

NATIONAL WHEATGROWERS' SURVEY

No. 1

1976-77

by

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THE AGRICULTURAL ECONOMICS RESEARCH UNIT

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CONTENTS

	Page
List of Tables	ii
List of Figures	iii
PREFACE	iv
CHAPTER 1. INTRODUCTION	1.
1.1 Climatic Conditions	1.
1.2 Wheat Price	2.
1.3 Survey Description	5.
CHAPTER 2. FARM CHARACTERISTICS	9.
2.1 Farm and Crop Areas	9.
2.2 Livestock Numbers	12.
CHAPTER 3. WHEAT AREA AND YIELD	14.
3.1 Wheat Area and Production per Farm	14.
3.2 Wheat Variety Areas and Yields	17.
CHAPTER 4. MANAGEMENT AND CULTURAL PRACTICES	21.
CHAPTER 5. COSTS AND RETURNS	26.
REFERENCES	36.
ACKNOWLEDGEMENTS	37.
APPENDICES	38.
A. Reliability of Survey Estimates	40.
B. Description of Cost and Revenue Items	42.

LIST OF TABLES

TABLES

No.		Page
1.	Climatological Indices for New Zealand Wheat Growing Areas	3.
2.	Basic Wheat Prices	4.
3.	Growers' Storage Increments	5.
4.	Distribution of Survey Farms and Survey Population by Region	7.
5.	Survey Farms Growing Wheat	9.
6.	Farm and Crop Areas	10.
7.	Total Wheat Production per Survey Farm	11.
8.	Livestock Numbers	12.
9.	Fodder and Greenfeed Crops	13.
10.	Wheat Area and Yield per Survey Farm Growing Wheat	14.
11.	Estimated Wheat Production Sold to the Wheat Board per Farm	15.
12.	Wheat Area and Yield by Region and Variety	19.
13.	Average Sowing and Harvesting Dates	21.
14.	Average Sowing Rates	22.
15.	Tractor Hours for Wheat Cultivation and Drilling	23.
16.	Various Cultural and Management Practices	24.
17.	Harvesting Method	25.
18.	Summary Costs and Returns for the Wheat Crop	29.
19.	Establishment Costs	30.
20.	Growing Costs	31.
21.	Harvesting Costs	32.
22.	Machinery Overhead Costs (A) (historical cost basis)	33.
23.	Machinery Overhead Costs (B) (current cost basis)	34.
24.	Revenue	35.
25.	Relative Standard Errors (RSE) of Mean Estimates of Important Cost and Revenue Totals	41.

LIST OF FIGURES

No.		Page
1	Relative Importance of Different Varieties	17.

PREFACE

The National Wheat Growers' Survey was initiated in 1976 to provide continuing information on the costs and returns from wheat growing, and generally on the production patterns on farms where wheat is grown. The Survey involves a random sample of approximately 180 farms on which wheat has been grown. Regional stratification of the sample ensures that between region comparisons of major production factors may be made: this report pays specific attention to the physical characteristics of farms, the area of wheat sown, wheat yields by varieties, cultural practices involved and costs and returns for the 1976/77 crop. In a time when the fixed costs of crop production have assumed major proportions, it is essential that the costing work goes beyond assessment of the direct costs of production. Consequently, an attempt has been made to allocate plant and machinery costs to the wheat enterprise. This has been done both by the historical depreciation method and by the current cost method; the latter reflecting inflation in machinery prices. Both assessments are presented in the report so that appropriate comparisons can be made.

The need for current and detailed information from the Survey involved two visits to the farms in the sample; one in the spring following drilling and the second in the autumn after harvest. The ready co-operation and goodwill of the farmers who spared their time for these visits is gratefully acknowledged as is the financial assistance of the Federated Farmers of New Zealand Inc.

Professor J B Dent
Director

December 1977

CHAPTER 1

INTRODUCTION

The National Wheatgrowers' Survey is an annual survey being undertaken by the Agricultural Economics Research Unit at Lincoln College on behalf of Federated Farmers of New Zealand Inc. This report summarises information collected from participating farmers for the 1976-77 wheat growing season, the first year of the survey.

1.1 Climatic Conditions

For the 1976-77 season weather conditions in the main wheat growing areas of Canterbury and North Otago remained relatively cool and changeable until mid January and development of wheat throughout the season was about three weeks later than normal [Wright, 1977]. Information from various Ministry of Agriculture and Fisheries' Advisory Officers indicated that many individual farm yields were disappointing, with apparently healthy crops producing quantities of shrivelled grain. However, the Canterbury harvest was completed in March with above-average yields. In the North Island, above-average rainfall in the spring delayed sowing but conditions for establishment and growth were good and no problems were reported. Reports from South Otago indicated that conditions were fairly dry and cool until early December.

One method of gaining an overall picture of the climatic conditions as they relate to wheat growing is to weight the information received from various meteorological stations throughout the country by the amount of wheat grown in the vicinity of those stations. The New Zealand Meteorological Service currently produces such figures for rainfall, temperature, sunlight and days of moisture deficit (Table 1). The weighting is based on the area of

wheat grown in the various counties and ensures that the counties with more wheat contribute to a greater extent to the final average climatic figure. The weather information produced relates to wheat growing areas of New Zealand as a whole rather than to any one area.

An examination of the figures presented in Table 1 shows that for wheat growing areas in New Zealand, Autumn 1976 (March, April and May) was drier, warmer and sunnier than normal. From June to October, however, wheat growing areas experienced more rainfall than average as evidenced by the delayed planting of spring crops in many areas. December and January were also wetter than normal (58 percent and 25 percent respectively). Associated with above average rainfall in the spring were less sunshine and lower temperatures than normal.

Exceptional growing conditions in the previous season (1975-76) resulted in a total production of 426,600 tonnes of wheat from 99,600 hectares with a record average yield of 4.28 tonnes per hectare [New Zealand Wheat Board, 1977]. Of this total yield the Wheat Board purchased 365,479 tonnes. Final figures for the 1977 harvest are not yet available but indications are that both area and average yields have been lower than for 1976.

1.2 Wheat Price

The New Zealand Wheat Board is responsible for the purchase from growers of all wheat of milling standard quality, except those lines qualifying for acceptance as certified seed wheat under the scheme operated by the Department of Agriculture. Lines of wheat that do not meet milling standard are disposed of by the growers themselves, generally for stock feed.

TABLE 1

Climatological Indices for New Zealand Wheat Growing Areas^a

1976-77

Month	Rainfall	Average Temperature	Soil Moisture Deficit ^b	Sunshine
	Percent of normal ^c	Deviation from normal ^c	Days for Month	Percent of normal ^c
March	42	+0.3	1.8	103
April	59	+0.3	0.7	112
May	81	+0.4	0.2	111
June	104	-0.5	-	110
July	104	+0.7	-	107
August	128	0.0	-	81
September	97	-1.2	-	90
October	115	-1.6	0.1	79
November	63	-1.8	0.3	94
December	158	+0.2	4.8	84
January	125	-1.6	14.1	86
Februray	81	0.0	8.6	116
March	28	+0.3	19.9	116
April	87	+0.4	15.7	102

^aWeighted by county wheat areas in 1967/68.

^bWeighted number of days for the month with a soil moisture deficit of more than 75mm.

^c1941-70

Source: Maunder, W.J., N.Z. Meteorological Service, pers. comm., 1977.

The price to be paid for wheat of milling standard is fixed by the Government and announced prior to sowing. The Government also sets the prices for the products of milling. The price for milling standard quality wheat becomes the maximum price that may be charged for wheat of lower quality.

