter wheat and HRSW crops or that in fact their HRSW out yielded their winter wheat. In addition, the regression equation states that there is a 34.48 acreage increase in average acreage of winter wheat grown per farm for for every one year increase in experience producing winter wheat. Therefore, as years of experience producing winter wheat increased, the actual area sown to winter wheat increases. Finally this equation states that there is a 2.67 acreage increase in average acreage of winter wheat grown per farm, for every $1 net savings per acre in winter wheat production over the production of HRSW. That is, as the net $ savings of winter wheat production over HRSW increases, the average acreage of winter wheat grown increases.

It should be noted, that the nature of the data in this model led to a R-SQUARE value of 0.0484, a covariance value of 113.51 and low F-values. This implies high variation exists in the data used in this model, and that the overall fit of the regression equation to the sample data is poor, resulting in no significant conclusions. (Note Appendix D, page 97).

Recall that two of the winter wheat farmers interviewed were growing winter wheat for the first time, therefore, they could not answer questions dealing with where it was marketed. Of the remaining 18 winter wheat farmers interviewed, 16 sold their winter wheat through the Canadian Wheat Board, one sold his winter wheat as registered seed and one sold his crop to feed mills, who at the time would accept it more quickly than the Canadian Wheat Board at comparable prices. Among those farmers who marketed their winter wheat through the Canadian Wheat Board, grades ranged from No. 1 to No. 3. The lower grades of No. 2 and No. 3 were received by 7 farmers due to sprouting and by 5 farmers due to starchy kernels or bleaching. Other reasons for lower grades that were cited by two farmers included volunteer rye being present and wrinkled seed. It is important to note that lower grades imply lower prices which could offset any dollar savings or advantages associated with winter wheat production.

Each of the winter wheat farmers interviewed was then asked to estimate any yield reductions of their most recent winter wheat crop due to soil problems. All farmers interviewed felt that because soil problems such as wind and water erosion were controlled when winter wheat was grown on stubble, no yield reduction was present due to soil problems.

All of the 20 winter wheat farmers interviewed still consider growing winter wheat each year depending on the weather conditions such as excessive rainfall during the fall seeding period. The uncertainty associated with weather during the fall seeding period is significant because the crop requires approximately forty days of growth in the fall if it is to be able to reach its potential yield.

4.2.3.2 Part B

This final section of the farmer interview schedule consisting of three questions was answered by each of the thirty farmers. First each farmer was asked to rank the three most important problems inhibiting the growth of more winter wheat. Table 10 summarizes the results of this question. Note that one farmer felt their were no major problems and some of the participants did not feel their were a total of three important problems inhibiting increased production on their individual farms.

Table 10 shows that amongst those farmers interviewed, problems with winter kill and rust are most commonly refered to as being one of the major three problems inhibiting growth of more winter wheat.

TABLE 10

Problems Inhibiting Increased Winter Wheat Production

A: First Important Problem

Problem	Number of Farmers
Winter kill	9
Leaf rust	6
Perennial weeds (quack grass)	4
Overlap of seeding/harvest	3
Price	2
Lodging	1
Spring flooding	1
Not able to incorporate into present crop rotation	1
Risk (no crop insurance)	1
Seeding implement cost	1
Total	29

B: Second Important Problem

Problem	Number of Famers
Stem and/or leaf rust	4
Winter kill	4
Seeding implement cost	3
Risk (no crop insurance)	2
Perennial weeds (quack grass)	2
Overlap of seeding/harvest	2
Price	2
Spring flooding	1
Not able to incorporate into present crop rotation	1
Total	23

C: Third Important Problem

Problem	Number of Farmers
Stem and/or leaf rust	3
Risk (no crop insurance)	2
Perennial weeds (quack grass)	2
Price	2
Sprouting	2
Starch content	1
Overlap of seeding/harvest	1
Lack of knowledge	1
Total	14

The next question in Part B dealt with whether or not they would grow more winter wheat if the most important problems such as rust and winter kill were overcome by plant breeders. Twenty-one of the thirty farmers interviewed, said yes they would grow additional acres if a new winter wheat variety were developed which would help overcome some of the major problems associated with present varieties. Eight farmers said they would not increase their acreage seeded to winter wheat just because a new variety was developed and one farmer could not say. These eight farmers who would not increase their winter wheat acreage show that the amount of winter wheat grown per farm depends not only on the problems associated with the present cultivar, but the amount of winter wheat each farmer is capable of working into his crop rotation scheme. Twenty-eight of the thirty farmers interviewed were able to quantify this answer. The average increase in acreage was 130.5 acres, with a range of 0 to 400 acres. Figure 12 illustrates this distribution.

