SPECIAL STUDY No. 12

Interregional Competition in Canadian Cereal Production

by

W. J. Craddock

prepared for the

Economic Council of Canada

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PREFACE

In recent years, the Canadian cereal economy has been characterized by large and growing inventories of wheat and feed grains. Two possible solutions exist to this problem. Either demands must be expanded or the production of these crops reduced. This Report explores the regional impact of following the latter of these two alternatives if crops are produced in those areas which have the greatest economic advantage. That is, the Study determines the comparative economic advantage of different geographical regions of Canada in producing specified domestic and export requirements of food and feed grains. Regional efficiency in crop production is based on production costs, crop yields, and transportation costs to point of demand. The results were obtained from solving large linear programming models by advanced computer hardware. The analysis should be considered as only a first step in determining interregional comparative advantage. There are many limitations to the Study. Much further research is necessary before definitive agricultural policies can be formulated with recognition of regional differences in productive efficiency.

The author is indebted to the Economic Council of Canada for providing the financial support for the Study. In particular, appreciation is extended to Dr. Ludwig Auer for initiating the project and for his invaluable assistance throughout its duration.

Many people in the Department of Agricultural Economics, University of Manitoba, made significant contributions to the project. Special recognition must be given to two graduate students, Mr. Daryl F. Kraft and Mr. Craig V. Fulton, who were co-project leaders along with the author. Mr. Kraft formulated most of the basic relationships for the estimation of power and machinery costs, and played a major role in conducting all surveys and analysing the resulting information. In addition, he was responsible for deriving all transportation costs and for much of the work in determining regional and national demands for cereals. Mr. Fulton assumed full responsibility for estimating regional trends in crop yields and acreages. Each of these men made many other contributions, both in terms of specific analyses, and in formulating the overall conceptual and methodological framework of the Study.

A number of research assistants were employed on this project. However, the author would like to explicitly acknowledge the contributions of Lynn Schlamb, Clark Roberts, Robert Roehle, Liisa Ikonen, Glen Slater, Donald Kowal, Barbara Deviaine, and Roslyn Beswick. The computer programming assistance provided by Mr. Neil Longmuir was essential to the success of the Study.

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CHAPTER 1

OBJECTIVES AND GENERAL PROCEDURE

GENERAL PROBLEM

Many Western Canadian grain producers are currently experiencing economic hardship unparalleled in recent history. Export clearances of wheat during the 1967-68 crop year were only about 60 per cent of their average level for the previous four years and declined even further in 1968-69. Wheat and feed grain stocks at the beginning of the 1968-69 crop year were at unprecedented high levels. Since commercial storage facilities are filled to near capacity, declining export markets have been directly reflected in low farm marketings of grain. Many Prairie grain farmers are on the verge of insolvency due to low levels of cash income and high expenditure commitments.

Even though wheat exports in the past two years have been significantly less than in the mid-1960's, it is unlikely that the current large grain inventories represent a short-run problem. The underlying premise of this Study is that the present situation in the cereal industry is a manifestation of long-term imbalances in resource utilization. That is, the acreage of cropland devoted to the production of wheat and feed grains is too large in relation to their long-term demand prospects. While policies can be devised to alleviate the Western farmers' current cash income shortage, such measures can only be considered to deal with the symptoms and not the causes of the Prairie grain problem. Resources must be shifted to other uses if the agricultural industry is to remain in an economically viable position within the Canadian economy.

The current problem of surplus cereal grains did not suddenly arise in the past one or two years. Wheat stocks have been abnormally large for the past 16 years. During the early and mid-1960's, inventory accumulation leveled off due to large export sales to the Communist-bloc countries. However, even in this period, stocks were at high levels. During the crop years 1963-64 to 1966-67, export sales each year were greater than had been experienced in any previous year; yet average production during this period was still slightly greater than the total of export plus domestic use of wheat. Farmers not only shifted land previously producing other grains into wheat, but also brought new land into production in response to the exceptionally large export sales.

The relative magnitudes of wheat stocks, annual production, and disposition are illustrated in Table B.1, and Figure 1.1. Accumulated stocks have been greater than the total of export sales plus domestic consumption in 10 of the past 16 years. Over the crop years 1953-54 to 1968-69, wheat production averaged 544 million bushels per year while the average disposition of wheat for both export and domestic purposes was 515 million bushels. Hence, on average, wheat stocks have been accumulating at the rate of 29 million bushels per year for the past 16 years. The carry-over of wheat into the 1969-70 crop year was 11 per cent greater than the total disposition of wheat in 1963-64, the year of record export sales. Estimated production for 1969-70 in relation to anticipated wheat sales indicates that a further 200 million bushels will be added to stocks during the coming year.

Surplus wheat stocks are not unique to Canada. However, Canada holds a disproportionate share of the surpluses in relation to its share of the world export market. Over the past several years our exports have been 25 to 30 per cent of the total for Argentina, Australia, Canada and the United States; yet we have accounted for 40 to 45 per cent of the wheat stocks held by this group of countries.

The prospects for Canadian export sales of wheat in the foreseeable future are not optimistic. The Federal Task Force on Agriculture has estimated that the export demand for Canadian wheat might be approximately 360 million bushels per year over the next decade.[1] This compares with average exports of 360 million bushels since 1953-54 and 524 million bushels during the period 1963-64 to 1966-67.

The Canadian wheat economy is in disequilibrium with respect to the quantity of resources employed in wheat production. Land currently used to produce wheat must be employed in the production of other crops or pasture. However, while the wheat surplus problem emanates from Western Canada, it does not necessarily hold that all adjustments in resource use should take place in this region if the wheat industry is to be brought into balance.

Many interdependencies exist within Canadian agriculture. Long-run changes in the cropping patterns in one region of the country can necessitate changes in other regions, depending on their competitive position in production. One cannot assume *a priori* that all resource adjustments should take place in Western Canada. If wheat production were to decrease in the Prairies, a shifting of resources to feed grain production could affect the competitive position of these crops in Central Canada and the Maritimes.

Neither does it hold that all areas of Eastern or Western Canada should undergo the same adjustments in land use if production is to be brought into line with demand. Some areas of the Prairies can produce wheat more efficiently than feed grains. The opposite is true for other regions. Certain areas are not particularly well-suited to the production of any cereal grains. Likewise, some regions in Eastern Canada are very efficient in cereal production, while others are not.

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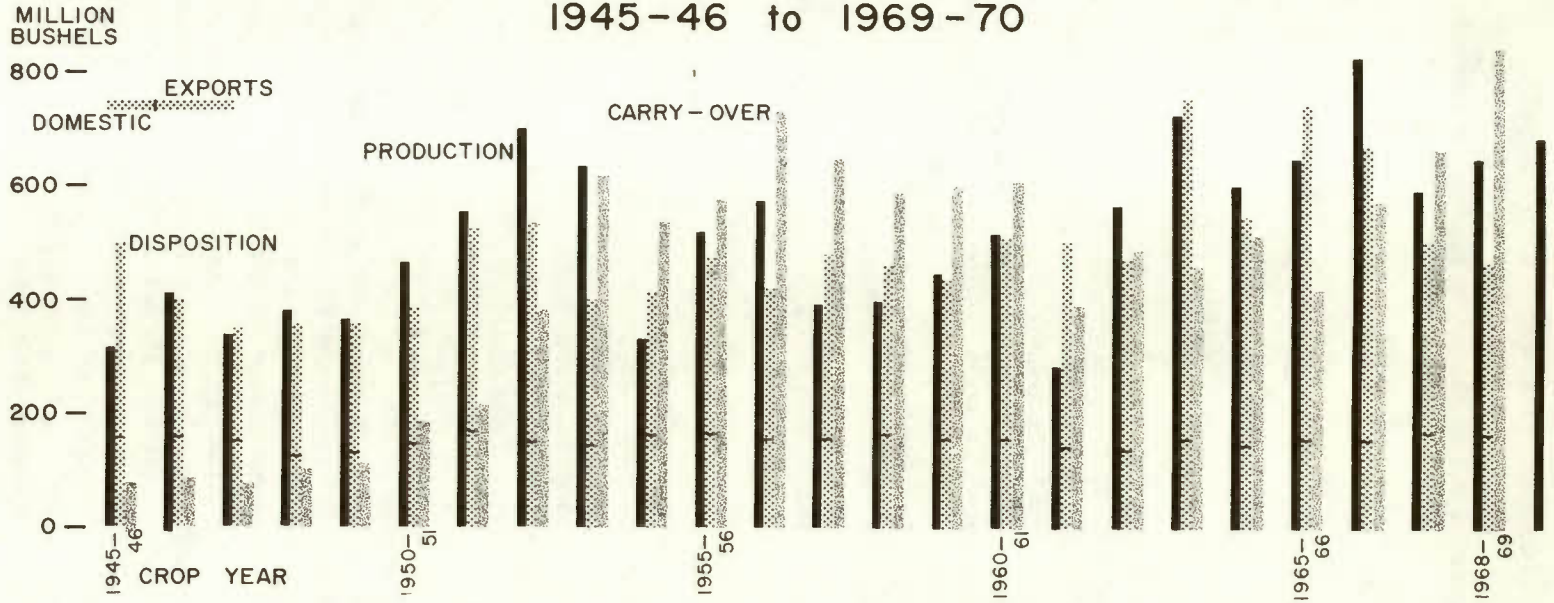
[1] Federal Task Force on Agriculture, *Wheat, Feed Grains and Oil Seeds*, a paper prepared for the Canadian Agricultural Congress, Ottawa, 1969.

FIGURE 1.1

SUPPLY AND DISPOSITION OF CANADIAN WHEAT
1945-46 to 1969-70



Agricultural policies designed to stimulate the reallocation of resources to alternative opportunities should recognize regional differences in productive capabilities. Canada's competitive position in export markets may be decidedly enhanced if regional comparative advantage in production is emphasized. Also, economic progress of the nation as a whole might be stimulated if production takes place in as efficient a manner as possible.

SCOPE OF THE STUDY

The objective of this Study is to determine the long-run competitive position of different areas of Canada in producing cereal crops, taking into consideration their proximity to domestic and export markets. Regional cropping patterns will be estimated that would permit national economic efficiency in cereal crop production for specified levels of annual demand. Some areas of Canada will be identified as partially or totally uncompetitive in supplying these demands. This Study does not specify how this uncompetitive land should be utilized. In certain areas it may be suited to the production of crops other than cereals. In some areas, pasture or forage may be the best alternative. It is not inconceivable that some land which is currently used in cereal production should be removed from all agricultural production if cereal markets do not improve, and if it is desired to produce the required output at the lowest economic cost.

Because this Study is directed at examining economic efficiency in cereal crop production for the entire nation, it must necessarily ignore some of the diversity in resource and management capabilities that exists in any given region. Hence, while the results might specify that all land in a region is inefficient for cereal crop production, it is possible that exceptional farm units might exist in the region and be strongly competitive. At the same time, small inefficient farms might be present in regions otherwise identified as being highly efficient. The analysis attempts to identify general tendencies in productive efficiency, giving as much attention to regional detail as research resources would permit.

Many adjustment problems would be encountered in implementing the estimated land use patterns. The social cost could be high in terms of finding acceptable alternatives for both farmers and the nonfarm communities in uncompetitive regions. It is possible that the economic gain from producing in the most efficient manner is not large enough to warrant the associated social upheaval. This Study does not attempt to answer this question.

This is the first attempt in Canada to estimate the optimal location of cereal crop production. Many pioneering problems of both a conceptual and methodological nature were encountered. The lack of reliable, relevant data severely impeded the Study. The analysis is incomplete in the sense that it deals with cereal crop production in isolation from livestock production. Regional livestock feed requirements are included; the question of the most efficient location of livestock production is not answered. While this is a serious deficiency of the Study, it can

nevertheless be considered a first approximation in determining the competitive position of different regions in agricultural production.

METHODS AND PROCEDURES[2]

General Approach

The cost of production per bushel, together with transportation charges to export and domestic markets, was used to determine a region's comparative advantage in cereal production relative to other regions. The specific objective was to determine the pattern and location of cereal crop production that would minimize the combined production and transportation costs for the nation, as a whole, in meeting specified levels of annual cereal demand.

An alternative approach would have been to find the pattern of production and distribution that would maximize profits for farmers. Such an analysis would give results identical to those achieved from the cost minimization approach if regional differences in cereal grain prices reflect regional transportation rate structures, and if regional quality differences are reflected in their cost of production. It is unlikely that major discrepancies in regional prices prevail over extended periods of time. The cost minimization approach was adopted in this Study partly because of difficulties in obtaining data that accurately reflect long-term differences in regional cereal prices.

Linear programming was the analytical technique used in this Study. Linear programming permits a quantifiable objective to be optimized (minimized or maximized), subject to certain quantitative constraints on the variables in the system. The solution procedures are somewhat similar to solving a large system of simultaneous equations in which the optimal solution maximizes or minimizes the objective. In this Study, some of the constraining conditions imposed on the minimization of production and transportation costs were the amount of land suitable for cereal crop production in each region, the amount of grain required for domestic and export purposes, and the capacity of the transportation and distribution system.

Several different linear programming models were specified to test the impact of different demand conditions and policy alternatives on the most efficient production location. Most of the research input for this Study was expended in specifying these models and obtaining data that adequately reflected production and transportation costs, crop yields, acreage and other constraints. The solving of the linear programming models involved only a small part of the total research input, including computer time.

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[2] A complete description of estimation procedures and supporting data is given in Appendixes A and B.

Model Development

Base year–It was necessary to limit the analysis to one particular point in time. The year 1966 was selected because it was the most recent period for which annual and census data were available when this Study was initiated. The analysis is *not* peculiar to any cyclical abnormalities in cereal production that existed in the base year. When they did occur, their influence was removed through trend analysis. It must be emphasized, however, that the results of this Study are specific to the base year and the specified cereal demands. Different acreages of inefficient land would be found for alternative levels of demand. The conclusions would also be different for future time periods if per-bushel production costs changed over time at different rates in different regions, of if there were substantial changes in cultivated acreage. It is unlikely that such changes would be of sufficient importance over short periods of time (three or four years) to materially alter the conclusions of this analysis. For projections encompassing periods of several decades, it would be mandatory to extend the estimation of costs, yields, and land supply beyond the base year.

Crops selected–The crops included as production alternatives were wheat, oats, barley, rye, mixed grains, and corn. Only the first four crops were considered for Western Canada since mixed grains and corn have historically comprised a very small percentage of the total cereal crop acreage. No distinction was made between the several classes of wheat, such as durum and winter wheats, except in Ontario where spring wheat and winter wheat were treated as separate crops. The analysis of corn production was limited to Ontario because of its lack of historical significance in other provinces, and correspondingly the paucity of data relevant to its production. For similar reasons, rye production was not considered in the Maritime Provinces.

Region delineation–The Canadian nation was separated into 188 producing regions. The selection of a regional unit was largely determined on the basis of geographical boundaries used for data collection by the Dominion Bureau of Statistics. The regions consist of crop reporting districts and census divisions in Western Canada, and counties in Eastern Canada.[3]

The inclusion of a number of counties or crop districts per region would have greatly simplified the analysis. However, it was considered that sufficient heterogeneity existed between these geographic areas, in terms of production costs and yields, to warrant their treatment as individual units.

The 188 producing regions included in this Study encompass all areas of Canada that have historically produced cereal grains, with the exception of

[3] Because of data problems, it was sometimes necessary to aggregate more than one county or census division into a region. This occurred in the Maritimes and in several instances in Quebec and Alberta. In this aggregation, only contiguous regions were combined.