For the 1977 harvest the announced basic price was \$110 per tonne with a 10 percent premium for Hilgendorf and a 10 percent discount for Arawa. The final price paid to growers in 1977 was reduced by \$6.00 per tonne to cover losses on 1976 exports and to allow for possible losses in 1977. An additional 43 cents per tonne for various levies also was subtracted.

Table 2 sets out basic wheat prices paid in recent years.

TABLE 2

Basic Wheat Price

Harvest Year	Price (\$/tonne f.o.r.)
1966	53.28
1967	53.28
1968	53.28
1969	53.28
1970	53.28
1971	53.28
1972	55.12
1973	56.95
1974	59.71
1975	91.66
1976	102.88
1977	110.00
1978 ^a	120.00

^aIn January 1977, the Government announced a 1978 basic price of \$120 per tonne with a premium of 20 percent for Hilgendorf and discount of 10 percent and five percent for Arawa and Karamu respectively.

In recent years growers who store wheat have been paid a storage increment. For the 1977 harvest the storage increment commenced at \$2.50 per tonne at the end of April and reached a maximum of \$10 per tonne for wheat stored until the end of October (Table 3).

TABLE 3

Growers' Storage Increments
1977

Month Sold	Storage Increment (\$ per tonne)
April	2.50
May	3.75
June	5.00
July	6.25
August	7.50
September	8.75
October	10.00

1.3 Survey Description

The sampling unit for the survey is the farm. Information relating to the farm, its management, crop and livestock enterprises, and wheat growing costs and returns was obtained from the farmers by personal interview conducted on two farm visits over the 1976-77 season.

Farms surveyed for the 1976-77 season were selected at random from a list of more than 9,000 names provided by the New Zealand Wheat Board. The list consisted of the names of growers who had sold wheat to the Wheat Board in any year from 1969 to 1975.

Growers selected for the Survey were initially contacted by letter and invited to participate. Farms were retained in the sample even if they were not actually growing wheat in 1976-77, since one of the longer term objectives of the survey is to collect information on crop areas and livestock numbers from year to year. To allow for growers who did not wish to participate in the survey or who could not be located due to death, sale of farm etc., further names were drawn randomly as replacements.

Stratification. To ensure that various regions within the industry were adequately represented, the sample was stratified by region. Four regions were specified for the purposes of the survey and the growers' names were allocated to these regions based on the rail station from which wheat was despatched. The regions were defined as follows:

1. North Island
2. Canterbury (South Island growers north of the Rangitata River).
3. South Canterbury (South Island growers north of Palmerston and south of the Rangitata River).
4. Southland (South Island growers south of Palmerston).

Survey farm distribution. Table 4 gives the distribution of farms in the sample by region and also the distribution of the population by region. Since wheat may have been sold under more than one name from one farm over the 1969-1975 base period (due to farm sales or internal transfers) the number of names on

the Wheat Board records is likely to be higher than the number of wheat growing farms. In order to determine the proportion of the total number of wheat growing farms which occur in each region it was assumed that the ratio of farms to names is the same for each region. Hence, the proportion of the population (farms) in each region is the same as the proportion of names on the Wheat Board records in each region.

TABLE 4

Distribution of Survey Farms
and Survey Population by Region

Region	Number of Farms Surveyed	Proportion of Sample in Region	Proportion of Population in Region
North Island	9	0.05	0.08
Canterbury	60	0.34	0.42
South Canterbury	66	0.37	0.21
Southland	42	0.24	0.29
	<u>177</u>	<u>1.00</u>	<u>1.00</u>

Due to problems in specifying the demarcation line between the Canterbury and South Canterbury regions, South Canterbury is somewhat over-represented in the sample (Table 4).

Weighting and the "All Farms Average". Since the four regions do not contain equal numbers of wheat growing farms a straight average of the regional survey results for any particular item would give a biased national estimate. The proportion of the population in each region (Table 4) is used, therefore, to "weight" the results obtained for each region to give an "All Farms Average". The weighting ensures

8.

that each region assumes its correct degree of importance in the overall wheat growing industry.

CHAPTER 2

FARM CHARACTERISTICS

This chapter outlines some general farm characteristics for the survey farms in each region and for the New Zealand "average" farm. The figures presented are averages for all survey farms and hence involve some farms which were not actually growing wheat in the 1976-77 season (Table 5). Some caution should be exercised in relation to North Island results because of the small number (9) of farms which were surveyed.

TABLE 5

Survey Farms Growing Wheat
1976-77

Survey Farms	North Island	Canterbury	South Canterbury	Southland	All Farms
Number Growing Wheat in 1976-77	8	54	56	38	156
Total	9	60	66	42	177

2.1 Farm and Crop Areas

Table 6 outlines the "average" farm for each region according to farm size and crop areas. Of the four regions cash crops were relatively more important on the Canterbury farms, followed by South Canterbury, North Island and Southland. The "All Farms Average" total cash crop area harvested was 51.7 hectares compared with an average potential cropping area of 164.8 hectares.

TABLE 6
Farm and Crop Areas

	North Island (9)	Canterbury (60)	South Canterbury (66)	Southland (42)	All Farms Average (177)
<u>Farm Area</u>					
Total Farm Area (ha)	376.4	201.3	223.2	232.6	229.0
Potential Cropping Area ^a (ha)	201.1	174.0	157.2	147.1	164.8
Potential Cropping Area as a Proportion of Total Farm Area (%) ^b	65	87	76	79	81
<u>Cash Crops: Area Harvested^c</u> (1977 harvest)					
Wheat Area (ha)	20.0	27.4	24.0	15.1	22.5
Barley Area (ha)	13.0	14.2	11.3	3.2	10.3
Seed Peas Area (ha)	3.4	8.1	6.1	0.3	5.0
Oats Area (ha)	0.0	1.8	1.3	1.6	1.5
Linseed Area (ha)	0.0	2.1	1.5	0.0	1.2
Maize Area (ha)	7.4	0.0	0.0	0.0	0.6
Grass Seed Area (ha)	5.4	6.2	3.8	0.4	4.0
Clover Seed Area (ha)	0.0	11.6	2.7	0.0	5.4
Other Cash Crops Area (ha)	1.5	1.6	1.5	0.0	1.1
Total Cash Crop Area Harvested (ha)	50.8	73.0	52.2	20.6	51.7
Wheat Area as a Proportion of Total Cash Crop Area (%)	55	38	44	72	51

^aPotential cropping area is that part of the total farm area that is suitable for cropping, taking account of soil type, rainfall, topography etc.

^bThis is a simple average of the individual farm percentages and therefore may differ from the figure arrived at by comparing average potential cropping area and average total farm area.

^cCrop areas are presented on an area harvested basis rather than area drilled for this table because the clover and grass seed area harvested in 1977 may have been drilled in a previous year. For other crops area harvested may be considered to be the same as area drilled.

The area of wheat grown on Canterbury and South Canterbury farms is higher than that on North Island and Southland farms but, due to a greater diversity of crops harvested, wheat formed a smaller porportion of the total cash crop area on the Canterbury and South Canterbury farms. Wheat made up 72 percent of the total cash crop area for the average Southland survey farm compared with only 51 percent for the "All Farms Average" farm. The "All Farms Average" wheat area for 1976/77 was 22.5 hectares compared with a total cash crop area harvested of 51.7 hectares (51 percent for the average farm). Barley was the second most important crop in terms of area harvested followed by clover seed, seed peas, grass seed and linseed.

The average total wheat production per survey farms for the 1977 harvest is shown in Table 7.

Since all survey farms are included, the calculated averages are a function of:

1. The number of farms growing wheat and,
2. The average total yield on those farms.

Total wheat area, total wheat production and yield per hectare for only those farms which grew wheat (in 1976-77) are detailed in Chapter 3.