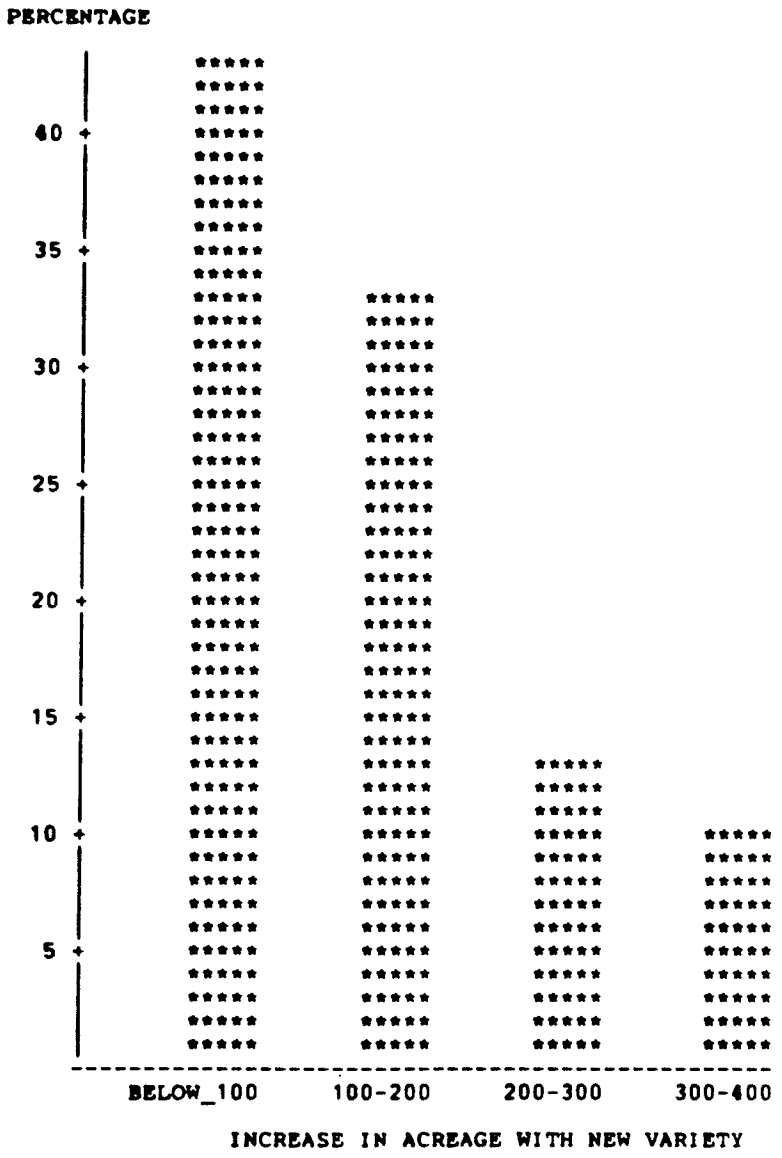

Figure 12: Increase in Winter Wheat Acreage With New Variety

The following linear regression model was run in an attempt to determine the existance of significant relationships, using SAS, General Linear Models Procedure:

WINTER WHEAT ACREAGE PER FARM WITH A NEW VARIETY = f(YEARS OF FARMING EXPERIENCE, YEARS OF EDUCATION, CROSS TABULATION OF YEARS OF FARMING EXPERIENCE AND YEARS OF EDUCATION);

where the 'WINTER WHEAT ACREAGE PER FARM WITH A NEW VARIETY' is the dependent variable explained by the independent variables:

1. YEARS OF FARMING EXPERIENCE
2. YEARS OF EDUCATION
3. CROSS TABULATION OF YEARS OF FARMING EXPERIENCE AND YEARS OF EDUCATION

In mathematical terms, this model is stated as follows:

$$Yi = B_0 + B_1 X_1 i + B_2 X_2 i + B_3 X_3 i + \text{error term}$$

$i = 1,2...,28$ farmers. (note: two of the thirty farmers where unable to quantify the winter wheat acreage they would grow with a new variety.)

Where Yi is the dependent variable explained by X_1 , X_2 and X_3 . The estimated regression model as generated by SAS, General Linear Models Procedure is:

$$Yi = 1368.98 - 26.02X_1 - 72.10X_2 + 1.51X_3$$

The beta coefficient for X_1 shows that there is a 26.02 acreage decline in winter wheat acreage per farmer with a new variety for every one year increase in years of farming experience. This suggests that the development of a new winter wheat variety will not result in increased winter wheat acreages among more experienced farmers. With regard to the variable X_2 , the beta coefficient implies that there is a 72.10 acreage decline in winter wheat acreage per farmer with a new variety for every one year increase in years of education. Therefore, the more educated farmers would be more resistant to increasing their winter wheat acreage just because a new variety was developed. However, the beta coefficient associated with X_3 shows that there is a 1.15 acreage increase per farm in winter wheat acreage with a new variety, for every one unit increase in the variable representing a cross tabulation of years of farming experience and years of education. This suggests that with a new winter wheat variety, winter wheat acreage per farm would increase slightly among farmers with a combination of increased years of farming experience and years of education.

The nature of the data for this model leads to an overall poor goodness of fit, with a high amount of variation present in the sample data, resulting in the determination of no significant relationships. This is represented by a R-SQUARE of 0.134, a covariance of 88.982 and low F-values. (Note Appendix E, page 98).