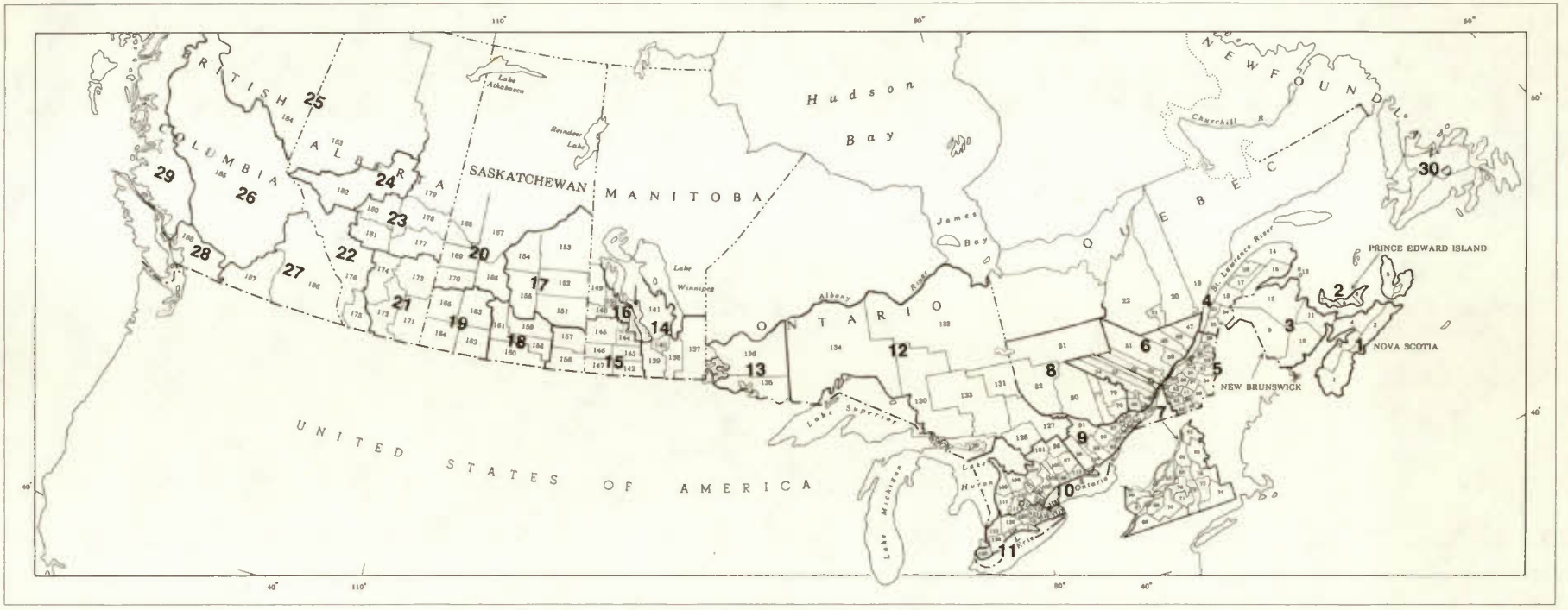

FIGURE 1.2 LOCATIONS AND REFERENCE NUMBERS FOR PRODUCING AND CONSUMING OR SUPPLYING REGIONS.

Newfoundland and two areas in British Columbia.[4] The 188 regions are distributed by province as follows: Nova Scotia 5 regions, Prince Edward Island 3, New Brunswick 4, Quebec 70, Ontario 54, Manitoba 14, Saskatchewan 20, Alberta 13, and British Columbia 5 regions. For ease of identification each producing region has been assigned a number.

The 188 producing regions were aggregated to form 29 domestic demand or consumption regions. This aggregation was necessitated to reduce the overall problem to a manageable size.[5] While consuming regions typically consist of more than one producing region, their boundaries do not overlap. One additional consumption region was identified in Newfoundland to make a total of 30. Export demands were established at 12 ports. The producing regions that comprise each consuming region are identified in Table 1.1. A map of producing and consuming regions is given in Figure 1.2.

TABLE 1.1

IDENTIFICATION OF COUNTIES OR CROP DISTRICTS
WITHIN PRODUCING AND CONSUMING OR SUPPLYING REGIONS

Consuming or Supplying Region	Producing Region	Counties, Crop Districts or Census Divisions*
1	1	Digby, Yarmouth, Shelburne, Queens and Lunenburg
	2	Annapolis, Kings and Hants
	3	Cumberland, Colchester, Pictou and Antigonish
	4	Halifax, Guysborough and Richmond
	5	Cape Breton, Inverness and Victoria
2	6	Kings
	7	Prince
	8	Queens
3	9	Carleton, York, Victoria and Madawaska
	10	Charlotte, Kings, Queens, St. John and Sunbury
	11	Albert, Kent and Westmorland
	12	Gloucester, Northumberland and Restigouche
4	13	Îles-de-la-Madeleine
	14	Gaspé-Est and Gaspé-Ouest
	15	Bonaventure
	16	Matane
	17	Matapédia

[4] The regions excluded in British Columbia were crop districts 4 and 6 (Vancouver Island and the coastal area) which together produced less than 1,600 acres of cereal grains in 1966. Most of this acreage was harvested as forage rather than grain. Cereal demands in these regions were explicitly considered, however.

[5] Current computer technology is not capable of solving a linear programming problem of the magnitude that would have resulted if each producing region were considered as a consuming region.

TABLE 1.1 (continued)

Consuming or Supplying Region	Producing Region	Counties, Crop Districts or Census Divisions*
	18	Rimouski
	19	Saguenay
	20	Chicoutimi
	21	Lac-St-Jean-Est
	22	Lac-St-Jean-Ouest
	23	Rivière-du-Loup
	24	Témiscouata
	25	Kamouraska
5	26	L'Islet
	27	Montmagny
	28	Bellechasse
	29	Lévis
	30	Dorchester
	31	Beauce
	32	Lotbinière
	33	Mégantic
	34	Frontenac
	35	Nicolet
	36	Arthabaska
	37	Wolfe
	38	Compton
	39	Stanstead
	40	Sherbrooke
	41	Richmond
	42	Drummond
	43	Yamaska
	44	Bagot
	45	Shefford
	46	Brome
6	47	Charlevoix-Est and Charlevoix-Ouest
	48	Montmorency No. 1 and Montmorency No. 2
	49	Québec
	50	Portneuf
	51	Champlain
	52	Maskinongé
	53	St-Maurice
7	54	Montcalm
	55	Joliette
	56	Berthier
	57	Terrebonne
	58	Argenteuil
	59	Deux-Montagnes
	60	L'Assomption
	61	Richelieu
	62	Verchères

TABLE 1.1 (continued)

Consuming or Supplying Region	Producing Region	Counties, Crop Districts or Census Divisions*
	63	St-Hyacinthe
	64	Chambly
	65	Île-de-Montréal and Île-Jésus
	66	Vaudreuil
	67	Soulanges
	68	Huntingdon
	69	Beauharnois
	70	Châteauguay
	71	Napierville
	72	St-Jean
	73	Iberville
	74	Missisquoi
	75	Rouville
	76	Laprairie
8	77	Hull-Gatineau
	78	Papineau
	79	Labelle
	80	Pontiac
	81	Abitibi
	82	Témiscamingue
9	83	Prescott
	84	Glengarry
	85	Russell
	86	Stormont
	87	Carleton
	88	Dundas
	89	Grenville
	90	Lanark
	91	Renfrew
	92	Leeds
	93	Frontenac
	94	Lennox-Addington
	95	Prince Edward
	96	Hastings
10	97	Peterborough
	98	Haliburton
	99	Durham
	100	Victoria
	101	Muskoka
	102	Ontario
	103	York
	104	Simcoe
	105	Halton
	106	Peel
	107	Dufferin

TABLE 1.1 (continued)

Consuming or Supplying Region	Producing Region	Counties, Crop Districts or Census Divisions*
	108	Grey
	109	Bruce
	110	Wellington
	111	Perth
	112	Huron
	113	Northumberland
11	114	Wentworth
	115	Waterloo
	116	Lincoln
	117	Welland
	118	Haldimand
	119	Norfolk
	120	Oxford
	121	Brant
	122	Lambton
	123	Middlesex
	124	Elgin
	125	Essex
	126	Kent
12	127	Nipissing
	128	Parry Sound
	129	Manitoulin
	130	Algoma
	131	Timiskaming
	132	Cochrane
	133	Sudbury
	134	Thunder Bay
13	135	Rainy River
	136	Kenora
14	137	6 (Manitoba)
	138	5 (Manitoba)
	139	3 (Manitoba)
	140	4 (Manitoba)
	141	12 (Manitoba)
15	142	2 (Manitoba)
	143	8 (Manitoba)
	144	9 (Manitoba)
	145	10 (Manitoba)
	146	7 (Manitoba)
	147	1 (Manitoba)
16	148	11 (Manitoba)
	149	13 (Manitoba)
	150	14 (Manitoba)
17	151	5A (Saskatchewan)

TABLE 1.1 (continued)

Consuming or Supplying Region	Producing Region	Counties, Crop Districts or Census Divisions*
	152	5B (Saskatchewan)
	153	8A (Saskatchewan)
	154	8B (Saskatchewan)
	155	6A (Saskatchewan)
18	156	1A (Saskatchewan)
	157	1B (Saskatchewan)
	158	2A (Saskatchewan)
	159	2B (Saskatchewan)
	160	3AS (Saskatchewan)
	161	3AN (Saskatchewan)
19	162	3BS (Saskatchewan)
	163	3BN (Saskatchewan)
	164	4A (Saskatchewan)
	165	4B (Saskatchewan)
20	166	6B (Saskatchewan)
	167	9A (Saskatchewan)
	168	9B (Saskatchewan)
	169	7A (Saskatchewan)
	170	7B (Saskatchewan)
21	171	1 (Alberta)
	172	2 (Alberta)
	173	4 (Alberta)
	174	5 (Alberta)
22	175	3 (Alberta)
	176	6, 9 (Alberta)
23	177	7 (Alberta)
	178	10 (Alberta)
	179	12 (Alberta)
	180	11 (Alberta)
	181	8 (Alberta)
24	182	13, 14 (Alberta)
25	183	15 (Alberta)
	184	7 (British Columbia)
26	185	5 (British Columbia)
27	186	1 (British Columbia)
	187	2 (British Columbia)
28	188	3 (British Columbia)
29	–	4, 6 (British Columbia)
30	–	Newfoundland

*The geographic units are counties in Eastern Canada; crop districts in Manitoba, Saskatchewan and British Columbia; and census divisions in Alberta.

Farm size–Each producing region was assumed to consist of one or two different farm sizes in terms of acreage. Quebec was the only province for which one farm size was identified. These farm sizes were considered to be representative of all farms in the region in terms of production costs and yields. Representative farm sizes differed by province but were the same for all producing regions within a province.

In reality many different sizes of farms exist. Furthermore, even two farms of a similar acreage in the same neighbourhood are likely to have different yield and cost structures. However, in an interregional analysis, consideration of every farm or unique group of farms would be beyond the scope of research resources. For the purpose of this Study, it was assumed that one or two sizes of farms could reflect the production cost structures that exist in any given region.

The representative farm sizes are specified by province in Table B.3. Throughout this publication the smaller of the two sizes for any region will be referred to as "small" farms, while the second size class will be specified as "large" farms.

Crop yields–A base-year yield was estimated for every crop considered as a production alternative in a region. Because crop yields are subject to year-to-year variations due to weather fluctuations and other factors, actual 1966 yields were not used. Rather, a "normalized" yield was estimated by trend analysis. A time period of sufficient duration was selected so that the influences of technological advances and improved managerial practices on yield increases could be measured apart from cyclical variations due to weather phenomena. Crop yield data are only available by crop district or county. Hence, it was not possible to identify a different yield for each of the two sizes of farms in a region.

It should be re-emphasized that the estimated 1966 yields differ from the actual yields observed in that year. The yields used in this Study are long-run trend levels and are not to be confused with the actual 1966 yields, which may be higher in some regions due to favourable weather and lower in others because of poor growing conditions in that particular year.

Production costs–A per-acre cost of production was required for every crop that could be produced in a region for each of the two representative sizes of farms. In the Prairies, an estimate was necessary for both summerfallow and stubble crops as well as for the summerfallow operation itself.

The results of this Study were, in large part, determined by the differences in per-bushel production costs that exist between regions. It was therefore essential that these costs be estimated in a consistent and uniform manner for all regions for the base year 1966. The estimation of production costs comprised one of the major research activities of this project.

The principal cost items included in this analysis were power and machinery, labour, fertilizer, chemicals, and seed. Land costs, including taxes, were not considered. The price of land in a region, in large part, reflects its potential in crop production. Hence, land prices tend to be highest in regions of greatest productivity. Existing land prices have developed from an agricultural industry

geared for surplus production. To include land costs would therefore bias the analysis against efficient regions. If cropland were removed from production because of its inability to compete with other regions, its market price would be substantially less than present levels. For these reasons, land costs were not considered as relevant in determining the most efficient location of cereal production.

Machinery costs were developed from estimates of typical regional practices and types of machines used to produce each crop. Survey techniques were used to obtain this information plus estimates of implement and tractor sizes. Costs for as many different types and sizes of implements and tractors as used in a region were obtained from the principal machinery manufacturers. Regional prices were estimated which reflected existing transportation charges from the factories. A per-acre cost for each tillage operation for every crop, farm size, and region was developed, recognizing the influence on cost of soil texture, implement and field size, fuel prices, and crop yields. Machinery depreciation and repair rates were calculated so as to recognize the annual and total use of each machine in a region (for each of the two farm sizes) in relation to its useful life expectancy.

Labour costs reflect only the physical labour used in crop production at prevailing wage rates in the region. The concept of a labour return per month or year was not adopted. Although a farmer is concerned with the return to labour and management from his entire farm operation, this return is dependent not only on the quantities and types of resources that he has at his disposal, but also on the prevailing market prices for his products. This Study used production costs to determine which regions and farm sizes in Canada can most efficiently produce annual crop requirements. It does not establish levels of labour returns and hence crop prices necessary for minimum or acceptable standards of living.

Fertilizer and chemical costs were estimated on the basis of actual use per acre and prevailing 1966 prices. Seed was not explicitly included as a production cost. Instead, estimated seed requirements per acre were subtracted from estimated crop yields. This was necessary because the total demand for seed is dependent upon the acreage seeded, and the results of this Study indicated different acreages of each crop for each set of alternative assumptions.

Available acreage–The total land available for cereal production in a region was assumed equal to the 1966 acreage devoted to cereal crops. Not all land in a region is equally suited to the production of every crop. Hence, restrictions were placed on the maximum acreage of any crop that could be grown in a region based on historical variations in its seeded acreage.

Cereal grain demand–Estimates were made of the domestic regional demand for each cereal grain for milling and industrial purposes. These demands were based on 1966 rates of consumption. Cereal demands by livestock were expressed in terms of barley equivalents; minimum regional requirements for each grain were also specified. Export demands for feed grains were established at average levels for the period 1957-58 to 1966-67. Although the effect of alternative levels of feed

grain exports on the location and pattern of most efficient cereal production could have been assessed, this was not undertaken.

Three different assumptions were made with respect to wheat export demands. Export levels of 300, 350, and 420 million bushels were analysed. These demands were allocated to the 12 ports of final demand according to each port's share of export sales over the period 1963-64 to 1966-67.