TABLE 7
Total Wheat Production per Survey Farm

Number of Survey Farms	North Island (9)	Canterbury (60)	South Canterbury (66)	Southland (42)	All Farms Average (177)
Wheat Area (ha)	20.0	27.4	24.0	15.1	22.5
Wheat Production (tonnes)	93.62	102.01	87.51	66.16	87.90

2.2 Livestock Numbers

Average livestock numbers and total stock units per farm are presented for June 30, 1976, and for November 30, 1976 (Table 8). For Canterbury survey farms, total stock units per farm decreased from 1,539 to 1,381 over this spring period. A number of intensive cropping farms in the Canterbury region run stock only during the winter. For the "All Farms Average" farm, total stock units decreased from 1,926 at June 30, to 1,865 at November 30.

TABLE 8

Livestock Numbers

	North Island (9)	Canterbury (60)	South Canterbury (66)	Southland (42)	All Farms Average (177)
<u>Farm Area</u>					
Total Farm Area (ha)	376.4	201.3	223.2	232.6	229.0
<u>Livestock Numbers</u>					
<u>at 30/6/76</u>					
Ewes	1740	1131	1375	1695	1395
Other Sheep	712	333	365	459	407
Cattle	237	40	49	59	63
Total Stock Units ^a	3348	1539	1841	2247	1926
<u>Livestock Numbers</u>					
<u>at 30/11/76</u>					
Ewes	1689	1062	1358	1658	1347
Other Sheep	389	269	353	435	344
Cattle	282	34	52	75	70
Total Stock Units ^a	3194	1381	1800	2248	1865

^aStock Unit Conversions (per head)

<u>Sheep:</u>	Ewes	1.0 S.U.	<u>Cattle:</u>	Cows	6.0 S.U.
	Hoggets	0.6 S.U.		Others	4.0 S.U.
	Others	0.8 S.U.		Calves	3.0 S.U.
				Bulls	5.0 S.U.

Consistent with the relative cash crop areas shown in Table 6, livestock enterprises were relatively more important on the North Island and Southland farms than on Canterbury and South Canterbury farms both in terms of total stock units per farm and total stock units per hectare of total farm area. The reduction in total stock units per farm between June 30 and November 30 is most marked for the Canterbury "average farm". On average, Southland farms did not reduce their total stock units going into the summer.

The area of fodder and greenfeed crops sown for livestock (Table 9) was higher than for the "All Farms Average" Canterbury and South Canterbury farms despite the lower stock numbers on these farms. This is presumably partly a result of the more intensive cropping rotations on these farms which permit autumn sown fodder and greenfeed crops to be grown between cash crops.

TABLE 9

Fodder and Greenfeed Crops

	North Island (9)	Canterbury (60)	South Canterbury (66)	Southland (42)	All Farms Average (177)
<u>Fodder and Greenfeed</u>					
<u>Crops</u>					
Autumn Sown Area (ha)	10.1	17.2	17.2	10.5	14.7
Spring Sown Area (ha)	1.9	2.2	2.7	1.6	2.1
Total Area (ha)	12.0	19.4	19.9	12.1	16.8

CHAPTER 3

WHEAT AREA AND YIELD

This chapter deals with wheat area and yield for those survey farms which grew wheat in the 1976-77 season. A total of 156 of the 177 farms surveyed are included (Table 5).

3.1 Wheat Area and Production per Farm

Table 10 presents average wheat area, total production and yield per hectare results for those survey farms which grew wheat in the 1976-77 season.

TABLE 10

Wheat Area^a and Yield per Survey Farm
Growing Wheat, 1976-77

Number of Survey Farms	North Island (8)	Canterbury (54)	Canterbury (56)	Southland (38)	All Farms Average (156)
Wheat Area (ha)	22.5	30.4	28.3	16.7	25.3
Total Wheat Production (tonnes)	105.33	113.34	103.13	73.12	98.90
Yield per Hectare ^b	4.94	3.40	3.58	4.54	3.89

^aWheat area is given as area wheat drilled.

^bRegional yield per hectare figures are simple averages of the yields recorded for individual farms. The "All Farms Average" is a weighted average of the averages for the four regions.

The average survey farm growing wheat (All Farms Average) in 1976-77 grew 25.3 hectares and produced 98.9 tonnes with an average yield of 3.89 tonnes per hectare. North Island survey farms recorded the highest average yield per hectare (4.94 tonnes/ha)

followed by Southland (4.54 tonnes/ha) South Canterbury (3.58 tonnes/ha) and Canterbury (3.40 tonnes/ha). It should be noted that these per hectare yields are the simple averages of the individual farm yields. Since they are not weighted by the area of wheat grown they do not necessarily equal the figure obtained by dividing average total production by average wheat area. The figures presented may be interpreted as the average yield which the so called "average: survey grower achieved for the 1976-77 season.

Because some of the wheat grown is not of sufficiently high quality and because some wheat is retained for seed, the Wheat Board does not purchase the total wheat production in any year. Table 11 gives an estimate of the amount of wheat per farm sold to the Wheat Board from the 1977 harvest. Since much of the wheat had not been sold at the time of the second survey interview, the estimated amount sold to the Wheat Board is that which had already been sold plus any which was expected to be sold, taking into account quality and own seed requirements.

TABLE 11

Estimated Wheat Production Sold to the
Wheat Board per Farm 1977 Harvest

	North Island (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	All Farms Average (156)
Number of Survey Farms					
Total Production (tonnes)	105.33	113.34	103.13	73.12	98.89
Estimated Wheat Sold to the Wheat Board ^a (tonnes)	16.01	92.53	95.39	65.79	79.25
Wheat Sold to Wheat Board as a proportion of Total Production(%)	21	76	89	82	76

^aWheat sold to the Wheat Board is an estimate determined from the amount which had actually been sold at the time of the survey visit plus any which was expected to be sold, taking into account quality and own seed requirements.