Twenty-one of the interview participants felt their answers were typical for their particular area. While six felt their answers were not typical largely because no other farmers near them grew winter wheat and three farmers interviewed could not say whether or not their answers were typical.

4.3 AGRICULTURAL REPRESENTATIVE INTERVIEWS

Nine Provincial Agricultural Representatives located throughout southwestern Manitoba in the towns of Minnedosa, Shoal Lake, Hamiota, Virden, Melita, Boissevain, Souris, Brandon and Carberry were interviewed. Three questions were addressed to each as outlined in Appendix C, page 96.

The first question dealt with the characteristics of winter wheat producers. Those farmers with experience growing winter wheat were described as the more progressive, forward looking farmers who are interested in looking at new production practices to improve their operations. They are the innovators, most often with larger acreages or bigger farms and are considered more financially stable. Their farm operations tend to be more diversified. Therefore, the additional risk associated with trying something new such as winter wheat, is not major. In general winter wheat farmers are more aggressive farmers willing to take risks.

Each or the nine Agricultural Representatives was then asked to describe the major problems restricting winter wheat production in their area. The most commonly cited problem (cited by 7 of the 9 Agricultural Representatives), was that of disease or rust. Lack of the knowledge required to grow winter wheat in Manitoba was also a major problem. Winter wheat requires a new type of management, that is, seeding directly into stubble in order to trap snow. Zero tillage is seen as a new management practice that is increasing, albeit slowly. The seeding drill required to plant directly into stubble is another problem. The costs associated with purchasing new equipment at a time when many farmers are having financial difficulties, restricts many farmers from even considering growing winter wheat. Other problems in producing winter wheat involve straw or trash management of the previous crop. Where large amounts of straw are present, if not spread properly to allow seeding into stubble and a uniform snow cover, problems with winter kill could arise. Problems also arise when farmers do not plant a previous crop which is harvested early enough to allow winter wheat seeding to be on schedule and when stubble is not left at heights to allow enough snow to be trapped.

If a new cultivar or variety of winter wheat was developed, all of the agricultural representatives interviewed felt that there would probably be a positive response in terms of increased production to some extent. However in-

creases in production due to a new variety would be most noticable amongst those farmers who already have experience growing winter wheat. The attraction of farmers with no experience growing winter wheat would more likely be a combination of market factors such as higher prices and better quotas than spring wheat and reduced risk through crop insurance coverage.

4.4 FOLLOW-UP

A summary or abstract of research results was sent to each interview participant including 30 farmers and nine Provincial agricultural representatives, upon completion of the report.

Chapter V

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

It is the purpose of this chapter to draw conclusions based on the results as presented in the previous chapter. The overall attitude of farmers towards winter wheat as a conservation technique will be summarized taking into consideration what the individual farmers feel are the major problems or limitations associated with its production. Given the information obtained from the farmers and agricultural representatives, an assessment will be drawn with regard to the future role of winter wheat as a soil and water conservation technique in Manitoba. Recommendations with regard to the future significance of winter wheat production in southwestern Manitoba will then be made to both the Federal and the Provincial governments and to organizations who have a particular interest in winter wheat production in Manitoba.

5.2 THE GENERAL ATTITUDE OF FARMERS INTERVIEWED

The general attitude amongst the majority of farmers interviewed was favorable towards winter wheat, especially in terms of the increased yield potential and effective utilization of early spring moisture. Of the farmers interviewed, those who were located in areas of lighter, sandy soils, felt winter wheat to be a good alternative to the fall rye which many farmers have grown for years as a soil and water conservation technique. Although the general attitude of those farmers interviewed towards winter wheat as a soil and water conservation technique tended to be favorable, actual economic advantages associated with winter wheat production were not present for some of those winter wheat farmers interviewed. Of the twenty winter wheat farmers interviewed five experienced either no savings or additional costs with growing winter wheat as compared to hard red spring wheat and seven of the winter wheat farmers estimated their average winter wheat yields to either equal to or less than hard red spring wheat. The problems of winter kill, rust and perennial weeds were seen by many of those interviewed to be major impediments to increased production. However, as effective fungicides to control rust in winter wheat become more widely available, the risk associated with rust could be lessened, at a cost of about $30 to $40 per hectare ($12 to $16 per acre). Rust was an important concern to the winter wheat farmers interviewed, even though

only two of the twenty winter wheat farmers interviewed realized additional fungicide costs with their winter wheat as opposed to spring wheat crops. If costs to control rust are taken into consideration, yields and the price of winter wheat must be at sufficient levels to make the crop economically viable, if farmers are expected to consider growing it as a soil and water conservation technique. For farmers experiencing financial difficulties, concerns with the cost of conservation tillage equipment were prevalent. At present, concerns with being able to continue farming into the future as costs continue to rise, is of more importance, before the immediate extra costs of conservation can be considered.