Transportation–The model allows grain produced in each of the Prairie regions to be shipped: (1) directly to any consuming region for domestic consumption, and (2) to the export ports of Vancouver, Prince Rupert, Churchill and Thunder Bay. In addition, Prairie grain can be shipped from Thunder Bay to: (1) eastern consuming regions, and (2) eastern export ports. Interregional shipments of grain produced in British Columbia (other than its Peace River area[6]) are considered only to other consuming regions in British Columbia and adjacent Alberta regions. In Eastern Canada only interregional movements between Southern Ontario Regions (supplying regions 9, 10, and 11) and other eastern regions were considered. Since none of the other eastern supply regions had sufficient land resources to meet their own local feed demands, it seemed unlikely that any out-shipments of grain would take place.

The cost of moving grain between different regions was assumed equal to prevailing transportation rates plus terminal elevator storage and handling costs. Transportation charges were established for several different routings and modes of carriers for the interregional movements described above. For example, in shipping grain from Thunder Bay to Eastern Canada for domestic consumption, direct rail shipments were considered along with different combinations of water, rail, or truck movement to the region of final demand. Limits were placed on the amount of grain that could be moved through any Eastern elevator to reflect its annual handling capacity.

Explicit consideration was given to the different freight rates that exist for export and domestic movements of grain. Initially, the current level of feed freight assistance was assumed in the movement of grain for domestic livestock consumption. The impact of the feed freight subsidy on the location of cereal grain production was then determined by its removal, and observation of the resulting optimal production pattern, as generated through the models.

LIMITATIONS OF THE STUDY

A complete general equilibrium analysis would simultaneously take into consideration production costs, demand, and supply relationships for all products that compete with cereal grains in production and consumption. For Canadian agriculture, the obvious omissions of this Study include livestock and dairy production and other major crops such as oilseeds, tobacco, fruit, potatoes, and sugar beets. The production of these commodities was assumed at historical levels.

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[6]The Peace River area of British Columbia is handled in the same way as Prairie regions.

While livestock was excluded from the analysis to the extent that their optimal production location was not determined, their feed requirements nevertheless were included by specifying regional feed grain demands.

Further limitations of this Study arise from the selection of production and consumption regions. The specification of these regions was determined by data availability. Intraregional differences in soil productivity and climate detract from the homogeneity of the regions. In addition there are many different sizes of producers in a region. Cost and yield coefficients differ among farmers within a region. Grain production can be changed by using different proportions of inputs such as fertilizer.

The limitations of this approach to the analysis of regional production patterns are considerable. However, data requirements necessitate a simplified if less realistic model. It is intended that this Study will provide a building block from which more detailed and realistic analyses can proceed. Similar research directed at the question of optimal location of crop and livestock production in the United States has been in continuous progress by Earl O. Heady and his associates at Iowa State University[7] since 1956. Considerable research resources have been expended in these studies. However, they are now approaching a high degree of sophistication in terms of the agricultural policy questions they can evaluate. Notwithstanding the limitations of the present analysis, it can provide improved insight into resource adjustment on a regional basis.

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[7] The results of some of this research may be found in the following publications: Alvin C. Egbert and Earl O. Heady, *Regional Adjustment in Grain Production,* U.S. Dept. of Agriculture Technical Bulletin 1241 (with supplement), June 1961; Alvin C. Egbert and Earl O. Heady, *Regional Analysis of Production Adjustments in the Major Field Crops: Historical and Prospective,* U.S. Dept. of Agriculture Technical Bulletin 1294, November 1963; Alvin C. Egbert, Earl O. Heady, and Ray F. Brokken, *Regional Changes in Grain Production: An Application of Spatial Linear Programming,* Iowa Agricultural and Home Economics Experiment Station Research Bulletin 521, Ames, Iowa, January 1964; Leo V. Mayer, Earl O. Heady, and Dean H. Holst, *Costs of Marginal Land Retirement Programs,* Center for Agricultural and Economic Development Report No. 23, Ames, Iowa, May 1965; Earl O. Heady and Norman K. Whittlesey, *A Programming Analysis of Interregional Competition and Surplus Capacity of American Agriculture,* Iowa Agricultural and Home Economics Experiment Station Research Bulletin 538, Ames, Iowa, July 1965; Earl O. Heady and Melvin Skold, *Projections of U.S. Agricultural Capacity and Interregional Adjustments in Production and Land Use with Spatial Programming Models,* Iowa Agricultural and Home Economics Experiment Station Research Bulletin 539, Ames, Iowa, August 1965; Melvin D. Skold and Earl O. Heady, *Regional Location of Production of Major Field Crops at Alternative Demand and Price Levels, 1975,* U.S. Dept. of Agriculture Technical Bulletin 1354, April 1966; Ray F. Brokken and Earl O. Heady, *Interregional Adjustments in Crop and Livestock Production, A Linear Programming Analysis,* U.S. Dept. of Agriculture Technical Bulletin 1396, July 1968; Leo V. Mayer, Earl O. Heady, and Howard C. Madsen, *Farm Programs for the 1970's,* Center for Agricultural and Economic Development Report No. 32, Ames, Iowa, October 1968; and Leo V. Mayer and Earl O. Heady, *Projected State and Regional Resource Requirements for Agriculture in the United States in 1980,* Iowa Agricultural and Home Economics Experiment Station Research Bulletin 568, Ames, Iowa, June 1969.

CHAPTER 2

OPTIMAL CEREAL PRODUCTION LOCATION AND DISTRIBUTION PATTERNS

GENERAL APPROACH

Eight economic models were developed to represent the cereal grain economy, based on the data and assumptions outlined in the previous Chapter. These models include only the cereal grain production alternatives available to Canadian farmers, and all relevant transportation modes and routings for grain movement from production to demand location. Each production-distribution model was solved simultaneously for all cereal crops and regions in Canada. The objective was to specify the location and intensity of production for each crop and determine the grain flows between supplying regions and demand or consumption locations, which would minimize the total national cost of production and distribution. Specific demand levels for export and domestic purposes were assumed. No provision was made for inventory build-ups. Hence, based on 1966 population levels, all cropland not necessary to meet the specified annual requirements was identified as redundant or uncompetitive. Therefore, even though certain regions will have historically produced cereals, they may be identified as inefficient, relative to other regions in Canada, and should not produce these crops if certain levels of annual demand are to be met at lowest cost.

DESCRIPTION OF ALTERNATIVE ECONOMIC MODELS

The eight economic models differ only with respect to assumed levels of wheat export demand and agricultural policy objectives. Model 1 is based on a wheat export demand of 420 million bushels, with corn imports from the United States assumed equal to the 1966 level of 23 million bushels. The 420-million figure represents average wheat exports over the crop years 1960-61 through 1968-69. This level of exports was considered to represent an optimistic assessment of future wheat markets. It is somewhat greater than the projection made by the Economic Council of Canada in 1964, when they estimated that a normal level of exports by 1970 would be about 400 million bushels.[1] Production location and transportation flows for this model were optimized nationally. That is, unused land could be

[1] J. R. Downs, *Export Projections to 1970*, Staff Study No. 8, Economic Council of Canada, Ottawa, Queen's Printer, 1965.

derived for any region in Canada if that region's productive efficiency was low relative to other regions and if the assumed cereal demands were less than the nation's total productive capacity.

Models 2 and 3 are the same as Model 1 except that wheat exports are assumed at levels of 350 and 300 million bushels, respectively. Exports of 350 million bushels approximate the Federal Task Force estimates of expected market potential over the next decade.[2] The analysis for 300 million bushels of exports was undertaken to measure the competitive acreage if exports fell to their low levels of recent years. This figure is also close to Huff's projections of future export markets.[3] In his analysis, Huff estimated that by 1975 Canada could expect a wheat export market of from 235 to 285 million bushels, including sales to Communist-bloc countries.

Model 4 is the same as Model 2 except that it was assumed that there were no corn imports. The demands previously met by imported corn thus had to be supplied by domestic production. Feed requirements were not necessarily filled by domestically produced corn, however. Feed grains and wheat from any region in Canada could compete for the feed grain market previously filled by imported corn, based on their production and transportation costs relative to other regions.

The fifth and sixth models are comparable to Models 1 and 2, respectively, except that in Models 5 and 6 it was assumed that the federal feed freight assistance subsidy was not available for the movement of feed grains.[4] The transportation costs were thus equal to their unassisted levels. The purpose of this analysis was to ascertain the effect of the feed grain subsidy on the location of cereal grain production. Extreme caution must be exercised in examining these results, however. It must be remembered that this Study does not determine the most efficient location of livestock production. It is quite conceivable that the removal of this subsidy would affect the competitive location of both grain and livestock production.

Models 7 and 8 differ from the others in that it was assumed that all acreage adjustments in response to insufficient demand would fall on the Prairies. These models were therefore constructed so that all of the cropland in Eastern Canada and British Columbia[5] would be fully utilized. Models 7 and 8 are the same as

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[2] Federal Task Force on Agriculture, *Wheat, Feed Grains and Oil Seeds*, a paper prepared for the Canadian Agricultural Congress, Ottawa, 1969, p. 13. In this paper, wheat exports for 1980 were projected at 360 million bushels, However, a range of from 265 to 510 million bushels was specified.

[3] Bruce H. Huff, "Canada's Future Role in the World Wheat Market", *Canadian Journal of Agricultural Economics*, February 1969.

[4] The feed freight assistance subsidy was initiated in 1941 to offset the cost of shipping Western feed grains from Thunder Bay to local demands in Eastern Canada, and was extended in 1951 to cover shipments from Alberta points to British Columbia. A comprehensive description of the reasons for the subsidy, its development and changes in objectives is given in T. C. Kerr, *An Economic Analysis of the Feed Freight Assistance Policy*, Agricultural Economics Research Council of Canada Publication No. 7, 1966, pp. 1-24.

[5] The Peace River area of British Columbia was treated the same as the Prairies. In much of the discussion of the results of this Study, this area is considered a part of the Prairies or Alberta rather than British Columbia. This was done because of the greater similarity in farming operations in the Peace River area with the Prairies than with the rest of British Columbia.

Model 2 in terms of demand conditions. Wheat exports of 350 million bushels and 1966 levels of corn imports were assumed in each model. In Model 7, each region and farm size in the Prairies competes for the available markets on the basis of their relative productive efficiencies. It would be expected that a greater total cost of production and distribution would result for this model compared with Model 2, since all land in Eastern Canada and British Columbia would be retained in production regardless of its relative productive efficiency. The actual extent of the cost difference would depend on the number of acres in these regions that are not competitive, and their difference in production and distribution costs compared with marginal regions in the Prairies.

In Model 8, it was assumed that all regions and farm sizes in the Prairies would reduce their acreage by the same percentage to bring production into balance with demand. Like Model 7, all cereal cropland in Eastern Canada and British Columbia was kept in production regardless of its competitive position relative to the Prairies. In both models, however, while all land was utilized in these areas, the production location of different crops was determined so that total production and distribution costs would be minimized. Likewise, in the Prairies, production was optimally located for the assumed land supplies.

A comparison of the results of Models 7 and 8 will give some indication of the effect of treating all producers in the Prairies equally when surplus productive capacity exists. This is somewhat analogous to the effect of the current system of leveling equal grain marketing quotas in all regions. The total production and transportation cost for Model 8 would be expected to be greater than for Model 7. The same proportion of land in each region will be withheld from cereal production. Efficient regions will therefore produce less than in Model 7, while inefficient regions will produce more.

The underlying assumptions which change from one model to the next are summarized in Table 2.1.

TABLE 2.1

DIFFERING ASSUMPTIONS FOR ALTERNATIVE MODELS OF OPTIMAL CEREAL PRODUCTION LOCATION

	Model Number							
	1	2	3	4	5	6	7	8
Wheat exports (millions of bushels)	420	350	300	350	420	350	350	350
Corn imports (millions of bushels)	23	23	23	0	23	23	23	23
Feed freight assistance subsidy	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Possibility of surplus acreage in Eastern Canada and British Columbia*	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Possibility of different proportions of surplus acreage by region in Prairies*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

*The Peace River area of British Columbia was treated as part of the Prairies.

FINDINGS

Provincial Acreage Effects

In all models, the acreage employed in cereal production in 1966 was in excess of that needed to meet assumed export plus domestic cereal grain requirements. Efficient regional production patterns indicated that for moderate and low levels of wheat exports, uncompetitive acreage existed in all provinces. Most of the land was in the Prairies, however. The uncompetitive acreage in each province is given in Table 2.2, together with its percentage of both the provincial and national available cereal land.

The solution for Model 1, which was based on the average exports of the past decade, underscores the present surplus condition of the cereal grain economy. Total grain demand, including wheat exports of 420 million bushels, could be met with 2,197,215 fewer acres. This is about 3 per cent of the total acres cultivated for cereal production in 1966. Nearly 80 per cent of this acreage is in the Prairies, with much of the inefficient land found in Alberta. No land was identified as uncompetitive in Saskatchewan for this model.

A decrease in wheat exports, as depicted in Models 2 and 3, further reduced the required acreage in cereal crops. With wheat exports of 350 million bushels (Model 2), over seven million acres are identified as unnecessary for cereal production. A large part of this acreage (46 per cent) is found in Alberta. With a further decline in wheat exports to 300 million bushels (Model 3), there is a significant acreage of uncompetitive land in Saskatchewan (2,408,704 acres).

While a large percentage of the provincial acreage in British Columbia, Quebec, and the Maritimes is not competitive with the rest of Canada, its national significance is not nearly as great. For example, with 300 million bushels of wheat exports (Model 3), 71.7 per cent of the land in Quebec and 88.2 per cent in New Brunswick would not be required for cereal production. However, this represents only 8.2 per cent of the total uncompetitive land.

Most land in Ontario would be competitive with the remainder of Canada under all conditions studied. Even with a 300-million-bushel wheat export market (Model 3), only 3.7 per cent of the land in Ontario was identified as inefficient.

In Models 5 and 6, the feed freight subsidy was assumed not to apply; otherwise they are analogous to Models 1 and 2, respectively. The results presented in Table 2.2 indicate that land in Eastern Canada and British Columbia would become more competitive with the Prairies with the removal of the feed freight subsidy. Again, however, it must be remembered that this Study does not determine the optimal location of livestock production. Livestock feed requirements by region were estimated from the number of each class of livestock in a region in 1966. If the feed freight subsidy on cereal grains was removed, it is conceivable that, in the long run, shifts would take place in the location of livestock production away from Eastern provinces. Hence, the results presented in this Study for Models 5 and 6 can only be considered to represent a short-run equilibrium situation.