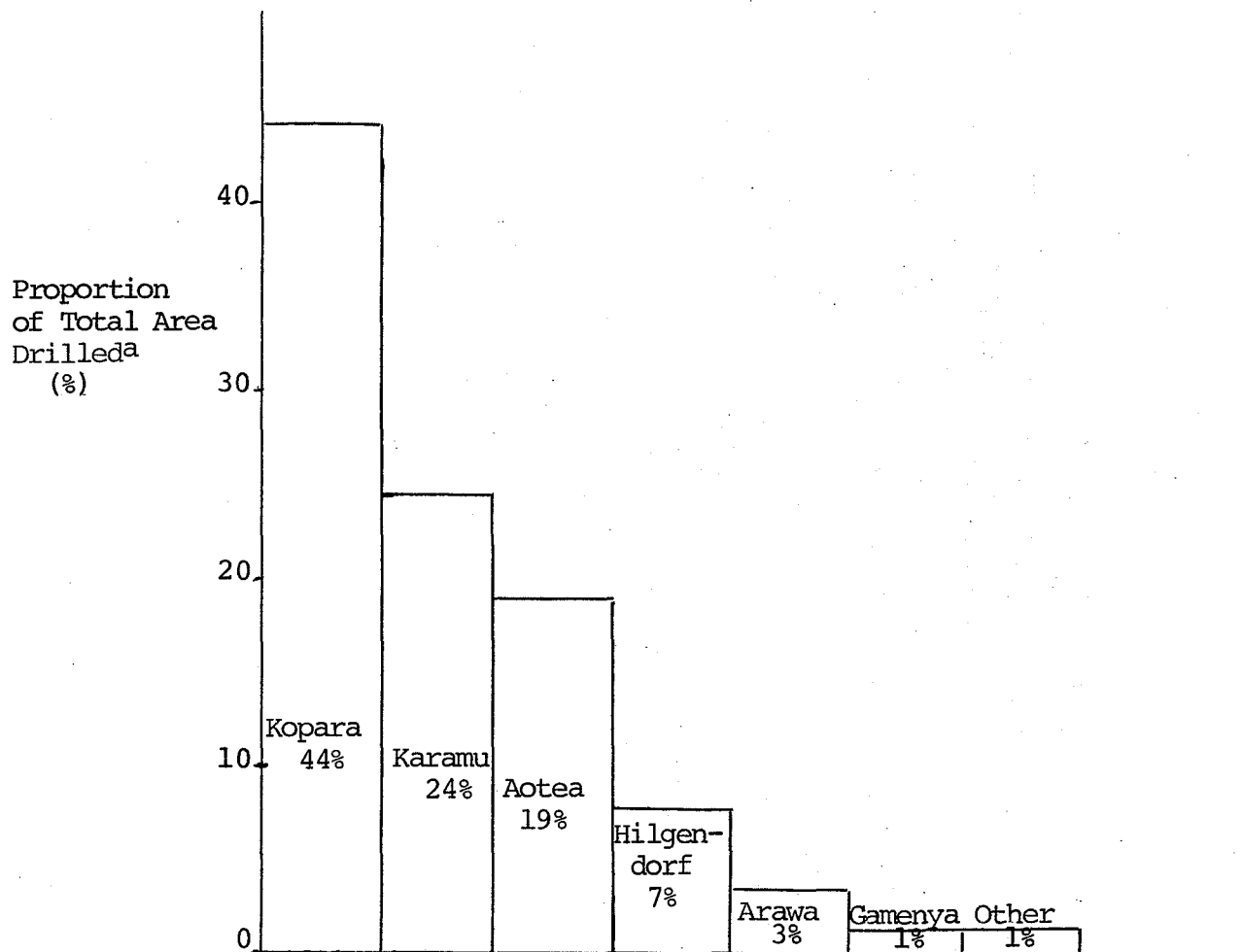
The significant quality problems encountered in growing wheat in the North Island are highlighted in Table 11. For the North Island survey farms which grew wheat an estimated 21 percent of the total production was of sufficiently high quality and had been sold or was expected to be sold to the Wheat Board. For the "All Farms Average" survey farm the estimated amount of wheat sold to the Wheat Board was 76 percent of the total production. Of wheat not sold to the Wheat Board the most important usage was as stock feed followed by sale or own use as seed (Table 24).

3.2 Wheat Variety Areas and Yields

For the average survey farm Kopara was the most significant variety making up 44 percent of the total wheat area (Figure 1 and Table 12). This was followed by Karamu (24 percent), Aotea (19 percent), Hilgendorf (seven percent), Arawa (three percent), Gamenya (one percent) and Other Varieties (one percent).

FIGURE 1

Relative Importance of Different Varieties



^a"All Farms Average" Survey Farm (Table 13)

Table 12 presents wheat area and production per survey farm for the different varieties recorded on the survey. Average yield per hectare for individual varieties is calculated as the simple average of the yields on those survey farms growing the variety. Wheat area is presented as wheat area drilled for consistency with other parts of the report. However, differences between wheat area drilled and wheat area harvested are negligible since only two wheat crops which were drilled on the survey farms in 1976 were not subsequently harvested in 1977.

For North Island farms the spring sown wheat, Karamu, was the dominant variety making up around 88 percent of the total wheat area drilled. Gamenya was the only other variety recorded. For both Canterbury and South Canterbury farms Kopara was the most common variety drilled making up approximately 59 percent and 51 percent respectively of the total area drilled per survey farm. For both of these regions Karamu was the next most favoured variety followed by Hilgendorf. On Southland farms where spring sowing is the common practice Aotea was the predominant variety (approximately 81 percent of total wheat area per survey farm) followed by Kopara and Hilgendorf.

Karamu gave a very high average yield of 5.22 tonnes per hectare for the seven North Island farms which grew the variety. As noted previously (Table 11) however, much of the wheat was not of sufficiently high quality to be sold to the Wheat Board. Of the major varieties sown in Canterbury and South Canterbury Karamu also gave the highest yields (3.76 tonnes per hectare and 3.97 tonnes per hectare respectively). For the same regions the average yield (per crop grown on the survey farms) for Kopara was 3.63 tonnes per hectare. Hilgendorf, for which a premium is paid

TABLE 12
Wheat Area^a and Yield by Region and Variety
1976-77

Variety	No. of Farms Growing Variety	Area Drilled ^b (ha)	Total Production ^c (t)	Average Yield (t/ha)	No. of Farms Growing Variety	Area Drilled ^b (ha)	Total Production ^c (t)	Average Yield (t/ha)
	North Island				Canterbury			
Kopara	-	-	-	-	35	17.80	69.53	3.69
Karamu	7	19.79	97.11	(5.22)	17	5.34	21.28	3.70
Aotea	-	-	-	-	8	1.70	4.96	(2.92)
Hilgendorf	-	-	-	-	15	2.90	8.35	2.88
Arawa	-	-	-	-	9	2.43	8.42	(3.27)
Gamenya	1	2.73	8.21	(3.01)	-	-	-	-
Other	-	-	-	-	1	0.19	0.82	(4.37)
Total		22.52	105.32			30.36	113.36	
	South Canterbury				Southland			
Kopara	38	14.85	52.23	3.63	6	1.15	6.87	(5.78)
Karamu	29	10.82	41.91	3.97	-	-	-	-
Aotea	2	0.40	1.60	(4.35)	30	13.43	57.05	4.39
Hilgendorf	6	1.87	6.14	(2.92)	3	0.88	3.54	(3.96)
Arawa	1	0.07	0.14	(1.98)	1	0.43	1.53	(3.58)
Gamenya	-	-	-	-	-	-	-	-
Other	2	0.25	1.12	(4.41)	4	0.76	4.13	(4.87)
Total		28.26	103.15			16.65	73.12	
	All Farms Average							
Kopara	79	10.85	42.16	3.79				
Karamu	53	5.99	25.51	3.96				
Aotea	40	4.77	18.96	4.00				
Hilgendorf	24	1.87	5.82	3.00				
Arawa	11	1.16	4.01	3.23				
Gamenya	1	0.22	0.66	(3.01)				
Other	7	0.35	1.78	(4.67)				
Total		25.21	98.90					

^aFor consistency with other parts of this report wheat area is presented as Area Drilled rather than Area Harvested. In effect there is no real difference between the two since only two crops of wheat which were drilled on the survey farms were not subsequently harvested.

^bArea Drilled is wheat area per survey farm growing wheat.

^cTotal Production is total production per survey farm growing wheat.

^dAverage yield is average yield per crop recorded on the survey farms. Figures in parentheses indicate that average yields were determined from less than ten farms.

because of higher baking quality, gave considerably lower average yields of 2.88 tonnes per hectare and 2.92 tonnes per hectare. For Southland survey farms the main variety (Aotea) gave an average yield of 4.39 tonnes per hectare. The six farms which grew Kopara recorded a high average yield of 5.78 tonnes per hectare. Southland "Other" varieties category which includes crops of the new variety Takahe also recorded an above average yield of 4.87 tonnes per hectare. Because of the small number of farms involved (four) no great significance should be attached to this figure.

CHAPTER 4

MANAGEMENT AND CULTURAL PRACTICES

Some of the management and cultural practices employed on the survey farms growing wheat in 1976-77 are summarised in this chapter.