In addition, because plant breeders do not expect to develop a more winter hardy variety than Norstar due to lack of genetic variability, the importance of standing stubble and the chopping and spreading of straw and chaff from the preceding crop is essential in optimizing the winter survival rates of winter wheat in Manitoba.

Some of the experienced winter wheat farmers interviewed felt that lack of knowledge about growing winter wheat and the resistance some farmers have towards change are two factors limiting any increases in winter wheat production in the future.

5.3 THE GENERAL ATTITUDE OF AGRICULTURAL REPRESENTATIVES INTERVIEWED

Upon completing discussions with Provincial agricultural representatives, the fact that winter wheat is a newer crop to Manitoba that involves different farming practices becomes extremely significant. Zero tillage requiring specialized seeding equipment is necessary in order to produce winter wheat in Manitoba, yet this practice is growing amongst Manitoba farmers rather slowly.

There are a number of recommendations in which farmers must follow (as outlined in Chapter II), in order to successfully grow winter wheat in Manitoba. Some of the agricultural representatives interviewed, felt that many farmers are making little effort if any, to acquire the knowledge associated with growing winter wheat in Manitoba. The information is available, yet only those innovative or progressive farmers appear to be taking advantage of it. This illustrates the resistance of many farmers to change. Major problems with producing winter wheat in Manitoba such as leaving the stubble of the previous crop at the proper height required to trap snow, and seeding directly into stubble in order to avoid winter kill, could be overcome if the information available on winter wheat were utilized more efficiently and effectively.

In general, the agricultural representatives interviewed felt winter wheat which requires zero tillage crop

production, is catching on in Manitoba, even though rather slowly. At present those more financially secure farmers are willing to try something new. The encouragement to farmers with soil and water erosion problems appears to be lacking. However in times of economic difficulties for farmers, such conservation problems tend to be temporarily placed aside.

5.4 CONCLUSIONS

In conclusion, farmer attitudes towards winter wheat as a soil and water conservation crop in southwestern Manitoba were generally favorable. Particularly, in terms of efficient utilization of early spring moisture and overall higher yields than spring seeded wheat. The successful production of winter wheat could be viewed as economically feasible to farmers currently practicing zero or minimum tillage cropping techniques due to increased yields and reduced herbicide costs. Among the winter wheat farmers interviewed for this study, there was an average yield advantage for winter wheat over hard red spring wheat of 4.53 bushels per acre and an average savings per acre of $10 for winter wheat over hard red spring wheat. The average price for winter wheat for the crop years 1981-82 through 1985-86 was only 6.8% less than Canada Western Hard Red Spring Wheat. It is important to note that 18 of the 20 winter wheat farmers interviewed used the same seeding equipment

for both spring and winter wheat, and therefore, experienced no additional equipment costs growing winter wheat. If a farmer did not own the appropriate seeding equipment, additional seeding costs for winter wheat could eliminate any potential economic gains. The farmers interviewed who have successfully produced winter wheat as a soil and water conservation technique, view its production favorably.

Among both farmers and agricultural representatives, rust is seen as a major problem associated with winter wheat production in Manitoba. Therefore, the future development of a disease resistant variety of winter wheat is seen as positive, in that winter wheat acreages will increase. However this would most likely occur amongst those farmers who already have experience growing winter wheat. Among interview participants there would be an average increase in winter wheat acreage per farm of 130.5 acres, if a new variety of winter wheat was developed that overcame some of the current problems associated with Norstar, such as susceptibility to rust. It should be noted that some of those winter wheat farmers interviewed already grow the maximum amount of winter wheat they can incorporate into their crop rotation scheme. When viewed as a controllable problem through the use of effective fungicides, rust and its associated risks, are of less importance so long as increased yields at equal or higher prices than hard red spring wheat are present in order to offset any additional fungicide costs. Yet the de-

velopment of a rust resistant cultivar would be favorable in terms of reduced fungicide costs.

The problem of winter kill may also be viewed as manageable, so long as available information on growing winter wheat in Manitoba is effectively utilized. It is the general attitude amongst those farmers interviewed, that a more winter hardy variety would be better, however a variety that would over winter in Manitoba's climate without the protection associated with seeding into stubble, is highly unlikely.

Those farmers in areas of lighter soils or sloping fields that have grown winter wheat as a soil and water conservation crop, realize and appreciate the conservation aspects associated with winter wheat production. The efficient utilization of spring moisture by winter wheat is also viewed as significant among farmers in drier areas of southwestern Manitoba. Therefore, winter wheat as a soil and water conservation technique is important to the agricultural sector of Manitoba, in that winter wheat not only conserves soil and water but is also viewed favorably by those experienced in its production.