Further research in progress, which considers the optimal location of hog and poultry production, indicates that major regional shifts in hog production would

TABLE 2.2

PROVINCIAL AND NATIONAL ACREAGE ADJUSTMENTS REQUIRED FOR PRODUCTION-DEMAND SPATIAL EQUILIBRIUM IN THE CANADIAN CEREAL GRAIN ECONOMY

	Surplus Acreage	Percentage of Total Surplus Acreage		Surplus Acreage	Percentage of Total Surplus Acreage	
		National	Provincial		National	Provincial
	MODEL 1			MODEL 2		
Nova Scotia	14,007	0.6	34.4	24,743	0.3	60.8
Prince Edward Island	27,301	1.2	18.5	32,608	0.4	22.1
New Brunswick	52,366	2.4	57.1	71,635	1.0	78.2
Quebec	338,201	15.4	29.4	681,983	9.2	59.2
Ontario	18,408	0.8	0.5	46,829	0.6	1.3
Manitoba	627,701	28.6	7.3	1,438,574	19.4	16.8
Saskatchewan	0	0	0	1,654,008	22.3	4.1
Alberta*	1,103,061	50.3	5.4	3,436,143	46.4	16.8
British Columbia*	16,170	0.7	25.6	26,789	0.4	42.4
Canada	2,197,215	100.0		7,413,312	100.0	
	MODEL 3			MODEL 4		
Nova Scotia	31,272	0.3	76.8	22,997	0.4	56.5
Prince Edward Island	55,297	0.5	37.4	32,608	0.5	22.1
New Brunswick	80,876	0.7	88.2	68,877	1.1	75.1
Quebec	825,246	7.5	71.7	503,599	7.9	43.7
Ontario	129,551	1.2	3.7	30,939	0.5	1.2
Manitoba	2,582,123	23.5	30.1	1,171,587	18.4	13.7
Saskatchewan	2,408,704	21.9	6.0	1,283,323	20.2	3.2
Alberta*	4,833,792	44.1	23.6	3,227,046	50.6	15.8
British Columbia*	33,829	0.3	53.5	24,674	0.4	39.0
Canada	10,980,690	100.0		6,365,650	100.0	
	MODEL 5**			MODEL 6**		
Nova Scotia	906	0.1	2.2	4,767	0.1	11.7
Prince Edward Island	0	0	0	0	0	0
New Brunswick	0	0	0	0	0	0
Quebec	36,898	1.5	3.2	166,911	2.0	14.5
Ontario	13,765	0.5	0.4	20,812	0.2	0.6
Manitoba	791,639	31.3	9.2	2,105,243	25.3	24.5
Saskatchewan	0	0	0	2,360,357	28.4	5.8
Alberta*	1,682,681	66.5	8.2	3,649,589	43.9	17.8
British Columbia*	2,215	0.1	3.5	6,430	0.1	10.2
Canada	2,528,104	100.0		8,314,109	100.0	
	MODEL 7			MODEL 8		
Nova Scotia	0	0	0	0	0	0
Prince Edward Island	0	0	0	0	0	0
New Brunswick	0	0	0	0	0	0
Quebec	0	0	0	0	0	0
Ontario	0	0	0	0	0	0
Manitoba	2,105,243	26.1	24.5	1,072,347	12.4	12.5
Saskatchewan	2,305,741	28.6	5.7	5,052,492	58.2	12.5
Alberta*	3,659,497	45.3	17.9	2,557,805	29.4	12.5
British Columbia*	0	0	0	0	0	0
Canada	8,070,481	100.0		8,682,644	100.0	

*The data for Alberta include the Peace River area of British Columbia. Likewise, the British Columbia figures exclude this area.

**The results for Models 5 and 6 must be interpreted with caution since the estimation of the optimal livestock-production location was not undertaken in this Study.

take place if the feed freight subsidy was removed.[6] By comparing the results presented in Table 2.2 for Models 2 and 6, it can be seen that the uncompetitive acreage in New Brunswick would decrease from 78 per cent to zero if the transportation subsidy was removed. The research undertaken subsequent to this Study indicates that the required adjustment in cropland acreage in New Brunswick would be similar if hog production and poultry production were optimally located. However, much of the hog production in New Brunswick would become uncompetitive and would take place in other regions of Canada. The removal of the subsidy would make New Brunswick's cereal farmers more competitive with other regions, but would adversely affect its hog producers. Since this province normally imports much of its feed grains from other provinces, it is not inconsistent that domestic production of cereals could increase, yet livestock production decrease, such as described above.

In Models 7 and 8, all acreage reductions were assumed to take place in the Prairies. Hence, by definition, no uncompetitive land was found in British Columbia and Eastern Canada. The results of these models will be discussed in Chapter 4.

Regional Distribution of Surplus Acreage

In Model 1, with 420 million bushels of wheat exports, no uncompetitive land was found in Saskatchewan. However, about 7 per cent of the land in Manitoba and 5 per cent in Alberta was found to be uncompetitive with the rest of Canada. In examining Figure 2.1 and Table C.1, it can be seen that the inefficient land in Manitoba lies in the eastern part of the province. Only 22 per cent of the land in the extreme eastern region of Manitoba (region number 137) would remain in production. About the same proportion of land in the Interlake area of Manitoba is competitive.

In Alberta, most of the inefficient land was found in regions on the northern fringe of the province. The uncompetitive position of these regions is in part due to greater transportation costs for shipping grain to export and domestic markets in Eastern Canada as compared with other regions. Their competitiveness is further deteriorated through higher costs for farm inputs due to greater shipping charges compared with some other regions.

About 29 per cent of the land in Quebec was uncompetitive when wheat exports were 420 million bushels. In examining Figure 2.1, it can be seen that this land is distributed over much of the province. While a number of regions in Quebec are uncompetitive, the total acreage is relatively small. Often the inefficient acreage in just one region in the Prairies is greater than for all of Quebec. For example, about 338 thousand acres are uncompetitive in Quebec under the assumptions of Model 1, yet region 179 in Alberta has over 554 thousand acres of uncompetitive land. Accordingly, in examining the maps showing surplus acreage in Eastern Canada, one must be careful to recognize that while many regions may be uncompetitive, the acreage involved is not nearly as significant from the national point of view.

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[6] Unpublished research, Department of Agricultural Economics, University of Manitoba.

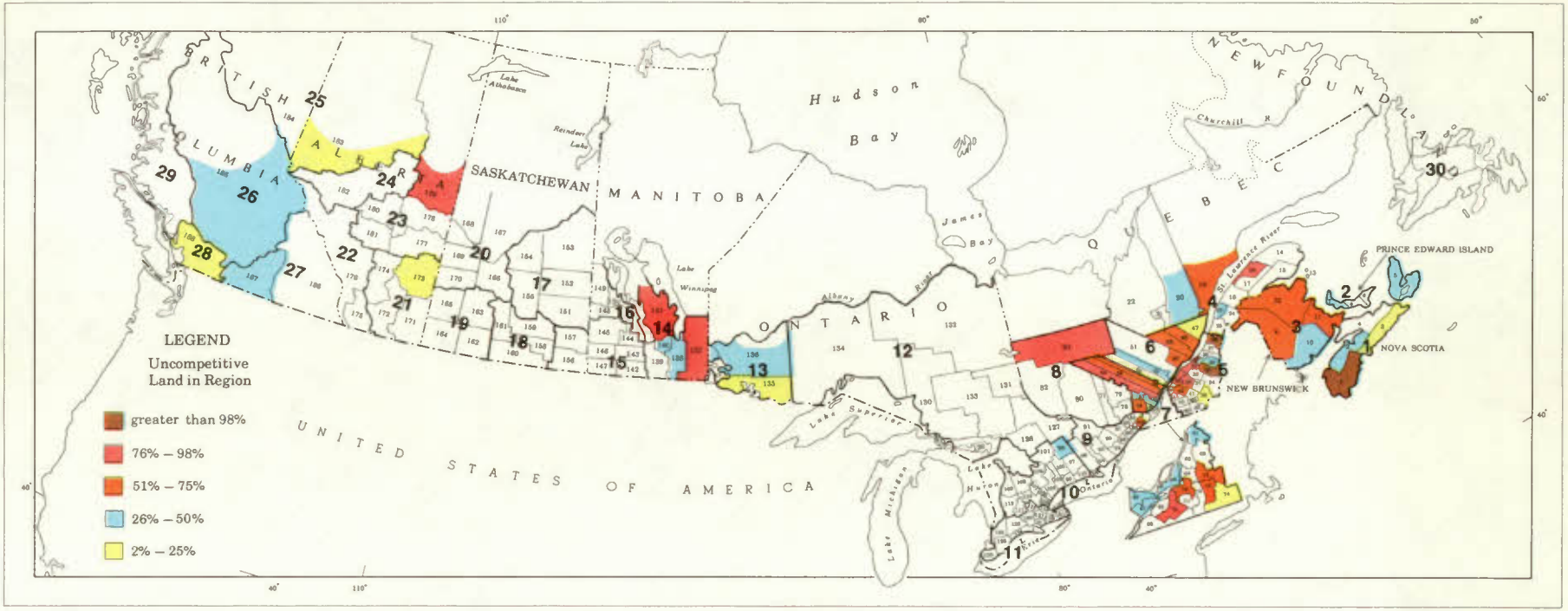

FIGURE 2.1 UNCOMPETITIVE LAND FOR CEREAL PRODUCTION BY REGION, MODEL 1.

FIGURE 2.2 UNCOMPETITIVE LAND FOR CEREAL PRODUCTION BY REGION, MODEL 2.

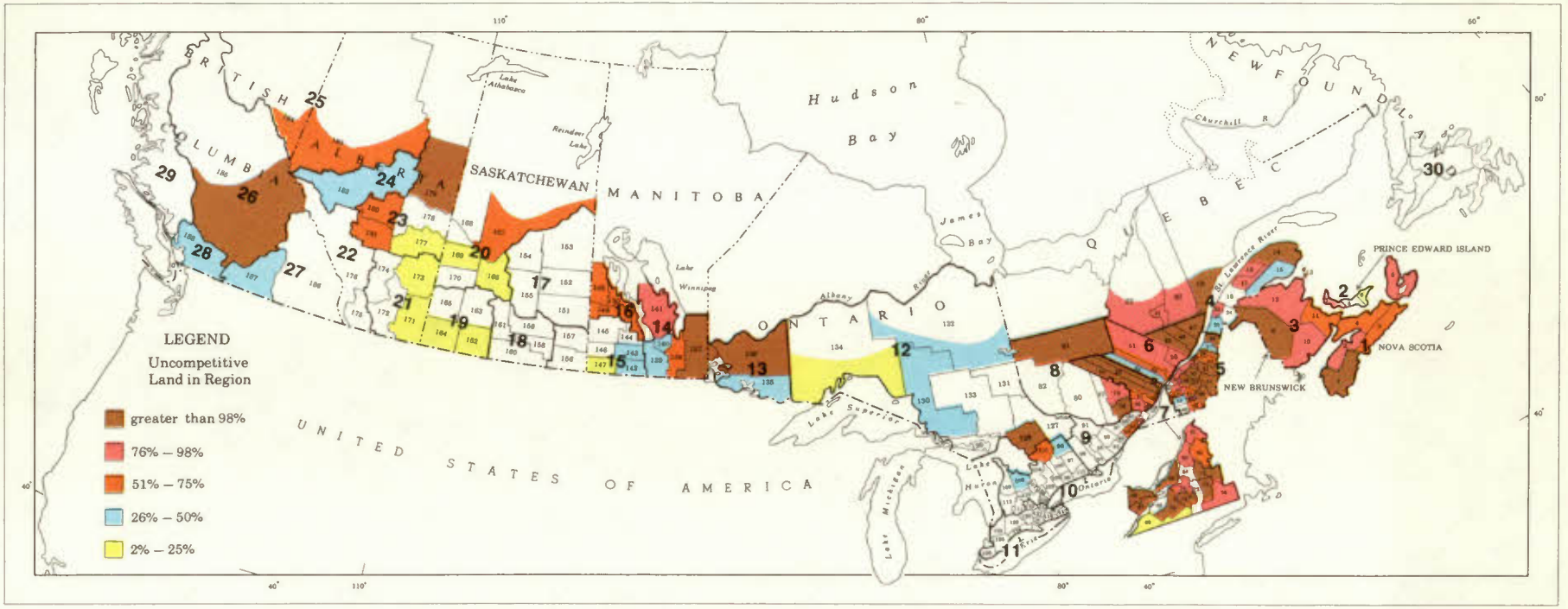

FIGURE 2.3 UNCOMPETITIVE LAND FOR CEREAL PRODUCTION BY REGION, MODEL 3.

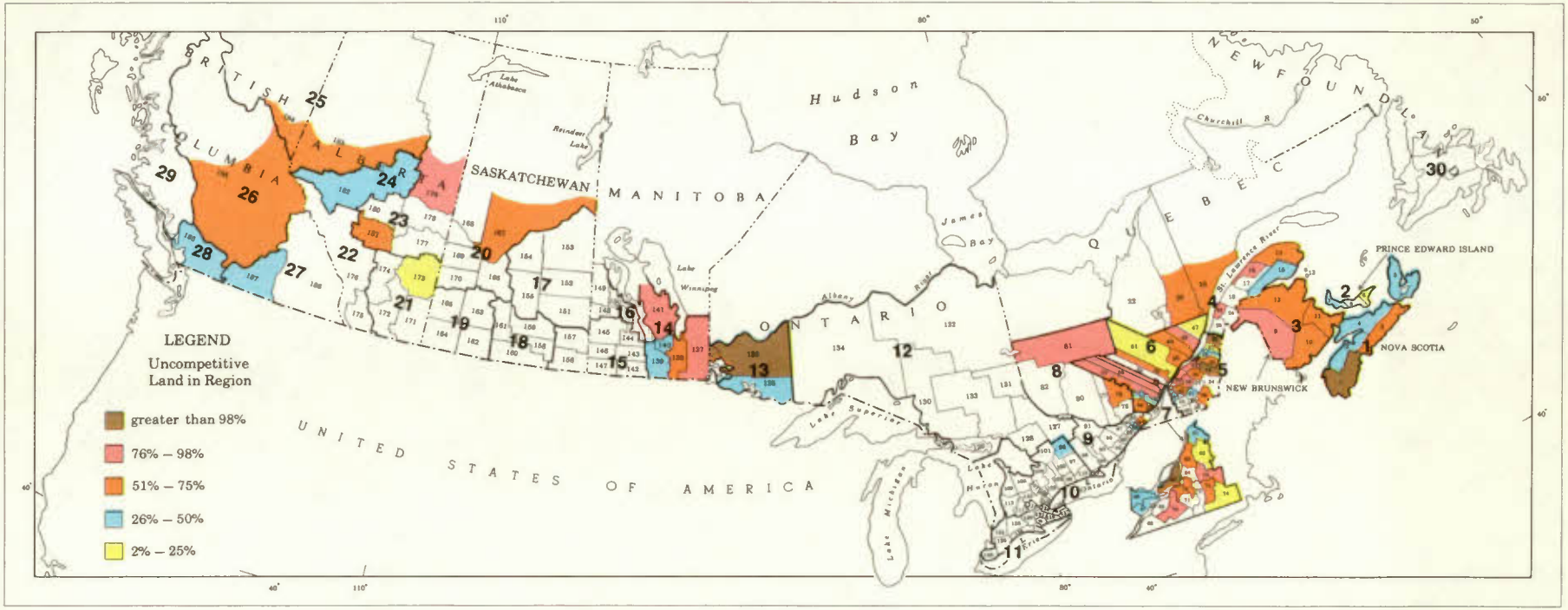

FIGURE 2.4 UNCOMPETITIVE LAND FOR CEREAL PRODUCTION BY REGION, MODEL 4.

When the export demand for wheat was reduced to 350 million bushels in Model 2, inefficient regions were identified in Saskatchewan (Figure 2.2 and Table C.2). New regions in Alberta and Manitoba also became uncompetitive. In addition, a greater percentage of the land in regions previously identified as marginal became uncompetitive for cereal production.