Average sowing and harvesting dates varied considerably between regions (Table 13). For North Island and Southland farms wheat is almost exclusively a spring sown crop, whereas for Canterbury and South Canterbury, the majority of crops are sown in the autumn. In general, harvesting was considered to be several weeks later than average for all regions in 1977. For the survey farms Canterbury had the earliest average harvest date followed by North Island, South Canterbury and Southland.

TABLE 13
Average Sowing and Harvesting Dates^a

No. of Survey Farms growing wheat	North Island (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	All Farms Average (156)
<u>Sowing Date, 1976</u>					
Average	Sep.24	Jun.24	Jun.29	Sep.13	Jul.26
Std. Dev. ^b (days)	9	33	39	41	36
<u>Harvesting Date, 1977</u>					
Average	Feb.26	Feb.18	Mar.3	Mar.28	Mar.4
Std. Dev. ^b (days)	6	32	24	34	30

^aThe recorded average date is a simple average of the average harvest dates recorded for individual survey farms.

^bStd. Dev. is the standard deviation, which gives an idea of the range of values involved in calculating the average. For a normal distribution, 68 percent of the individual figures lie within plus or minus one standard deviation of the mean, and 96 percent lie within plus or minus two standard deviations.

The differing average sowing dates for the four survey regions are evidenced by different average sowing rates (Table 14). North Island and Southland where wheat is almost exclusively spring sown recorded higher average sowing rates than Canterbury and South Canterbury where the majority of wheat crops are autumn sown.

TABLE 14

Average Sowing Rates (kg/ha)

No. of Survey Farms Growing Wheat	North Island (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	All Farms Average (156)
<u>Sowing Rate (kg/ha)</u>					
Average	162	121	135	181	145

Tractor running costs involved in cultivation and drilling and associated labour costs make up a substantial proportion of the cost of establishing the wheat crop. Average tractor running times for cultivation and drilling are presented in Table 15.

TABLE 15

Tractor Hours for Wheat Cultivation and Drilling

No. of Survey Farms Growing Wheat	North Island (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	All Farms Average (156)
<u>Tractor Cultivation</u>					
<u>Time</u> (hrs/ha)					
-Average	3.46	4.41	3.94	3.94	4.10
-Std.Dev ^a	1.35	2.12	1.70	1.99	2.05
<u>Tractor Drilling</u>					
<u>Time</u> (hrs/ha)					
-Average	1.03	0.90	0.84	1.02	0.93
-Std.Dev ^a	0.44	0.30	0.32	0.41	0.35

^aStd.Dev. is the standard deviation, which gives an idea of the range of values involved in calculating the average. For a normal distribution 68 percent of the individual figures lie within plus or minus one standard deviation of the mean, and 96 percent lie within plus or minus two standard deviations.

For the "All Farms Average" survey farm (weighted average of the four regions) an average 4.10 tractor running hours was involved in land preparation per hectare prior to drilling. Drilling and any associated rolling and harrowing took another average 0.93 tractor running hours per hectare.

Table 16 lists a number of cultural and management practices which were involved in growing and harvesting the wheat crop and the proportion of survey farms growing wheat in 1976-77 which undertook these practices. A given practice is regarded as having been carried out on the farm even if the practice only applied to a limited amount of the wheat crop. For example, only part of the wheat crop may have been undersown with clover or only part of the wheat may have had nitrogenous fertilizer topdressed.

TABLE 16

Various Cultural and Management Practices

Cultural and Management Practice	Proportion of Farms Using Various Harvesting Methods				
	North Island (8) %	Canterbury (54) %	South Canterbury (56) %	Southland (38) %	All Farms Average (156) %
Wheat Crop Undersown with Clover	0	22	13	0	12
Fertilizer Applied at Drilling	100	87	98	100	94
Nitrogenous Fertilizer Applied at Drilling	75	26	14	53	35
Nitrogenous Fertilizer Topdressed	0	30	25	3	18
Weedicide Used	100	56	77	92	74
Insecticide Used	25	7	21	0	9
Fungicide Used	25	0	0	18	7
Wheat Irrigated	0	7	4	0	4
Grain Dried	63	11	59	76	44

^aA given practice is regarded as being carried out on a farm even if the practice only applied to a limited amount of the wheat crop.

^bFertilizer Applied at Drilling includes all fertilizers.

A number of the differences between regions in the adoption of the various cultural and management practices can be at least partly attributed to the amount of autumn and spring sown wheat grown in the region. For example, Canterbury and South Canterbury which are both predominantly autumn sown areas had a higher percentage of farms topdressing nitrogen and undersowing the wheat crop. The undersowing of the wheat crop with clover is also limited to Canterbury and South Canterbury because of climatic factors which favour the harvesting of clover seed crops in these areas. The necessity to apply fungicides and dry the harvested grain for some North Island and Southland farms is presumably due mainly to the wetter climate experienced in these regions over the growing and harvesting periods.

A large proportion of survey farms in Canterbury and South Canterbury use their own header to harvest their wheat crop whereas North Island and Southland farmers tended to favour the use of contract harvesting (Table 17). Overall, 56 percent of farms used only their own header, 39 percent used only a contractor, four percent used both their own header and a contractor and one percent sold their wheat standing.

TABLE 17
Harvesting Method

Harvesting Method	Proportion of Farms Using Various Harvesting Methods ^a				
	North Island	Canterbury	South Canterbury	Southland	All Farms Average
No. of Survey Farms Growing Wheat	(8)	(54)	(56)	(38)	(156)
	%	%	%	%	%
Own Header	38	72	68	34	56
Contractor	63	25	27	61	39
Own Header and Contractor	-	4	5	3	4
Sold Standing	-	-	-	3	1

^aRounding of the figures in this table has resulted in some of the columns not summing to exactly 100 percent.

CHAPTER 5

COSTS AND RETURNS

One of the objectives of the Wheat Growers' Survey is to provide a continuing set of statistics on economic aspects of wheat growing. The costs and returns presented in this chapter should provide a basis for comparison with the results of future surveys.

Although the costs outlined are reasonably comprehensive, no attempt has been made to present a total or complete cost-of-production figure. The figures presented include all major variable costs up to and including harvesting, and any on-farm cartage of wheat. In addition, an estimate of off-farm cartage cost was made, and overhead costs relating to farm machinery used on wheat have been calculated.

The returns (revenue) from wheat growing have been determined from the price received for, or value of, wheat at the completion of harvesting. No storage increments have been assessed and no costs relating to the storage of wheat have been included.

For the purpose of tabulating the results the costs have been classified into the following groups:

1. Establishment Costs
2. Growing Costs
3. Harvesting Costs
4. Cartage Costs, and
5. Machinery Overhead Costs.

In Table 18 total variable costs are subtracted from total revenue to give a gross margin estimate. Machinery overheads are then subtracted to give a net

return to the wheat enterprise⁽¹⁾. Statistical information relating to the reliability of the survey estimates in Table 18 are listed in Appendix A.

In the short run, wheat should continue to be grown as long as it offers growers the promise of a sufficiently attractive gross margin relative to other stock and crop enterprises. In the longer run, however, growers are faced with the prospect of replacing machinery and if returns from wheat growing are not sufficiently high, enterprises with similar gross margins but with lower machinery inputs will become relatively more attractive. The allocation of machinery overheads has been undertaken so that the significance of this aspect of wheat growing may be assessed. In calculating machinery overheads, depreciation and average book value for the year have been determined on a "current cost" basis as well as by the traditional "historical cost" method. Under historical cost accounting, depreciation is a means of allocating the original cost of the asset concerned over its expected life. The aim in calculating "current cost" depreciation is to determine that amount which would need to be set aside at the end of the year so that machinery operating capacity could be restored to its position at the start of the year. This is achieved by taking account of inflation in machinery prices⁽²⁾. Book values arrived at by the "current cost" method more closely approximate market values.