However, if winter wheat is to play a more significant role in conserving soil and water in Manitoba in the future, the fact that winter wheat can be used as a conservation technique must be extended to all Manitoba farmers. Some

farmers interviewed did not understand or see any connection between soil and water conservation and winter wheat production. For those Manitoba farmers currently practicing zero or minimum tillage crop production economic benefits associated with winter wheat production such as increased yields and reduced chemical costs could be realized and therefore should be made known to these Manitoba farmers and others considering zero or minimum tillage crop production. For farmers who do not own the specialized seeding equipment required to produce winter wheat, the costs to obtain such equipment would offset any potential gains in terms of higher yields and reduced herbicide costs. In addition, if problems with rust should arise and require the application of fungicides, the economic gains associated with increased yields and reduced herbicides could be eliminated. It is possible that financial stress and stress on Manitoba's agricultural land base could be lessened simultaneously by improving the understanding of winter wheat under zero or minimum tillage as an economical soil and water conservation technique.

The future role of winter wheat in Manitoba as a soil and water conservation technique, could be of greater significance when present problems or limitations associated with its production become either overcome or more manageable. As the more conservation oriented farmers increase their knowledge of winter wheat and in particular, the soil

and water conservation aspects associated with it, the use of it as an economically feasible crop to conserve soil will be viewed enthusiastically. Winter wheat could play a more important role for those farmers already involved with zero or minimum tillage, who expressed a deep concern about preserving Manitoba's agricultural land base for future generations, at a time when financial problems are of a greater concern.

5.5 RECOMMENDATIONS

This section will set forth recommendations to Manitoba farmers, farm organizations, the Manitoba Government, the Government of Canada and to other agencies who are involved with or are interested in winter wheat production in Manitoba.

5.5.1 Recommendations to Farmers

1. Farmers with experience growing winter wheat should take advantage of the information available on its production in Manitoba, such as the Manitoba Department of Agriculture facts sheet on winter wheat production in Manitoba, in an effort to understand all of the factors associated with winter kill because a more winter hardy variety than Norstar is unlikely to be developed due to lack of genetic variability. Therefore, those farmers expressing concerns with the

problem of winter kill should utilize available information on stubble height of the previous crop and type of previous crop, in an effort to minimize winter kill.

2. Information should also be utilized to a greater extent by farmers in order to deal with the problems of rust and perennial weeds. Farmers currently growing winter wheat or farmers owning appropriate seeding equipment to grow it in the future, should know the costs of controlling rust on their individual farms and weigh these potential costs against any economic gains in term of increased yield and reduced herbicide costs. Such an assessment would help farmers determine if the potential gains will be positive if a rust outbreak was to occur. In addition, they should note that winter wheat should not be grown on fields in which perennial weeds such as quack grass are present because these weeds will flourish in the absence of tillage, a management practice essential to successful winter wheat production in Manitoba.

3. Farmers who have no experience growing winter wheat, but who currently practice zero or minimum tillage to control problems with wind and water erosion on their farms, should attempt to learn more about winter wheat production as a soil and water conservation technique. Successful winter wheat production under zero tillage does not only act to conserve soil and

water, but it also may prove to be more economical than hard red spring wheats in terms of higher yields at comparable prices and reduced herbicide costs for wild oats.

5.5.2 Recommendations to Farm Organizations

1. Farm organizations in Manitoba should anticipate increased interest in the production of winter wheat in Manitoba, particularly since beginning in the fall of 1986, it will be insured by the Manitoba Crop Insurance Corporation. They should make a concerted effort to inform and support farmers, in particular minimum or zero tillage farmers, with regard to the proper production techniques involved with insuring successful winter wheat production in Manitoba.
2. Farm organizations should inform farmers with wind and water erosion problems that successful winter wheat production can be a more economical method of soil and water conservation than other crops such as fall rye and forages, at a time when financial problems are of greater concern to farmers than soil degradation.

5.5.3 Recommendations to the Government of Manitoba

1. Manitoba Department of Agriculture:
   a) Should put more effort into the extension of information on growing winter wheat in Manitoba. Although the information is available, those farmers with no experience growing winter wheat lack specific knowledge on growing this crop and also, do not understand the use of winter wheat as a soil and water conservation technique in Manitoba.
   b) Should study in greater detail the machinery costs associated with conservation tillage to determine how significant this problem is and to suggest ways in which it may be overcome to encourage or accelerate the movement towards reduced or zero tillage and to make the option of producing winter wheat available to a greater number of farmers.
2. Departments Concerned With Soil and Water Conservation: Should understand that conservation must be economical in times of financial stress within the farming community. Thus, these departments should be aware that successful winter wheat production under zero tillage, may prove to be a more economical way of conserving soil and water so long as the potential costs associated with rust control do not offset the economic gains of higher yields and lower herbicide costs. There was an average per acre saving for win-

ter wheat over hard red spring wheat of $10 among interview participants.

5.5.4 Recommendations to the Government of Canada

1. Agriculture Canada: As concerns with regard to the degradation of Canada's agricultural land base become greater, more emphasis should be placed on studying methods of conservation which do not place additional financial pressures on Canada's farmers. Agriculture Canada should be aware that winter wheat production outside of its traditional growing areas, may be viewed as a soil and water conservation technique because it must be seeded into the undisturbed stubble of the previous crop in an effort to reduce winter kill.
2. The Canadian Grain Commission: Should make an effort to help farmers understand the reasons for lower grades when received, in order to improve the quality of winter wheat crops, particularly in cases where lower grades could have been prevented. Among the farmers interviewed in this study, some associate higher yielding winter wheat crops with lower grades, possibly due to confusion with higher yielding semi-dwarf wheat varieties. Hard red winter wheat is a separate class of wheat from hard red spring wheats and thus, is graded accordingly. For some of those

farmers interviewed, the lower grades associated with starchy kernels could be attributed to growing conditions and weathering, rather than the higher yields associated with winter wheat production.