The eastern area of Manitoba (region 137) was found to be completely uncompetitive when wheat exports were assumed at 350 million bushels. About half of the land in region 150, located along Lake Manitoba, was identified as inefficient for cereal production. Part of the cropland in region 139, which encompasses the Red River Valley of Manitoba, was now found to be uncompetitive. Historically, this region has had a reputation of being very well-suited to crop production. It must be remembered, however, that in this Study we are determining optimum production location with a total cereal demand which is less than productive capacity. The results of this Study suggest that for the specified demand levels, the Red River Valley is not fully competitive with other areas of Canada in terms of productive efficiency.[7]

The southwestern corner of Saskatchewan (regions 162 and 164) and the southeastern area of Alberta (region 171) appeared as partially uncompetitive with the rest of Canada in Model 2. This comprised only about 7 to 16 per cent of the land in these areas. Over 56 per cent of the land in the north central area of the province (region 167) was now found to be uncompetitive.

In Alberta, several new regions contained uncompetitive land (regions 181, 182, 184, and region 171 which was previously discussed). Much of the inefficient land was located in the northern areas of the province (2,283,941 acres compared with 1,152,202 acres in the rest of the province).

Inefficient land was found in at least one of the regions comprising the Peace River area (regions 183 and 184) for each of Models 1 to 4. For example, with wheat exports assumed at 350 million bushels, 60 per cent of the land on the Alberta side of the area, and 56 per cent on the British Columbia side were identified as uncompetitive. The fact that these regions only recently came into production would support their marginal economic position relative to the rest of Canada. The present surplus productive capacity of the Canadian cereal grain economy is in part explained by areas such as these being brought into production.

Fifty-six of the seventy regions in Quebec contained at least some inefficient land in Model 2. However, from Table 2.2, it was seen that only 9.2 per cent of the total uncompetitive land for this model was found in Quebec.

Only eight regions in Ontario contained uncompetitive land. These regions have been historically of minor importance to the province's cereal economy.

When the wheat export demand was reduced to 300 million bushels (Model 3), the total surplus land for the nation increased by 3,567,378 acres over that for the 350-million-bushel analysis (Model 2). Over 1.1 million acres of this difference was in Manitoba with five new regions exhibiting marginal productive capabilities.

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[7]Production costs by region and farm size will be examined in more detail in Chapter 3.

Only 754,696 acres of additional inefficient land were found in Saskatchewan. Compared with Model 2, two further regions (numbers 166 and 169) were identified as containing uncompetitive land (Figure 2.3 and Table C.3). These regions were in the northwestern part of the province. Of the five uncompetitive regions in Saskatchewan, only one contained more than 20 per cent of such land.

In Alberta, two regions were identified as marginal in Model 3 compared with Model 2. Most of the additional inefficient acreage in Alberta for Model 3 was accounted for by these regions.[8]

Incidence of Adjustment by Farm Size

The results presented in the previous sections of this Chapter have dealt with either national, provincial or regional implications of different levels of wheat exports or agricultural policy alternatives. In all cases, however, the analyses were carried out for two sizes of farms in each region (with the exception of Quebec where only one farm size was used). The more detailed findings have been aggregated for ease of presentation. When a region was identified as uncompetitive, the small and large farms were often affected differently. In the estimation of production costs within any given region, it was found that the smaller producing unit had higher per-bushel costs. Consequently, within any region, the smaller farms became uncompetitive first. In some cases, the acreage associated with all the small farms in a region was identified as uncompetitive, yet the full acreage for the larger farms would be able to compete with other regions.

The surplus acreage by farm size for Model 2 is given in Table C.7. In the Red River Valley (region 139) where 36 per cent of the acreage was found to be uncompetitive (Table C.2), it can be seen that all of this land is associated with the smaller farms. None of the small farms in this region are found to be competitive, yet the opposite is true for all of the large farms.

In some regions all land was identified as uncompetitive with the rest of Canada in cereal production. In Model 2, the eastern part of Manitoba (region 137) was identified as totally inefficient in cereal production. Hence, in this region, both large and small farms were found to be inefficient. This occurs because the larger units in this region have higher production costs per bushel than the smaller farms in some other regions.

A detailed enumeration of the surplus acreage by farm size for Models 1 to 3 is given in Tables C.6, C.7, and C.8. Further discussion of the effects of different policy alternatives on farm numbers follows in Chapter 4.

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[8] In Model 2 (350 million bushels, wheat exports) 3.436,143 acres were uncompetitive in Alberta. This figure was 4,833,792 acres in Model 3. Of the 1,397,649-acre increase in inefficient land, 223,354 acres would be due to decreased production in regions previously marginal, and 1,174,295 acres due to land in new regions becoming comparatively inefficient.

Crop Production Patterns

The program solutions determined the optimal acreage of each crop in every region for both representative farm sizes necessary to meet domestic and export cereal grain requirements. As was seen in a previous section, not all acreage available for cereal production would necessarily be utilized. In this discussion, we will examine the cropping patterns for that acreage which is comparatively efficient. It should be remembered that domestic demands for grains were specified on a consuming-region basis which typically consisted of more than one producing region. Accordingly, in some cases a producing region might specialize in wheat, with the livestock feed grain requirements being met by other producing regions within the larger consuming region.[9]

The distribution of wheat acreage for the Prairie Provinces is given in Table C.9 for Models 1 to 4.[10] As might be expected, wheat production tends to be concentrated in Saskatchewan. In Model 1, nearly two-thirds of the Prairie wheat acreage was located in Saskatchewan. Over 67 per cent of the cereal acreage within this province would be in wheat, with most of the remainder in oats and barley. In Alberta, feed grains acreage was somewhat greater than that of wheat.

When wheat exports were assumed at successively lower levels, the competitive acreage of both wheat and feed grains in the Prairies declined. However, wheat acreage decreased in Manitoba by a greater amount than feed grains.

Feed grains acreage in Alberta remained about the same in Models 1, 2, and 3, even though the total competitive acreage was less in the models incorporating smaller wheat export markets. This observation underscores the strong competitive position of feed grains relative to wheat in Alberta. However, a conflicting conclusion can be drawn by comparing the results of Models 2 and 4 which differ only to the extent that no corn imports from the United States were permitted in Model 4. Wheat exports were equal to 350 million bushels in each model. The competitive acreage of both oats and barley in Alberta decreased when this additional feed grain market was available in Eastern Canada. Instead, wheat acreage increased by more than an offsetting amount. Most of the additional Prairie feed grains production in Model 4, compared with Model 2, came from Saskatchewan, with Manitoba acreage increasing by a moderate amount.

A more detailed observation of crop acreage concentration is possible by examining land use at producing and consuming region levels. Wheat acreage relative to other cereals within producing regions is illustrated in Figure 2.5 and Tables C.10 and C.11 for Model 1. In Manitoba, the central regions (142, 143, and 144) should specialize in wheat, while the southwestern region (147) and the

[9] No costs were attributed to grain shipments within a consuming region.

[10] In the estimation of crop acreage, explicit consideration was given to crops grown on stubble and summerfallow. For ease of presentation, this distinction will not be utilized in this discussion.

Interlake area (region 141) appear to have the greatest competitive advantage in feed grains.

It would appear that much of the Manitoba rye acreage should be located in region 147 in the southwestemmost part of the province. Saskatchewan rye production appears to be best suited to the southeastern part of the province (region 156), adjacent to the area of greatest competitive advantage for rye in Manitoba.

The competitive position of wheat relative to feed grains in the northern and northeastern regions of Saskatchewan contradicts historical production patterns. (This inconsistency will be explored in greater detail in the following chapters.) The relatively large acreages of wheat in most other regions are not surprising. The derived wheat production for Model 1 was greater than 40 per cent of cropped acreage in all but four of the twenty regions in Saskatchewan.

The greatest percentage of cropped acreage in the most southwestern region of Saskatchewan (164) and the southeastern regions of Alberta was estimated to be most efficiently utilized in feed grains production. For Models 2 and 3, most of the provincial rye production was concentrated in regions 171 and 173. Only a few regions in Alberta appear to be best suited to wheat production, given the assumed level of wheat exports. Barley was estimated to be strongly competitive in regions 177 and 181 and in the southwestemmost part of the province (region 175).

Looking at Eastern Canada for Model 1, we see that in Ontario (Table C.15), not unexpectedly, corn and winter wheat can be produced very efficiently in the southwestern area (regions 112, and 120 through 126). These eight regions produce 32 per cent of the winter wheat and 76 per cent of the corn acreage in Ontario under the assumptions of Model 1. Because of their high yields relative to other regions, they would account for an even greater proportion of the production. South Central Ontario (supplying region 10) was found to be very competitive in winter wheat production, accounting for 55 per cent of the provincial acreage. Mixed grains were usually the most competitive crop in many of the other regions. It was estimated that spring wheat could not be produced efficiently in any region. Undoubtedly, much of the historical spring wheat acreage has resulted from reseeding due to winter killing of the winter wheat crop.

No particularly striking patterns of crop acreage were estimated for Quebec (Table C.20). Oats were found to be uncompetitive in most instances. Mixed grains would predominate in many regions; however, a significant number of regions were found to be competitive in barley.

Barley also appeared to be strongly competitive with other crops in New Brunswick (Table C.21). It was estimated that 50 per cent of the cropped acreage should be in barley with only a minor acreage seeded to oats. This is in contrast with historical acreages where over 75 per cent of the land was seeded in oats and about 5 or 6 per cent in barley.

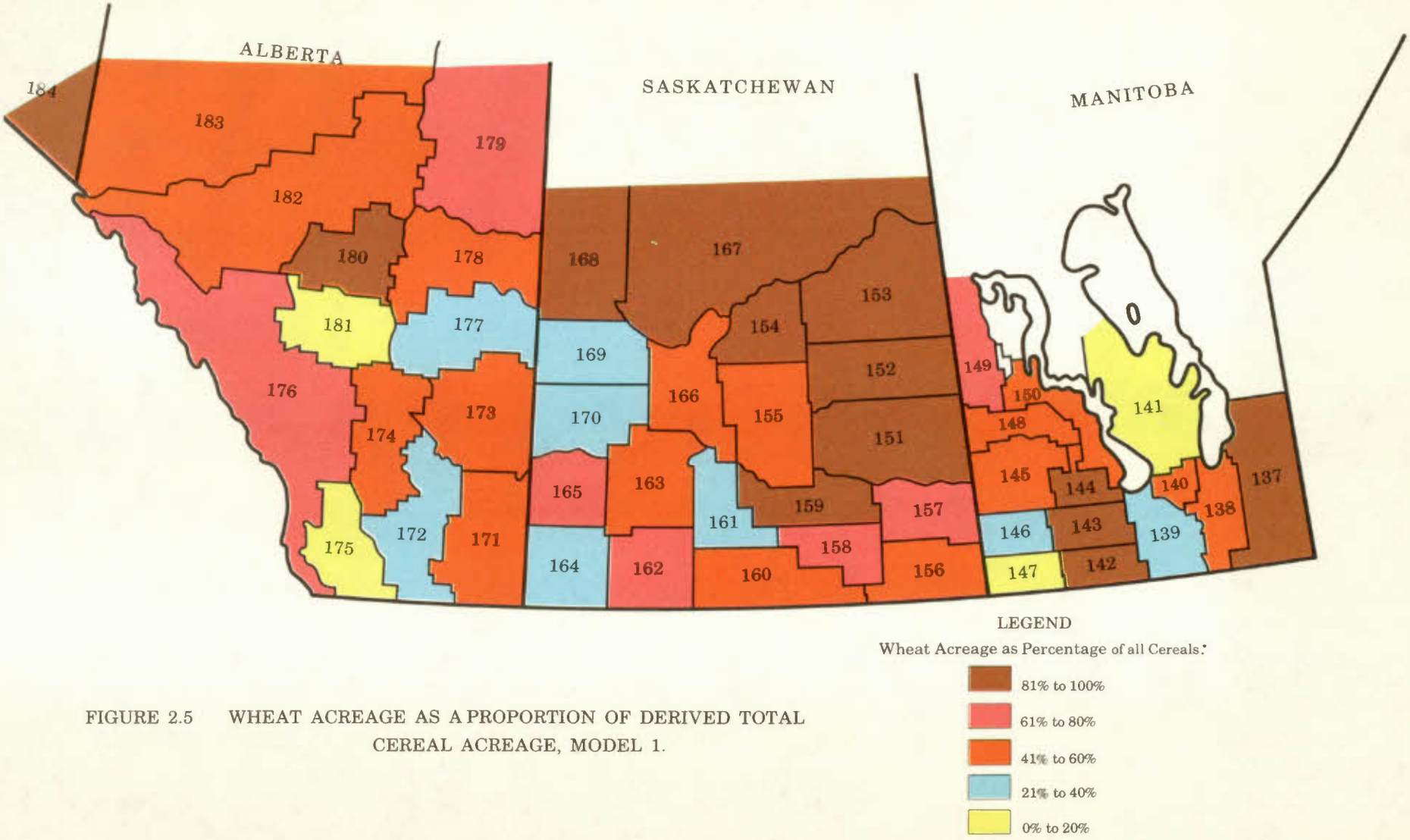

FIGURE 2.5 WHEAT ACREAGE AS A PROPORTION OF DERIVED TOTAL CEREAL ACREAGE, MODEL 1.

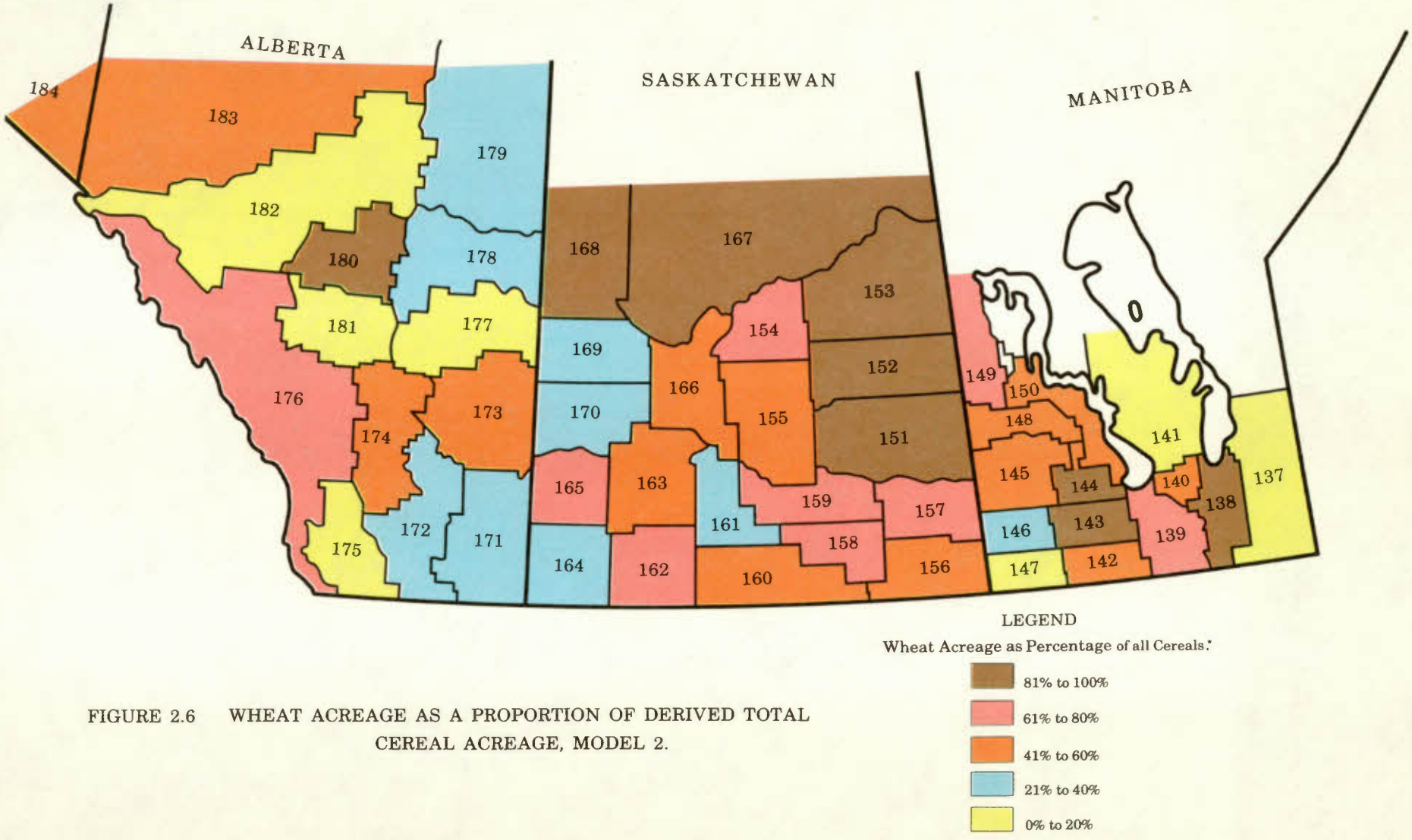

FIGURE 2.6 WHEAT ACREAGE AS A PROPORTION OF DERIVED TOTAL CEREAL ACREAGE, MODEL 2.