The approach taken for this survey is that the relevant costs to be considered should be those which

- (1) The "net return" might be interpreted as a return to land capital, management and other overheads (overheads excluding machinery).
- (2) See Appendix B, pages 46-48.

influence farmer decisions between competing crop and livestock enterprises. Land is assumed to be a fixed cost and no rental figure has been imputed. All costs are presented on a before-tax basis. Information for use in this report was collected from farmers well in advance of any taxation accounts being available so that all figures presented might be as current as possible. It should be noted that first year depreciation and investment incentives allowed for by the current taxation laws go some of the way toward transforming the normal historical cost (taxation) depreciation figures into "current cost" equivalents. However, they do not adequately bridge the gap [Richardson, 1977]. Enterprises not undertaking new investment do not gain from such allowances.

The wheat enterprise costs and revenues for the four regions listed in Table 18 are averages of the calculated costs and returns per hectare of wheat drilled for individual survey farms in those regions. As described previously (1), the "All Farms Average" is a weighted average of the regional figures based on the proportion of wheat growing farms in each region (Table 4). Care should be taken in interpreting the North Island figures because of the small number of farms involved.

(1) See Page 7.

TABLE 18

Summary Costs and Returns for the Wheat Crop

Item	No. of Survey Farms Growing Wheat	Average Cost (Return) (\$/ha)				All Farms Average (156)
		North Island (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	
1. Establishment Costs		80.99	52.13	51.47	72.83	60.32
2. Growing Costs		20.79	13.29	18.37	18.81	16.56
3. Harvesting Costs		51.17	20.07	32.28	62.15	37.32
4. Cartage Costs		24.19	9.77	13.29	14.80	13.12
5. Total Variable Costs ^a (1+2+3+4)		177.14	95.26	115.41	168.59	127.32
6. Machinery Overhead Costs (A) (historical cost basis)		26.02	32.61	36.03	50.92	38.11
7. Machinery Overhead Costs (B) (current cost basis)		42.95	51.69	55.68	75.96	58.87
8. Total Selected Costs (A) (5+6)		203.16	127.87	151.44	219.51	165.43
9. Total Selected Costs (B) (5+7)		220.10	146.99	170.10	244.73	186.04
10. Revenue		434.77	360.73	327.51	466.47	399.79
11. Gross Margin (10-5)		257.31	265.47	257.10	297.88	272.47
12. Gross Margin minus Machinery Overheads (A) (11-6)		231.29	232.85	221.07	246.96	234.36
13. Gross Margin minus Machinery Overheads (B) (11-7)		214.36	213.78	202.42	221.92	213.30

^aFarm labour involved in tractor work, drilling and harvesting and also tractor repairs and maintenance have been included as variable costs.

In Tables 19-24 the cost and revenue items making up the totals presented in Table 18 are detailed. A description of each cost and revenue item is given in Appendix B.

TABLE 19
Establishment Costs
1976-77

Item	Average Cost (\$/ha)					
	No. of Survey Farms Growing Wheat	North Island (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	All Farms Average (156)
(a) Cultivation and Drilling -Tractor Running Costs		8.37	10.31	9.93	6.69	9.90
(b) Cultivation and Drilling -Labour Cost		11.44	12.60	12.04	13.02	12.51
(c) Cultivation-Contractor Cost		0.00	1.46	0.00	0.00	0.61
(d) Drilling-Contractor Cost		0.77	0.46	0.00	0.56	0.43
(e) Seed Cost		33.29	19.72	21.13	31.36	24.48
(f) Seed Cartage		0.82	0.46	0.50	0.95	0.63
(g) Fertilizer Cost		25.05	6.37	6.97	15.85	10.74
(h) Fertilizer Cartage		1.26	0.76	0.89	1.39	1.01
Total Establishment Costs		80.99	52.13	51.47	72.83	60.32

TABLE 20
 Growing Costs
 1976-77

Item	No. of Survey Farms Growing Wheat	Average Cost (\$/ha)				All Farms Average (156)
		North Island (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	
(a) Harrowing and Rolling- Tractor Running Cost		0.00	0.30	0.24	0.50	0.32
(b) Harrowing and Rolling- Labour Cost		0.00	1.10	1.09	0.95	0.97
(c) Fertilizer Topdressing- Tractor Running Cost		0.00	0.02	0.01	0.02	0.02
(d) Fertilizer Topdressing- Labour Cost		0.00	0.03	0.01	0.02	0.02
(e) Fertilizer Topdressing- Contractor Spreading Cost		0.00	0.74	1.48	0.00	0.62
(f) Fertilizer Cost		0.00	4.32	2.65	0.84	2.61
(g) Fertilizer Cartage Cost		0.00	0.23	0.06	0.17	0.16
(h) Spraying - Tractor Running Cost		0.36	0.19	0.09	1.01	0.42
(i) Spraying - Labour Cost		0.42	0.26	0.11	1.22	0.52
(j) Spraying - Contractor Cost		0.84	0.17	1.16	0.44	0.52
(k) Weedicide - Material Cost		14.86	5.00	10.06	12.38	8.99
(l) Insecticide - Material Cost		2.39	0.42	1.18	0.05	0.63
(m) Fungicide - Material Cost		1.92	0.00	0.00	1.19	0.50
(n) Irrigation - Running Cost		0.00	0.47	0.13	0.00	0.22
(o) Irrigation - Tractor Running Costs		0.00	0.01	0.00	0.00	0.00
(p) Irrigation - Labour Costs		0.00	0.05	0.10	0.00	0.04
Total Growing Costs		20.79	13.29	18.37	18.81	16.56

TABLE 21
Harvesting Costs
1976-77

No. of Survey Farms Growing Wheat	Average Cost (\$/ha)				
	North Island (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	All Farms Average (156)
(a) Header Fuel Cost	0.52	0.99	0.98	0.98	0.95
(b) Header-Tractor Running Costs	0.44	1.16	1.13	1.00	1.06
(c) Harvesting Labour (excluding contractor)	1.42	4.00	4.59	2.79	3.56
(d) Heading Contract Cost	35.37	11.57	15.99	33.88	20.58
(e) Paddock to Silo Truck Fuel Cost	0.01	0.04	0.06	0.22	0.09
(f) Paddock to Silo-Tractor Running Cost	0.00	0.11	0.13	0.10	0.11
(g) Paddock to Silo-Truck Hire Cost	0.00	0.10	0.40	0.48	0.26
(h) Net Bag Cost	2.15	0.58	0.34	0.62	0.66
(i) Grain Drying-Farmer Equipment Running Cost	1.32	0.12	0.36	0.34	0.34
(j) Grain Drying-Contract Cost	8.58	0.00	5.93	20.79	7.97
(k) Crop Insurance Premium	1.36	1.41	2.36	1.94	1.76
Total Harvesting Costs	51.17	20.07	32.28	62.15	37.32

TABLE 22

Machinery Overhead Costs (A)
(historical cost basis)
1976-77

Item	Average Cost (\$/ha)				
	North Island No. of Survey Farms Growing Wheat (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	All Farms Average (156)
(a) Repairs and Maintenance (excluding Tractors)	4.40	7.44	8.41	8.09	7.59
(b) Depreciation - (15 percent diminishing value method-historical cost basis)	14.36	16.77	13.38	28.45	19.25
(c) Interest on Average Book Value (at 8.2 percent per annum)	7.26	8.48	9.29	14.38	10.26
Total Machinery Overheads (A)	26.02	32.61	36.03	50.92	38.11