5.5.5 Recommendations to Other Agencies

1. Agencies involved with the development of rust resistant winter wheat varieties should continue, in an effort to eliminate any negative attitudes towards winter wheat in Manitoba which may exist because of the threat of rust. In addition, a rust resistant variety would help eliminate or reduce future fungicide costs to winter wheat producers.
2. Agencies involved with the development of a new cultivar should attempt to develop a variety more resistant to sprouting, to help farmers achieve better grades for their winter wheat.

5.6 SUMMARY

The production of winter wheat in Manitoba is relatively new. Under conventional tillage practices, winter wheat cannot survive Manitoba's harsh winter temperatures. However, through the use of zero tillage, stubble is maintained which acts to trap snow providing protection to the winter wheat crop by moderating soil temperatures. Zero tillage in turn promotes soil and water conservation through reduced

wind and water erosion. The purpose of this research was to assess the attitudes of farmers towards winter wheat, in particular as a soil and water conservation technique. Winter wheat is advantageous, particularly in drier areas where soil moisture deficits occur. This is because winter wheat is capable of utilizing early spring moisture, whereas this moisture is lost to crops seeded in the spring after fields have dried. For this reason and because rust is less of a problem in drier areas of Manitoba, winter wheat production largely occurs in the drier southwestern part of the province. This area having farmers with the most experience in winter wheat production was chosen as the study area for this research.

Interviews were conducted with thirty farmers and nine Provincial agricultural representatives throughout southwestern Manitoba. The farmer interview consisted of questions dealing with soil conservation and winter wheat production. Of the thirty farmers interviewed, twenty or 67% said that they have considered growing winter wheat as a soil and water conservation technique. Each farmer was then questioned with regard to major soil problem on their farm and if they have made changes due to soil problems in their farming practices within the last 10 years. The major problems cited were wind and water erosion. Other soil problems mentioned included salinity, organic matter content and flooding. Changes in farming practices due to soil problems

were made by 90% or twenty-seven of those farmers interviewed. The most frequently made changes were reduced or zero tillage and continuous cropping.

Twenty of the 30 farmers interviewed have experience with winter wheat production. Each of these 20 farmers were asked a series of questions with regard to producing winter wheat. The years of experience growing winter wheat among these twenty farmers ranged from one year to seven years, with the average years of experience being 2.65. As the years of experience increase the corresponding acreage seeded to winter wheat rose for those farmers interviewed.

Of the winter wheat producers interviewed, eighteen or 90% sowed their winter wheat crop directly into the standing stubble of the previous crop. Seeding implements used by these farmers included hoe drills, disc type drills and air seeders. The type of implement used in most cases reflected the type of soil on the individual farms. Each farmer interviewed used pedigreed seed either registered of certified, the variety being Norstar. A majority of 75% or fifteen of the winter wheat farmers interviewed, estimated the seeding date of their winter wheat to be during the first two weeks of September. However four of the farmers explained that the wet fall of 1985, delayed seeding some two or three weeks during that year.

Fertilizers were applied by 18 of the 20 winter wheat farmers interviewed. The most common application schemes used by these farmers involved applying phosphate in the fall with the seed and nitrogen in the spring. Of the 20 winter wheat farmers interviewed, 16 applied herbicides in the spring to control broad leaf weeds.

Approximately 61% or eleven of the eighteen winter wheat farmers who have previously harvested winter wheat crops, felt that their winter wheat out yielded their spring wheat crops. Of the remaining farmers, five felt yields were similar and two felt their spring wheat out yielded their winter wheat crops. Therefore, if herbicide savings were to be offset if a rust problem arises through additional fungicide costs, the seven farmers interviewed who realized no yield increases, would have been better off if they had chosen to grow a higher priced crop.

Of the twenty winter wheat farmers interviewed, fourteen realized extra dollar savings with winter wheat as opposed to spring wheat in terms of reduced herbicide costs and fuel, machinery and labour costs due to less tillage being required with winter wheat. However five winter wheat farmers interviewed, realized no dollar savings and three experience extra costs of $4, $6 and $11 per acre with winter wheat production when compared to hard red spring wheat. The Canadian Wheat Board was the most common channel of marketing winter wheat among the farmers interviewed. Grades

for winter wheat received by the farmer interviewed ranged form No. 1 to No. 3. Lower grades were attributed to a number of factors including sprouting and starchy kernels or bleaching. The general attitude towards winter wheat among those experienced in its production was favorable particularly with regard to higher yields than spring wheat and the use of it as a conservation technique.