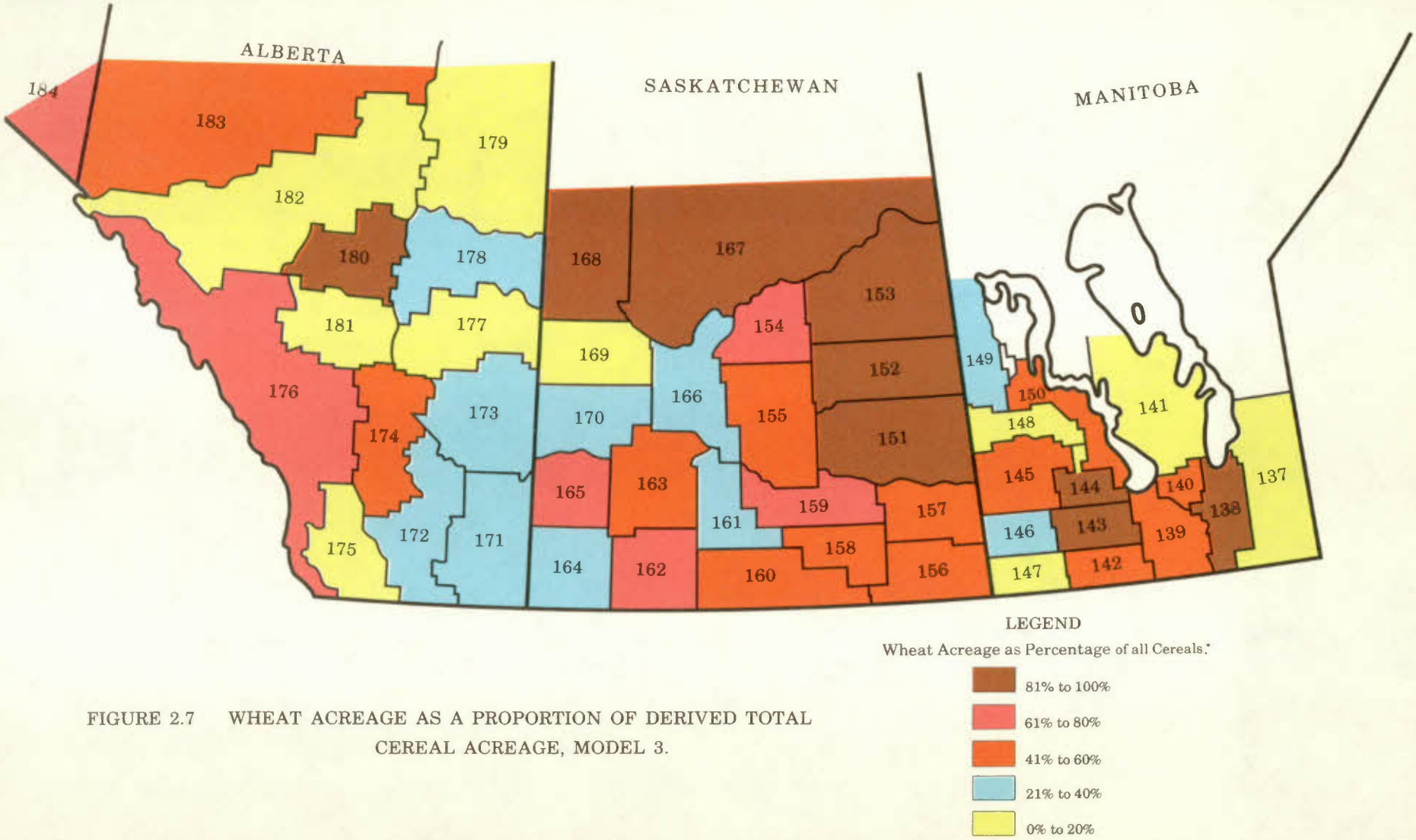

FIGURE 2.7 WHEAT ACREAGE AS A PROPORTION OF DERIVED TOTAL CEREAL ACREAGE, MODEL 3.

Mixed grains were found to be the most competitive crop in Prince Edward Island, as was barley in Nova Scotia. Oats were totally uncompetitive in both provinces, again in direct contrast with historical observations.

The relative competitive position of different crops in Eastern Canada did not change materially for the models employing different levels of wheat exports, with perhaps the exception of Southwestern Ontario where corn acreage was shifted to winter wheat when lower levels of spring wheat exports were assumed. As was outlined earlier, the total competitive acreage was less in Quebec and the Maritimes for those models assuming lower wheat exports; however, for the remaining land, the cropping pattern was similar for the different models.

Regional Cereal Consumption and Interregional Shipments

The demands for cereal grains for nonlivestock purposes were assumed the same in all models. Likewise, the export demands for oats, barley, and rye were left unchanged in the construction of each model. Livestock consumption of feed grains was pre-specified by region in terms of bushels of barley equivalents. These demands did not change from one model to the next. However, the specific grains that were used to meet these demands could differ within certain limits to reflect the relative cost of each grain for livestock feed within the region. Hence, even though, historically, certain regions may have imported much of their feed grain requirements as barley or oats from Western Canada, the shipment of this grain from regions in Eastern Canada was permitted by the models, if it could be more competitively produced in these regions and transported to the point of demand.

The livestock consumption of feed grains by province for Models 1 through 4 are given in Table C.23. Comparing the results of the situation where 350 million bushels of wheat are exported with that of the 420-million-bushel analysis (Model 2 versus Model 1), it can be seen that livestock consumption of domestically produced corn declined from over 63 million bushels to about 56 million when wheat exports decreased. However, as was indicated earlier, the competitive position of Ontario cropland did not change significantly between models. Rather, there was a change in the crop mix to more winter wheat and less corn, with much the same total acreage employed.

In Model 4, it was assumed that there were no corn imports from the United States. Hence, approximately 9.3 million additional bushels of corn were required for human purposes and 13.5 million bushels (11.2 bushels, barley equivalents) for livestock feed. Approximately 20.2 million bushels of corn were produced for human purposes and 59.7 million bushels for livestock feed in Model 4. The total production of 79.9 million bushels compares with a total of 66.9 million bushels in Model 2 (10.9 million bushels for human purposes and 56.0 million bushels for livestock feed). Hence, about 13 million of the 22.8 million bushels of imported corn were replaced by Ontario production. However, again the overall competitive position of land in Ontario did not change appreciably. Rather, the impact of the increased feed grain market on total land

use would be greatest in Saskatchewan, and to a somewhat lesser extent in Manitoba. Most of the effect in Ontario would be reflected through a shift in the crop mix within each region.

Various interregional shipments of grain were associated with the land use patterns estimated for each model. All grain for export would come from the Prairies.[11] The Eastern Canadian feed grain demands in this analysis were met either by shipments out of Thunder Bay (originating in the Prairies) or from Southwestern or South Central Ontario. Some movement of grain between regions in the Prairies was indicated as being necessary to achieve maximum productive efficiency (Table C.24). These interregional shipments are perhaps surprising in light of the comparatively high costs of transportation within the Prairies due to the inapplicability of the Crowsnest Pass freight rates (Tables B.5 and B.6). Feed grain requirements in British Columbia came from the Prairies (Tables C.25, C.26, and C.27) and to a limited extent from local production. All grain required for domestic milling and industrial purposes in British Columbia originated in the Prairies (Tables C.28, C.29, and C.30).

Tables C.31, C.32, and C.33 and Figures 2.8, 2.9, and 2.10 indicate the shipments from supplying regions in the Prairies to terminal elevators for Models 1 to 3. No direct rail transfers to Eastern Canada were found to be desirable; hence, the movement to Thunder Bay represents the total of Prairie grain exported through Eastern elevators and used for domestic purposes in Eastern Canada.[12] In examining Figure 2.8, it can be seen that when wheat exports are assumed at 420 million bushels, Western Saskatchewan is the dividing line between grain going to West Coast ports and that moving eastward. Northwestern Saskatchewan (supplying region 20) can competitively ship to Vancouver and Thunder Bay, as well as supply the Churchill export demand.

When lower levels of wheat exports are assumed, a slightly different terminal shipment pattern emerges. With a 300-million-bushel wheat export market (Model 3), Northwestern Saskatchewan (supplying region 20) can competitively supply a larger number of bushels for the Vancouver export market while shipments from supplying region 24 in Alberta disappear (Table C.33). Production costs are apparently low enough that cereals can compete with regions further west when the Eastern demands are not sufficient to utilize all the land in supplying region 20.

Given the proximity of supplying regions 16 and 17 to Churchill, one would expect that at least one of these regions should ship to this port.

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[11] As elsewhere in this paper, the Prairies are defined to include all regions in Manitoba, Saskatchewan, and Alberta as well as the Peace River area of British Columbia.

[12] The various models identified export demands for most grains at 12 different ports. The routings of shipments from Thunder Bay to the eight export demand ports in Eastern Canada were given explicit account in each model.

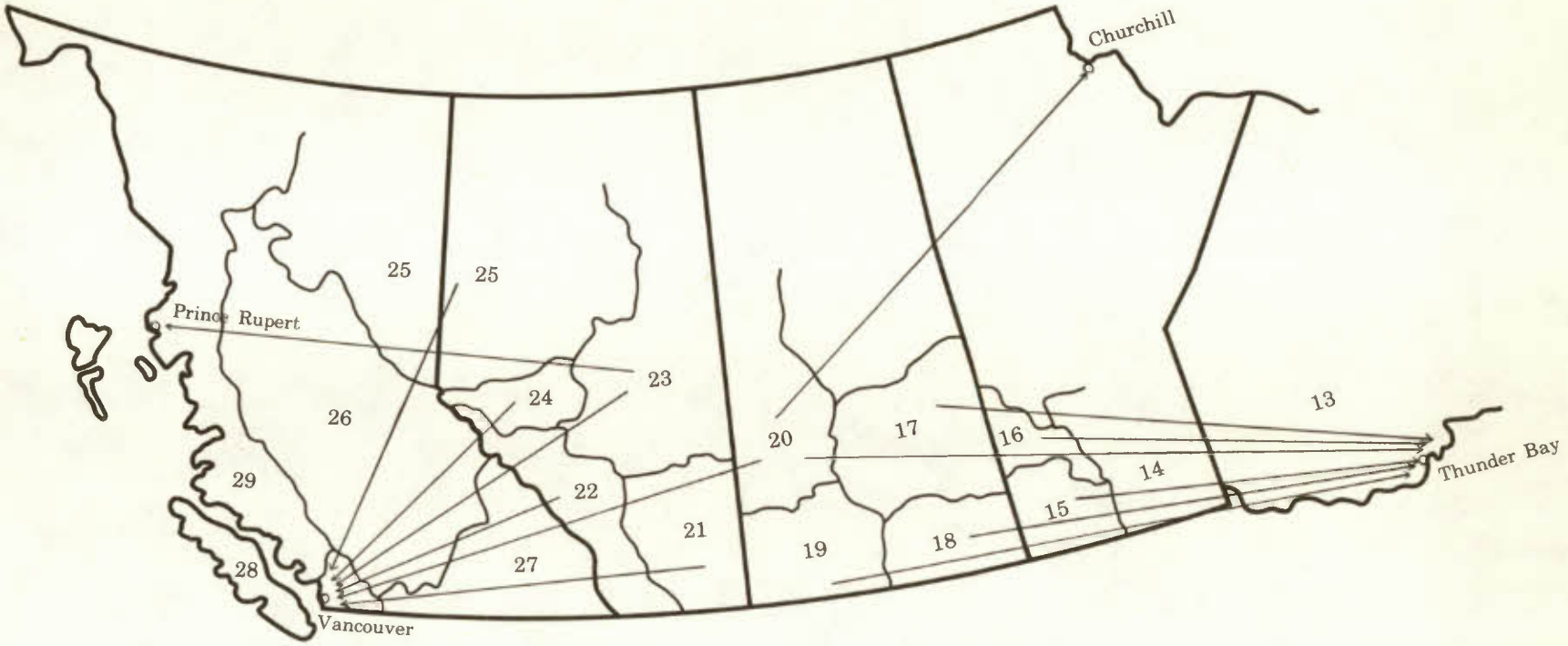

FIGURE 2.8 INTERREGIONAL FLOWS OF GRAINS FROM PRAIRIE REGIONS TO TERMINAL ELEVATORS, MODEL 1.

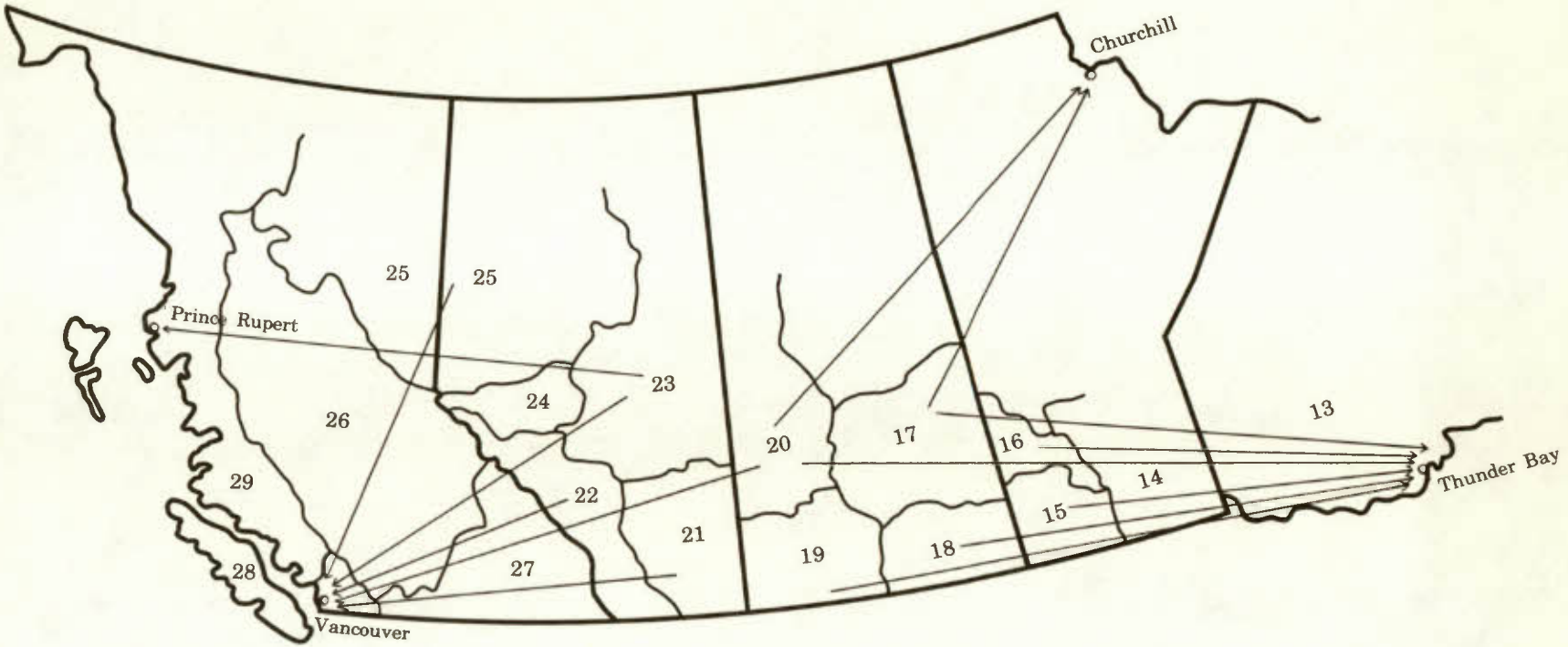

FIGURE 2.9 INTERREGIONAL FLOWS OF GRAINS FROM PRAIRIE REGIONS TO TERMINAL ELEVATORS, MODEL 2.