TABLE 23

Machinery Overhead Costs Allocated (B)
(current cost basis)
1976-77

Item	Average Cost (\$/ha)				
	North Island No. of Survey Farms Growing Wheat (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	All Farms Average (156)
(a) Repairs and Maintenance (excluding tractors)	4.40	7.44	8.41	8.09	7.59
(b) Depreciation (15 percent diminishing value method current cost basis)	26.59	30.52	32.61	46.82	35.38
(c) Interest on Average Book Value (at 8.2 percent per annum)	11.96	13.13	14.66	21.05	15.91
Total Machinery Overheads (B)	42.95	51.69	55.68	75.96	58.87

TABLE 24

Revenue
1976-77

Source of Revenue	Average Income (\$/ha)				
	North Island No. of Survey Farms Growing Wheat (8)	Canterbury (54)	South Canterbury (56)	Southland (38)	All Farms Average (156)
(a) Wheat Board	71.71	292.23	333.85	392.27	312.34
(b) Stock Feed	282.12	61.26	16.07	51.10	66.49
(c) Seed	80.94	7.24	22.59	14.72	18.53
(d) Sold Standing	0.00	0.00	0.00	8.38	2.43
(e) Insurance Claimed	0.00	0.00	0.00	0.00	0.00
Total Revenue	434.77	360.73	372.51	466.47	399.79

REFERENCES

Hussey, D.D. and Philpott, B.P. 1970. Productivity and Income of New Zealand Agriculture, 1921-1967, A.E.R.U. Discussion Paper No.21, Lincoln College.

Johnson, R.W.M. 1977. New Zealand Ministry of Agriculture and Fisheries, New Zealand, pers. comm.

Richardson, I.L.M. 1977. Report of the Committee of Inquiry into Inflation Accounting. Government Printer, Wellington, New Zealand, p.196.

Wright, G.M. 1977. Crop Research Division, D.S.I.R. pers. comm.

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APPENDICES

APPENDIX A

RELIABILITY OF SURVEY RESULTS

This appendix provides information on the reliability of the major cost and revenue totals presented in Chapter 5.

The reliability of the various survey estimates are presented as Relative Standard Errors (R.S.E.). The R.S.E. of a particular estimated mean interpreted as follows: It is 95 percent certain that the true value of the mean is within the range (2 x R.S.E. x estimated mean). For example, the R.S.E. of the "All Farm Average" estimated gross margin is 3.7 percent. Therefore, we may be 95 percent sure that the true mean gross margin is within plus or minus $\$(2 \times 3.7\% \times 272.47) = \20.16 of the estimated mean ($\$272.47$).

TABLE 25
 Relative Standard Errors (R.S.E.) of
 Mean Estimates of Important Cost and Revenue Totals
 1976-77

Item	North Island	Canterbury	South Canterbury	Southland	All Farms Average
Establishment Costs					
-mean (\$/ha)	80.99	52.13	51.47	72.83	60.32
-R.S.E. (%)	8.5	3.4	3.4	3.5	2.3
Growing Costs					
-mean (\$/ha)	20.79	13.29	18.37	18.81	16.56
-R.S.E. (%)	24.2	16.7	10.0	13.8	8.1
Harvesting Costs					
-mean (\$/ha)	51.17	20.07	32.28	62.15	37.32
-R.S.E. (%)	20.7	11.9	11.8	8.8	5.9
Cartage Costs					
-mean (\$/ha)	24.19	9.77	13.29	14.80	13.12
-R.S.E. (%)	15.0	5.9	6.2	7.0	3.9
Total Variable Costs					
-mean (\$/ha)	177.14	95.26	115.41	168.59	127.32
-R.S.E. (%)	8.5	4.3	4.2	4.5	2.5
Machinery Overhead Costs (A)					
-mean (\$/ha)	26.02	32.61	36.03	50.92	38.11
-R.S.E. (%)	24.6	9.9	9.4	14.7	7.1
Machinery Overhead Costs (B)					
-mean (\$/ha)	42.95	51.69	55.68	75.96	58.87
-R.S.E. (%)	22.5	9.4	8.5	12.3	16.1
Total Selected Costs (A)					
-mean (\$/ha)	203.16	127.87	151.44	219.51	165.43
-R.S.E. (%)	7.4	3.9	3.5	4.6	2.4
Total Selected Costs (B)					
-mean (\$/ha)	220.10	146.99	170.10	244.73	186.04
-R.S.E. (%)	7.1	4.0	3.5	4.6	2.4
Revenue					
-mean (\$/ha)	434.77	360.73	372.51	466.47	399.79
-R.S.E. (%)	15.6	4.1	3.9	4.3	2.6
Gross Margin					
-mean (\$/ha)	257.31	265.47	257.10	297.88	272.47
-R.S.E. (%)	26.2	5.5	5.0	6.2	3.7
Gross Margin minus Machinery Overheads (A)					
-mean (\$/ha)	231.29	232.86	221.07	246.96	234.36
-R.S.E. (%)	29.1	6.2	5.7	6.6	4.2
Gross Margin minus Machinery Overheads (B)					
-mean (\$/ha)	214.36	213.78	202.42	221.92	213.80
-R.S.E. (%)	31.7	6.9	6.4	7.3	4.6

APPENDIX B

Description of Cost and Revenue Items

1. Establishment Costs

(a) Cultivation and Drilling Tractor Running Costs:

Hourly running costs for tractors used on the survey farms were based on figures presented in the Lincoln College Farm Budget Manual (1976). These were updated to take account of increased costs since the Budget Manual was prepared. The tractor running cost figure includes fuel, oil and repairs and maintenance but no depreciation or interest on capital.

For tractors 55 h.p. or less, running cost = \$1.59/hr
For tractors 56-85 h.p. running cost = \$2.07/hr
For tractors greater than 85 h.p. running cost = \$2.57/hr

(b) Cultivation and Drilling-Labour Cost:

Total labour time for cultivation and drilling was determined from the tractor hours and the number of people involved. This time was costed at \$2.41 per hour based on the average salary (\$4,214) of full time employees on survey farms plus allowance of \$25 per week for housing etc.

(c) Cultivation - Contractor Cost:

The actual amount paid for any contract work was used.

(d) Drilling - Contractor Cost:

The actual amount paid for any contract drilling was used.

(e) Seed Cost:

For each farm the total seed cost was the sum of purchased and farm grown seed. The cost of purchased seed was taken to be the actual seed cost plus any costs for dressing, treating and bags. The cost of farm grown seed was generally taken as the

previous year's milling price plus any storage increments which would have accrued up to the sowing date plus any costs related to dressing and treating the seed. An exception to this method was made where the wheat seed was retained from a crop grown specifically for seed in which case the actual value of the seed was used.

(f) Seed Cartage:

"Seed Cartage" is the cost of transporting seed to the farm. Where a grower used his own transport this was charged at the appropriate commercial transport rate for the area.

(g) Fertilizer Cost:

"Fertilizer Cost" refers to that fertilizer applied at drilling. The cost was determined as the "Works Price" minus any appropriate spreading or price subsidies. The Government subsidies for spreading fertilizer applying at the time of the first visit (up to drilling) were:

\$7.50 per tonne for commercial aerial spreading
\$4.50 per tonne for contract ground spreading
\$3.00 per tonne for farmer spreading.

(h) Fertilizer Cartage:

"Fertilizer Cartage" includes both the actual cost of cartage plus any additional purchase price where the fertilizer was bought from a depot rather than directly from the works. The transport subsidy based on the distance from the Fertilizer Works to the farm was deducted. Where farmers carted their own fertilizer, appropriate commercial rates were used to determine the cost.