The second part of the winter wheat questions was asked of all thirty farmers interviewed. Each was asked what the major problems were that inhibited them from growing more winter wheat. Problems with rust and winter kill were most commonly cited. Of the thirty farmers interviewed, twenty-one or 70% felt they would grow additional winter wheat if a new cultivar that had improved rust resistant qualities was developed. Of these twenty-one farmers, fourteen currently have experience growing winter wheat, while seven presently have not grown winter wheat. Of the remaining nine farmers interviewed, one could not say if he would grow additional winter wheat and eight said they would not increase winter wheat production. Of these eight, five have winter wheat experience and three do not.

Nine Provincial agricultural representatives throughout southwestern Manitoba were also interviewed in an effort to get a different perspective of winter wheat production in southwestern Manitoba. The agricultural representatives described winter wheat producers as being innovative, forward

looking farmers who are always interested in trying something new in order to improve their farming operations.

Problems associated with winter wheat production in Manitoba that were cited by the agricultural representatives included rust as the major problem, lack of knowledge, seeding equipment costs and trash management of the previous crop. All of the agricultural representatives interviewed felt that if a new more rust resistant cultivar were developed, production would increase. However, it was felt that much of the increase would be among those farmers already experienced with winter wheat production in Manitoba.

REFERENCES CITED

Ducks Unlimited (Canada). n.d. Questions and Answers on Planning For Zero Tillage Farming. (unpubl.). 12 pp.

Faculty of Agriculture University of Manitoba. 1977. Principles and Practices of Commercial Farming. Fifth Edition. p. 96.

Fowler, D.B. 1983. Production of Stubbled - In Winter Wheat: Basic Considerations. Winter Wheat Series #6. Crop Development Centre, University of Saskatchewan, Saskatoon. 4 pp.

Grant M.N., U.J. Pittman, J.S. Horricks, N.D. Holmes, D.T. Anderson and A.D. Smith. 1976. Winter Wheat Production in Western Canada. Agriculture Canada Research Station, Lethbridge, Alberta. 16 pp.

Harvey, A.M. 1983. The Economics of Winter Wheat Production or Why Winter Wheat is Made for Conservation in Crop Production Systems. (unpubl.). Alberta Agriculture, Economics Services Division. Lethbridge, Alberta. 8 pp.

Lyster, B. 1984. Less Erosion with Winter Grains. In Country Guide, The Farm Magazine, Special Soil Conservation Issue. Vol. 103, No. 2A. pp. 20-21.

Manitoba Agriculture. n.d. Winter Wheat in Manitoba. Farm Facts Agdex 112. 2pp.

Rourke, D.R.S. and E.H. Stobbe. n.d. Intensive Management of Winter Wheat on the Prairies. (unpubl.) Department of Plant Science, University of Manitoba. 9 pp.

Saskatchewan Pool Farm Service Division. 1983. Successful Winter Wheat Production. Product Development Branch Field Notes. Regina, Saskatchewan. 6 pp.

Saskatchewan Pool Farm Service Division. n.d. Market Opportunities for Winter Wheat. Seed Marketing Department. Regina, Saskatchewan. 5 pp.

Statistics Canada. 1981. Census of Canada, Agriculture, Manitoba. Catalogue no. 96-908.

Stobbe, E.H. and L.E. Evans. 1979. Winter Wheat Production Under Zero Tillage. (unpubl.) Department of Plant Science, Faculty of Agriculture, University of Manitoba. pp. 2-4.

Stobbe, E.H. and D. Rourke. 1981. Tillage Practices in Winter Wheat Production. Department of Plant Science, University of Manitoba. 3 pp.

Vininsky, Elaine. 1986. Winter Wheat Insurable. Manitoba Co-operator Vol. 44, No.2. August 14.

Appendix A

FARMER INTERVIEW SCHEDULE

A.1 FARMER PROFILE

Date:

Name:

Address:

Phone:

1. Number of cultivated acres on your farm:
2. Years of farming experience:
3. Level of education:
4. Age: 20-30, 31-40, 41-50, 51-60, over 60.
5. Do you own all of the land you farm? Yes or No

A.2 SOIL CONSERVATION QUESTIONS

1. Have you considered growing winter wheat as a soil and water conservation technique? Yes or No
2. Major soil problems (if any):
   Wind erosion:
   Water erosion:
   Salinity:
   Compaction:

Flooding:

Other:

3. Have concerns with soil problems led to changes in your farming practices in the last ten years? If yes, what type of changes have been made.

   Reduced tillage:

   Reduced summerfallow:

   Crop residue management:

   Increased forage production:

   Other:

A.3 WINTER WHEAT QUESTIONS

Have you ever produced winter wheat? Yes or No

If yes answer all of the following questions, if not go to Part B of this section.

A.3.1 Part A

1. Number of years winter wheat was grown:
2. Acreage sown to winter wheat each year:

Year	Acreage
----	-------

3. Seedbed preparation: seeded on summerfallow or stubble.

4. Seeding implement used:

5. Where did you obtain your winter wheat seed and of what quality was it?

6. Seed variety sown:

7. Seeding date: 3rd week in August, 4th week in August, 1st week in September, 2nd week in September, 3rd week in September, other.