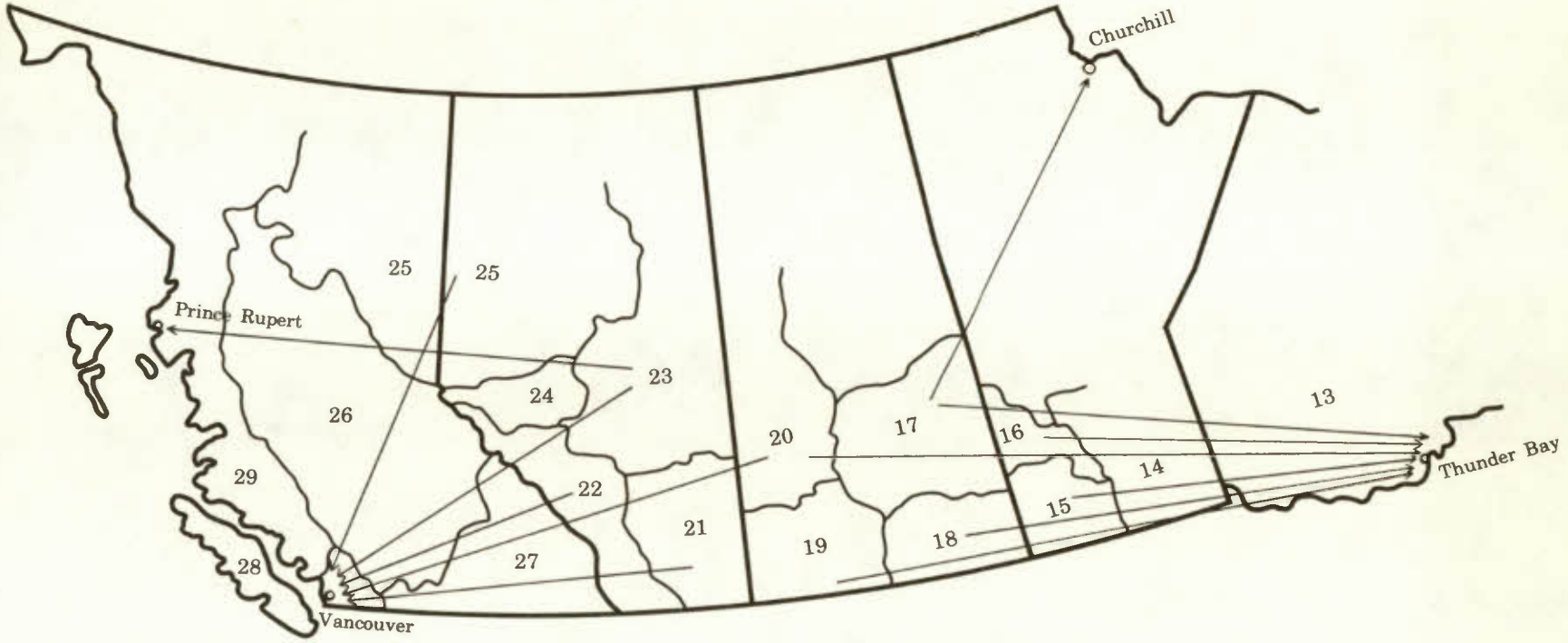

FIGURE 2.10 INTERREGIONAL FLOWS OF GRAINS FROM PRAIRIE REGIONS TO TERMINAL ELEVATORS, MODEL 3.

However, this does not happen in all models. With wheat exports of 420 million bushels, Churchill exports are met from Northwestern Saskatchewan (region 20), while regions 16 and 17 should ship to Thunder Bay. If one examines the relative shipping charges from these regions to Churchill and Thunder Bay (Table B.4), such a result is not inconsistent. The rates from regions 16 and 17 to Churchill for wheat are $0.120 and $0.126 per bushel, respectively. The rate from region 20 is only about one cent per bushel more. However, the rate from region 20 to Thunder Bay is about two cents per bushel more than from region 17 to Thunder Bay, and 3.6 cents more than for region 16. Hence, it is cheaper to ship grain from regions in Northwestern Manitoba and Northeastern Saskatchewan (regions 16 and 17) to Thunder Bay, and meet the Churchill demand from Northwestern Saskatchewan (region 20).

Southeastern Manitoba (supplying region 14) was found to be uncompetitive with other regions for markets outside its boundaries. It could not even competitively fulfil its own local cereal demands. From examining Table C.24, it can be seen that Southwestern Manitoba (supplying region 15) can effectively compete with Southeastern Manitoba for its local feed grain demands, despite the associated transportation costs between the two regions.

The British Columbia cereal market was completely met by Alberta production in each of Models 1 to 3. Much of the Peace River production (region 25) was shipped to the British Columbia domestic market under the assumptions of Model 1 (Tables C.25 and C.28). The direct rail link of the Pacific Great Eastern Railway from the Peace River area into the southwestern part of the province, and the feed freight assistance subsidy are major reasons for its competitive position in meeting these domestic markets.[13] However, since the Crowsnest Pass freight rates for grain moving to export do not apply on this railroad, the competitive position of this region in supplying grain to the Vancouver export market is seriously weakened. The freight rate for wheat moving from the Peace River area to Thunder Bay is only three cents per bushel more than to Vancouver, even though the distance is considerably greater.[14]

Shifting our attention to Eastern Canada, we find that under the assumptions of Model 1, about 75 million bushels of grain would be shipped from Thunder Bay for domestic livestock feed (Table C.34). In 1966-67, approximately 85 million bushels of grain were shipped.[15] A striking feature is the

[13] Cereals moving from all regions in Alberta to British Columbia regions, for domestic livestock purposes, have the same transportation levy due to the manner in which the feed freight assistance subsidy is applied. Grain shipped for domestic nonlivestock use does not receive the Crowsnest Pass rates. Hence, for these purposes, the relative distance of each supplying region from markets determines the relative transportation charges.

[14] The freight rate for wheat moving from the Peace River area to Thunder Bay is 21 cents per bushel and 18 cents to Vancouver. The rate from Northeastern Manitoba (region 16) to Vancouver is only 1.8 cents per bushel more. Most other regions in the Prairies have an even lower rate to Vancouver.

[15] Freight-assisted shipments of Western grain into Eastern Canada in 1966-67 consisted of 14,487,000 bushels of wheat, 37,500,000 bushels of oats, 32,516,000 bushels of barley, and 1,102,000 bushels of rye.

virtual absence of wheat shipments, whereas historically they consisted of about 15 million bushels. On the other hand, the movement of barley was somewhat greater than recent historical levels.

One reason for the estimated smaller marketings of Western grains for feed in Eastern Canada is the modest shipments of winter wheat and corn from Southwestern Ontario (supplying region 11), (Table C.37). The competitive position of this region in meeting feed grain demands in Quebec and the Maritimes was enhanced in the Fall of 1967, when the feed freight assistance subsidy, hitherto applying only to Western grain, was extended to winter wheat and corn originating in Ontario.

When a substantial drop in the wheat export market was assumed (Model 3), the use of Western grain in Eastern Canada increased by about 31 million bushels (Table C.36). Part of the increase occurred through a reduction in the interregional movement of Ontario-produced corn (Table C.37 compared with Table C.39). As was outlined earlier, however, these reduced shipments of corn did not imply a decline in the competitive acreage of land in Southwestern Ontario; rather, there was a shift from corn production to winter wheat. The lower yields of winter wheat relative to corn explains why reduced total outshipments from this region were not associated with reduced competitive acreage. Western feed grains were more competitive than corn in domestic markets outside Ontario when less land in the Prairies was required to produce wheat for export.

Summary

The results from the several economic models discussed in the previous sections indicate that, given average feed grain exports of the previous decade, and 1966 domestic consumption demands, even with wheat exports of 420 million bushels per year, excess productive capacity exists in the Canadian cereal grain economy. Many regions in Quebec and the Maritimes cannot competitively produce cereal grains compared with other areas of Canada. Within the Prairies, regions such as the Interlake area of Manitoba and the easternmost part of the province were found not particularly well-suited to cereal production when the potential of other regions to meet export and domestic demands was considered. Likewise, in Alberta, a number of areas were identified as marginal for cereal grain production under conditions of limited demand.

The following Chapter examines past changes in land use to ascertain whether interregional competitive pressures are leading to the production patterns estimated as most efficient by this Study. In addition, production costs and yields will be examined to identify why certain regions are competitive in cereal production and others are not.

CHAPTER 3

ASSESSMENT OF HISTORICAL AND DERIVED PRODUCTION LOCATION AND DISTRIBUTION PATTERNS

OBJECTIVES

The results of the previous Chapter indicated that surplus productive capacity exists in the Canadian cereal economy for the assumed demand levels, land supplies, and crop yields of 1966. If the criterion of economic efficiency was used to guide the location of cereal production, so that surplus stocks would not accumulate, the regional impact would vary due to regional differences in productive efficiency. The previous analysis identified those regions which were least efficient, given certain specified export and domestic demands. In addition, the most efficient cropping pattern was indicated for the remaining competitive land area.

With regional differences in productive efficiency and surplus productive capacity, one would expect that economic pressures would be causing adjustments in the cereal economy in the direction of the derived equilibrium of this Study. The purpose of this Chapter is to first determine the extent to which regional adjustments in land use are taking place, and secondly, if changes are evident, whether they are moving towards the equilibrium suggested as optimal by this Study. This assessment will include determining whether there are any regional trends in total cereal production, as well as identifying any shifts in the regional crop mix. Finally, some of the causes of regional differences in competitive efficiency such as production costs and yield levels will be examined.

ANALYSIS OF HISTORICAL CHANGES IN LAND USE

In the crop year 1968-69, an estimated 49 million acres were seeded to cereal crops in Canada.[1] This compares with an average of about 47 million acres over the crop years 1964-65 to 1966-67 (Table C.40). During 1939-40 to 1941-42, about 45 million acres were seeded to cereals. Hence, while this Study and other evidence indicates that excess productive capacity exists in the Canadian cereal economy, no long-term contraction has taken place in terms of total cereal acreage. However, if one examines regional cereal acreages over time, a different picture emerges.

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[1] It should be emphasized that summerfallow acreage is not included in this figure.

Eastern Canada

Maritimes–In the Maritimes, cereal acreage has declined by about 45 per cent during the 25-year period prior to 1966 (Table C.41.) This reduction has been more pronounced in New Brunswick than in Nova Scotia and Prince Edward Island. Oats have shown the greatest relative decline in all Maritime Provinces. The acreage of mixed grains, on the other hand, has increased moderately in each of these provinces. These developments are consistent with the findings of this Study, which suggest that oats acreage should be further decreased from current levels while that of mixed grains should be increased. However, the derived acreage of barley in the Maritimes was greater than recent production, even though the acreage of this crop has declined in recent years.

Quebec–With a 420-million-bushel wheat export market, this Study indicated that about 29.4 per cent (Table 2.2) of the cereal acreage in Quebec is uncompetitive with the rest of Canada. During the past 25 years, cereal acreage in this province declined some 36 per cent, reinforcing the conclusions of this Study with respect to its marginal economic position in cereal production (Table C.42). The picture is not clear with respect to individual crops. Barley acreage, for example, declined from 148,433 acres to 13,767 during the past 25 years, yet this Study suggests that this is a strongly competitive crop in Quebec. However, as in the Maritimes, oats were found to be uncompetitive for much of the available acreage. This is consistent with its half-million-acre decline in Quebec over the 1939-41 to 1964-66 period.

Ontario–The striking feature of all the analyses as they relate to Ontario is its very strong competitive position with respect to cereal production. Even with the most adverse wheat export demand situation (300 million bushels, Model 3), only 3.7 per cent of the provincial acreage was found to be uncompetitive. Nearly 40 per cent of this land is located in Grey County (region 108), (Tables 2.2 and C.3). Over the period 1939 to 1965, its total land use for cereals declined by 2,423 acres per year (Table B.9). Most of the regions with uncompetitive land showed declining cereal acreage over this period.

A major shift has taken place in the type of cereal grains produced in Ontario. Corn acreage has more than tripled in the past 25 years (Table C.42), with most of the increase taking place since the early 1950's. Much of the expansion in corn production occurred through a reduction in winter wheat, oats, barley, and mixed grains acreage.

In comparing recent cereal acreages in Ontario with the results of this Study, several major differences are observed. First, this Study suggests that winter wheat acreage should be significantly expanded, yet in 1964-66 its acreage was only 56 per cent of that found in 1949-51. However, it should be remembered that our calculations employed the feed freight assistance subsidy, as enacted in 1967, for winter wheat (and corn) shipments from Southern Ontario to regions in Eastern Canada. Prior to this time, no subsidy was available for the movement of these crops. It was found that 6.6 million bushels of winter wheat could be competitively shipped from this area for livestock feed under the assumptions of Model 2 (Table

C.38). This is in contrast with the experience up to 1966 when virtually no such shipments took place.

Spring wheat and barley acreages as estimated by this Study are more or less in agreement with recent historical acreages. Oats and mixed grains were found to be less competitive than their recent acreages indicate. This is in contrast with their average acreages in 1964-66; however, oats and mixed grains acreages have been declining, but not as rapidly as the various models indicate is in line with their comparative advantage.

TABLE 3.1
CORN ACREAGE IN SELECTED REGIONS, 1966
AND SOLUTION ESTIMATES

Producing Region						Estimated Annual Increment 1939 to 1965*
No.	County	1966	Model 1	Model 2	Model 3	
				(Acres)		
112	Huron	30,085	67,406	67,406	67,406	1,018
119	Norfolk	33,803	5,054	0	0	767
120	Oxford	47,073	88,310	88,310	88,310	1,479
121	Brant	26,976	44,137	44,137	44,137	591
122	Lambton	72,055	2,691	0	0	1,741
123	Middlesex	84,508	161,341	161,341	161,341	2,515
124	Elgin	77,121	121,676	121,676	121,676	1,924
125	Essex	89,829	0	0	0	638
126	Kent	195,528	237,191	166,990	160,756	4,256
	Total	656,978	727,806	649,860	643,626	14,929

*See Table B.9 for the historical trend coefficients for other cereal crops and regions in Ontario.