2. Growing Costs

(a) Harrowing and Rolling - Tractor Running Cost

Where harrowing and/or rolling of the newly

established wheat crop was carried out, tractor running costs were determined as for "Cultivation and Drilling-Tractor Running Costs" under Establishment Costs 1 (a).

(b) Harrowing and Rolling - Labour Cost

Labour associated with any harrowing and/or rolling of the established wheat crop was costed as for Establishment Cost 1 (b).

(c) Fertilizer Topdressing - Tractor Running Cost

Tractor running costs for fertilizer topdressing were costed as described under Costs 1 (a).

(d) Fertilizer Topdressing - Labour Cost

Labour for topdressing fertilizer was costed as under Establishment Costs 1 (b).

(e) Fertilizer Topdressing - Contract Spreading Cost

The contract spreading cost is the actual amount paid by the farmer (before deduction of spreading subsidy).

(f) Fertilizer Cost

This item refers to the cost of fertilizer topdressed onto the growing crop. The amount was determined as in Establishment Costs 1 (g) except that the appropriate spreading subsidies had been changed in the interim:

\$8.50 per tonne for commercial aerial spreading

\$4.00 per tonne for contract ground spreading

\$2.50 per tonne for farmer spreading

(g) Fertilizer Cartage Cost

Fertilizer cartage cost for fertilizer topdressed onto the growing crop was calculated as under Establishment Costs 1 (h).

(h) Spraying - Tractor Running Cost

Where spraying was carried out using a tractor the tractor running cost was determined as for Establishment Costs 1 (a).

(i) Spraying Labour Cost

Farm Labour involved in spraying operations was costed as under Establishment Costs 1 (b).

(j) Spraying - Contractor Cost

Amount paid for contract spraying of wheat crop.

(k) Weedicide - Material Cost

(l) Insecticide - Material Cost

(m) Fungicide - Material Cost

(n) Irrigation - Running Cost

Where any irrigation plant used an electric, deisel or petrol motor the estimated cost was included under this heading.

(o) Irrigation - Tractor Running Costs

Where a tractor was used for pumping or rebordering the tractor running cost was determined as described under Establishment Costs 1 (a).

(p) Irrigation - Labour Costs

Farm labour involved in irrigation was costed as for Establishment Costs 1 (b).

3. Harvesting Costs

(a) Header Fuel Cost

This is the estimated fuel cost of harvesting where a grower used his own self-propelled header.

(b) Header - Tractor Running Costs

Where a grower's own header was tractor-pulled

the tractor running cost was calculated as described under Establishment Costs 1 (a).

(c) Harvesting Labour

All farm labour (not contractors) involved in harvesting was costed at \$2.41 per hour as outlined in Establishment Costs 1 (b).

(d) Heading - Contract Cost

This covers the total contract cost to the farmer and includes the actual harvesting cost (machinery plus labour) and in some cases cartage to the farmer's silo.

(e) Paddock to Silo - Truck Fuel Cost

This item refers to on-farm cartage of the wheat to the farmer's silo.

(f) Paddock to Silo - Tractor Running Cost

Tractor running costs of cartage of harvested wheat to the silo was determined as outlined under Establishment Costs 1 (a).

(g) Paddock to Silo - Truck Hire Cost

This item includes the cost of hire of trucks or trailers to take wheat from the paddock to the silo where this was not included in the contract heading cost.

(h) Net Bag Cost

Although most wheat is harvested in bulk some is bagged. The cost of the bags involved was entered as the purchase price minus the salvage value after use.

(i) Grain Drying - Farmer Equipment Running Cost

Where a grower dried wheat and used his own equipment the estimated fuel or electricity cost was entered under this heading.

(j) Grain Drying - Contract Cost

Where grain was contract dried, the cost of drying plus any additional cartage required was entered.

(k) Crop Insurance Premium

4. Cartage Costs

Actual cartage costs for wheat were not available for most farms at the time the survey was undertaken. Hence, the cartage costs presented are imputed values. The total amount of wheat harvested is assumed to be carted to the nearest rail station at the appropriate commercial rate for the area. For wheat which is to be sold to the Wheat Board this should be an accurate estimate of the true cost since the Wheat Board Price for wheat is a f.o.r. price. Of the wheat not sold to the Wheat Board some might be expected to be retained on the farm as seed or feed but a major portion is sold off-farm.

5. Total Variable Costs

This is the sum of Establishment Costs, Growing Costs, Harvesting Costs and Cartage Costs. It should be noted that certain farm labour associated with the wheat enterprise has been included as a variable cost.

6. Machinery Overhead Costs (A)

Machinery overhead costs are allocated to the wheat enterprise on the basis of usage. This was determined as follows:

Tractors, Headers and

Grain Drying Equipment = $\frac{\text{hours on wheat}}{\text{total hours for the year}}$

Irrigation Equipment = $\frac{\text{area of wheat irrigated}}{\text{total area irrigated with the same equipment}}$

Cultivation and Spraying

Equipment, Trucks, Drills, Trailers and Grain Augers = $\frac{\text{area of wheat}}{\text{total area cultivated for the year}}$

(a) Repairs and Maintenance

This item includes repairs and maintenance on machinery and equipment used on the wheat enterprise for the 1976-77 wheat crop year. Repairs and maintenance on tractors is excluded because this is estimated in the running cost figures (see Establishment Costs 1 (a), page 39.

(b) Depreciation

For Machinery Overhead Costs (A) depreciation was calculated by the diminishing value method (15 percent per annum) based on the historical cost. Depreciation in year $n = \text{Cost}_0 \times (0.85)^{n-1} \times 0.15$ where Cost_0 is the historical cost.

(c) Interest on Average Capital

Using the diminishing value depreciation method outlined under (b) an average book value (depreciated) was determined for each item of plant and machinery used on wheat. The interest on average capital was then imputed at 8.2 percent. This is a weighted average of (1) the average overdraft interest rates of Trading Banks applying to Agriculture at September 1976, and (2) the normal rate being charged by Stock and Station Agents at that time.

7. Machinery Overhead Costs (B)

Machinery overhead costs are allocated to the wheat enterprise as described under item 6 "Machinery Overhead Costs (A)".

(a) Repairs and Maintenance

As described under item 6 "Machinery Overhead Costs (A)".

(b) Depreciation

For Machinery Overhead Costs (B) depreciation was calculated on a current cost basis. The historical cost of machinery used on the wheat enterprise

was inflated by a machinery price index⁽¹⁾ and diminishing value depreciation (15 percent) was then calculated from the updated cost.

$$\text{Depreciation in year } n = \text{Cost}_0 \times \frac{I_n}{I_0} \times (0.85)^{n-1} \times 0.15$$

Where Cost_0 = historical cost (year $n = 0$)

I_n = inflation index at the end of year n , and

I_0 = inflation index at the time of purchase (year $n = 0$).

(c) Interest on Average Capital

Interest on Average Capital was determined as described previously under Machinery Overhead Costs (A). However, for Machinery Overhead Costs (B) the book values were determined by the current cost method outlined under (b) above.

(1) The Statistics Department publishes a Farming Capital Expenditure Index dating from 1971. Hussey and Philpott [Hussey and Philpott, 1970] in updating previous work on productivity and income in New Zealand Agriculture, presented a plant and machinery prices index for the period 1921/22 to 1968/69. The Ministry of Agriculture and Fisheries [Johnson, R.W.M., 1977] has extended this index and linked it to the combined Transport Vehicles and Tractors and Farm Machinery series of the Statistics Department Farming Capital Expenditure Price Index.

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