8. Were fertilizers applied? Yes or No

Crop Year	Type	Approximate Application Date
---	---	---

9. Were herbicides applied? Yes or No

Crop Year	Type	Approx. Application Date	Weeds Controled
---	---	---	---

10. Estimate your average yield of winter wheat per acre:

Year	Yield Estimate
---	---

11. Estimate the difference in yield (bu./ac.) between winter wheat and hard red spring wheat:

Year	Yield Difference Estimate

12. Estimate the extra costs (or savings) per acre of winter wheat relative to hard red spring wheat in terms of the following:

Chemical costs:

Equipment costs (annual amortized depreciation costs):

Seeding costs:

Reduced labour costs(savings):

Other:

13. Was your winter wheat marketed through the Canadian Wheat Board? Yes or No: If yes give grade and reasons for lower grades.

Year	Grade (CWRWW No.1,2,etc.)	If lower grades were received, why?

If not marketed through the CWB, where was it sold or used?

14. For the most recent year that you produced winter wheat, estimate any yield reductions due to soil problems.

15. If you presently do not consider growing winter wheat given your past experience, why did you stop growing it?

A.3.2 Part B

16. What do you feel are the three most important problems inhibiting you from growing more winter wheat:

    Winter kill:

    Leaf rust:

    Stem rust:

    Lodging:

    Implement cost:

    Risk ie. not covered under crop insurance:

    Price:

    Other:

    Other:

17. If the three most important problems mentioned in the above question were overcome by plant breeders, estimate how many additional acres would you grow?

18. Do you feel your answers are typical for this area? Yes or No

Further comments:

Appendix B

LETTER TO PARTICIPANTS

Date:

Dear

I am a university graduate student conducting research into how farmers feel towards winter wheat production in southwestern Manitoba.

The study will involve interviews with farmers throughout southwestern Manitoba to determine their attitudes towards winter wheat production, in particular winter wheat as a soil and water conservation technique.

Information gained from interviews will be treated as confidential and will be used for research purposes only. A summary or abstract of research results will be mailed to all participants.

If any questions should arise, please feel free to contact me in Winnipeg at 256-1781 or leave a message at the Natural Resources Institute at 474-8373. Thank-you for your time and information.

Sincerely,

P. Joan Poor

Appendix C

AGRICULTURAL REPRESENTATIVE QUESTIONS

Date:

Agricultural Representative:

Location:

1. Describe the characteristics of winter wheat producers in this area.

2. What are the major problems restricting winter wheat production in this area.

3. You do feel a new variety or cultivar will increase production in this area?

Appendix D

REGRESSION ANALYSIS - AVERAGE ACREAGE OF WINTER WHEAT GROWN

AVERAGE ACREAGE OF WINTER WHEAT GROWN

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: AVE AVERAGE ACREAGE WINTER WHEAT GROWN

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	3	56033.19322384	18677.73107461	0.20	0.8921	0.048377	113.5098
ERROR	12	1102224.80677616	91852.06723135		ROOT MSE		AVE MEAN
CORRECTED TOTAL	15	1158258.00000000			303.07105971		267.00000000

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
DIFFY	1	2428.93093147	0.03	0.8735	1	23231.04862344	0.25	0.6241
IRS	1	38897.25301245	0.42	0.5275	1	47013.89422493	0.51	0.4880
SAVINGS	1	14707.00927992	0.16	0.6961	1	14707.00927992	0.16	0.6961

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	170.63893378	1.01	0.3304	168.21295591
DIFFY	-6.58061801	-0.50	0.6241	13.08509084
IRS	34.47575194	0.72	0.4880	48.18868794
SAVINGS	2.67245059	0.40	0.6961	6.67[illegible]49

Appendix E

REGRESSION ANALYSIS - WINTER WHEAT ACREAGE WITH A NEW VARIETY

WINTER WHEAT ACREAGE INCREASES WITH NEW VARIETY

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: TOT TOTAL WW ACREAGE WITH NEW VARIETY

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	3	246463.02593451	82154.34197817	1.23	0.3188	0.133728	88.9819
ERROR	24	1596550.40263692	66522.93344321		ROOT MSE		TOT MEAN
CORRECTED TOTAL	27	1843013.42857143			257.92040137		289.85714286

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
EXP	1	90886.85410334	1.37	0.2539	1	84554.63756971	1.27	0.2707
EDUC	1	115629.85555904	1.74	0.1998	1	121362.92432768	1.82	0.1894
EXP*EDUC	1	39946.31627213	0.60	0.4460	1	39946.31627213	0.60	0.4460

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	1368.97936800	1.97	0.0601	693.77365021
EXP	-26.01575900	-1.13	0.2707	23.07562542
EDUC	-72.09757852	-1.35	0.1894	53.37813041
EXP*EDUC	1.51457803	0.77	0.4460	1.95451488