Ontario corn production has always been concentrated in the southwestern part of the province. In 1966, over 87 per cent of the corn acreage was in the nine counties of Huron, Norfolk, Oxford, Brant, Lambton, Middlesex, Elgin, Essex, and Kent (regions 112, 119, 120, 121, 122, 123, 124, 125, and 126). Over the period 1939 through 1965, yearly increases in corn acreage ranged from 591 acres in Brant County to 4,256 acres in Kent County (Tables 3.1 and B.9). Some of these regional changes are in conflict with the findings of this Study. In Norfolk, Lambton, and Essex Counties (regions 119, 122, and 125), the acreages estimated by the mathematical models are significantly less than their 1966 levels (Table 3.1)[2]. The 1966 acreages for the other six regions are more or less moving in the direction of the estimated equilibrium. However, while little corn production was derived for

[2]This Study does not recognize the distinct demands for seed grain. Had this demand been included, it is likely that significant corn acreage would have been estimated for Essex County in line with its large historical acreage of seed corn.

Norfolk, Lambton, and Essex Counties, it should be emphasized that each of these regions was highly competitive in other crops, particularly winter wheat. Production costs for corn in these regions were estimated to be low, compared with some other regions (Table B.17); however, these counties had an even greater comparative advantage in crops such as winter wheat.

Prairies

Within the Prairies, there has been a significant increase in cropland since the early 1960's. In 1961, 66.9 million acres were employed in the production of cereals and oilseeds and in summerfallow (Table B.26). By 1968, this figure had increased to 73.8 million acres. Cereal acreage increased by a comparable amount during this period, going from 35.9 to 43.8 million acres. This expansion in cereal production is in part explained by the very favourable wheat export markets and unusually high wheat prices during the mid-1960's. Nevertheless, improved acreage has been expanding in the Prairies in a persistent, although irregular, manner even as far back as the late 1930's.

In examining provincial cereal acreages (Table C.43), it can be seen that while there has been an overall increase in wheat production in recent years, there have been shifts in the relative significance of wheat in different provinces. For example, in Alberta, there has been a marked increase in barley acreage in the place of wheat.

Manitoba – Changes in the relative acreages of different crops is more evident at the regional level. Over the period 1939 through 1965, wheat acreage increased in every region in Manitoba with the exception of the southwestern corner of the province (region 147), (Table B.10). The annual change varied from 257 acres per year in the eastern part of the province (region 137) to 3,224 acres in Central Manitoba (region 144). Expanded wheat acreage has taken place largely through reduced barley production. If one examines the change in total cereal acreage over this period (Table B.10), it will be noted that it has declined in eight of the fourteen regions in the province, despite the increased wheat acreage. In each of these eight regions, the reduction in cereals has been more than offset by increased flax acreage. For example, in the Red River Valley (region 139), wheat production increased at the rate of 1,570 acres per year over the period 1939 through 1965, while barley acreage declined by 11,236 acres per year. Total cereal acreage declined by 8,620 acres per year. Flax, on the other hand, increased by 14,048 acres annually. Together with summerfallow, total cropland increased by 10,090 acres per year over the 27-year period.[3]

The results presented in Chapter 2 indicated that six regions in Manitoba contained uncompetitive land when wheat exports were assumed at a level of 350 million bushels (Table C.2). Four of these regions corresponded to those regions exhibiting long-term declining cereal acreages. This could either mean that

[3]The summerfallow acreage includes all acreage in the region and not just that required for cereals and flax production. In most regions, the number of acres of summerfallow used by other crops is very small.

producers in these regions have not been as competitive as those in other regions and therefore have shifted to other crops; or it could mean that during periods of restricted markets they have had more opportunity to shift to other crops for which a market outlet exists. While the latter point undoubtedly explains some of the adjustment, it should be remembered that the cited trends in land use were estimated over a 27-year period, with much of the short-run influences therefore removed.

Alberta – Of the 13 regions in Alberta, only four showed a declining trend in cereal acreage over the 1939-65 period (Table B.11). Only one of these regions corresponds with the six regions identified as containing uncompetitive land under the assumptions of Model 2. Wheat acreage, however, has declined over this 27-year period in seven of the thirteen regions in Alberta. All regions in Alberta showed increasing barley acreage over this period, while oats declined in all except regions 178 and 179. The results of this Study generally concur with the apparently strong competitive position of barley relative to wheat in Alberta; however, the relative proportions of wheat and barley differed for certain regions compared with the historical situation. The prominence of barley production in the Red Deer area (region 181) was supported by the results of this Study.

Saskatchewan – Cereal acreage declined in 12 of the 20 regions in Saskatchewan over the period 1952 to 1965 (Table B.12).[4] In a few regions, this cereal acreage was diverted to flax production. Summerfallow acreage increased significantly in all regions. This type of adjustment was particularly noticeable in the drier areas of the province with light-textured land, such as the southwestern corner of the province (regions 163, 165, and 166) and the Saskatoon area. Unlike in Manitoba and Alberta, the total acreage in cereals and summerfallow increased in all regions in Saskatchewan. Two of the three regions identified as marginal for cereal production when wheat exports were assumed at 350 million bushels (Table C.2) corresponded to the regions of historically declining cereal acreage. With lower wheat exports (300 million bushels, Model 3, Table C.3), these figures were four out of five. However, in each of these regions rather significant increases in wheat acreage were observed. The decline for total cereals resulted from larger decreases in oats and barley acreage.

One major difference in the results of the mathematical analysis compared with the historical situation is the apparent strong competitive position of wheat relative to feed grains in the northern and northeastern regions of Saskatchewan. However, if one examines the historical trends in the different crop acreages (Table B.12), it will be noted that the combined oats and barley acreage is declining very rapidly in regions such as 151, 152, 153, 154, 167, and 168. At the same time, wheat acreage has been expanding to take up much of the land removed from feed grain production.

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[4] The historical trend data for Saskatchewan are not directly comparable with that cited for the other provinces because data on cereal acreages for the regional classification used in this Study were not available prior to 1952. Hence, the shorter period of 1952 through 1965 was used for estimating trend acreage coefficients in Saskatchewan.

Summary of Historical Acreage Changes

An overall assessment of the correspondence between the historical changes in crop acreage and the results of this Study is next to impossible. This arises partly because of the large number of regions involved and is compounded by the several different crop alternatives in each. The trends in adjustment and the estimated equilibrium acreages do show some correspondence, particularly in Eastern Canada. However, as the basic postulate of this Study indicates, surplus or uncompetitive acreage at the assumed export levels does exist. While there have been some regional adjustments in the Prairies away from cereals, the trend in total land base has been increasing in all except four regions over the last several decades (regions 175, 176, 180, and 181 in Alberta). If this exapansion in total acreage had not taken place, fewer adjustments in land use would be required at this time to bring production potential into balance with demand.

ASSESSMENT OF REGIONAL COMPETITIVE ADVANTAGE

The purpose of this section is to examine cereal yields and production costs to assess why certain regions have a stronger competitive position than others. It will also be necessary to give some consideration to the differences in transportation rates that exist between different regions.

Crop Yields

Within any region, yields often vary widely from one year to the next for any given crop. In this Study, however, we have not been concerned with this yearly variation within regions. Only long-term regional yields which have had their year-to-year variations removed have been used.[5]

Tremendous differences in long-term yields exist between different regions of Canada (Tables B.13 and B.14). Figure 3.1 illustrates the variation in wheat yields within the Prairies for crop seeded on summerfallow. Within Manitoba, estimated yields tend to be low in the East and to increase as one moves westward. The relatively low estimated yield for the Red River Valley (region 139) is perhaps surprising; however, in many years excess moisture has given rise to reduced yields.

In Saskatchewan, the highest wheat yields are found in the northeastern part of the province and the Regina Plains. Very low yields were found in Southwestern Saskatchewan and Southeastern Alberta. Some of the highest yields in the Prairies are found in the foothills and northern regions of Alberta.

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[5] All yields used in this Study are net of seed requirements and, hence, are one or two bushels less than the actual trend yield. The procedure used to estimate the per-acre seed requirements is discussed in Appendix A.

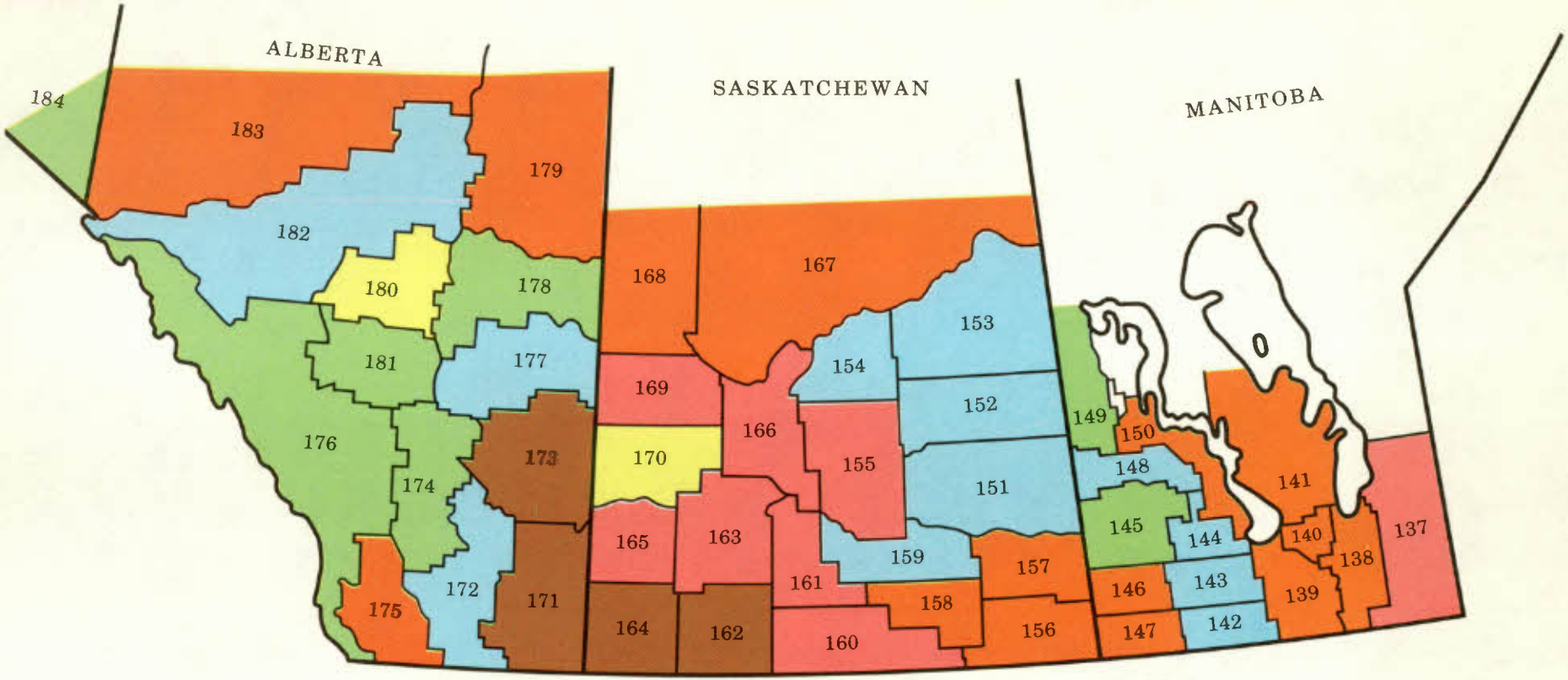

FIGURE 3.1 LONG-TERM YIELDS BY REGION FOR WHEAT SEEDED ON SUMMERFALLOW, BASE YEAR 1966.

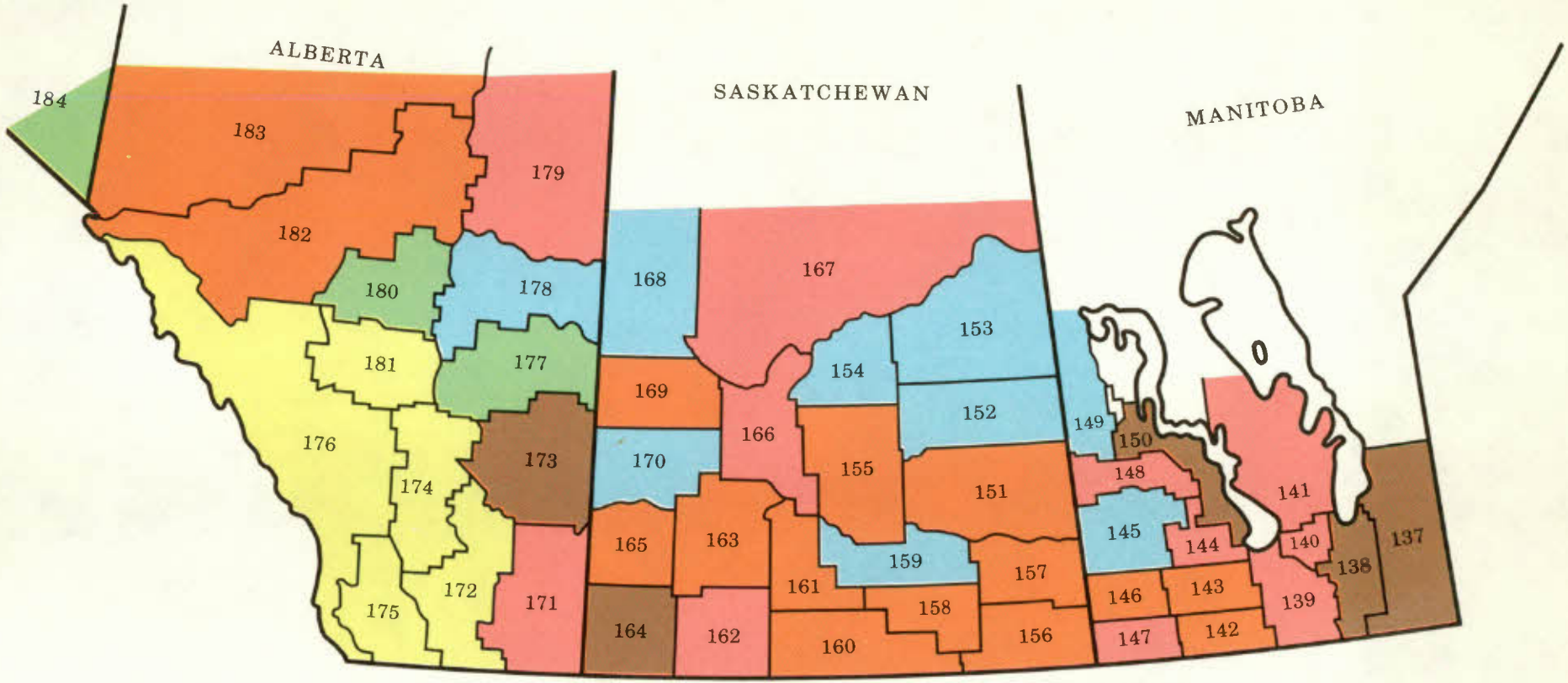

FIGURE 3.2 LONG-TERM YIELDS BY REGION FOR BARLEY SEEDED ON SUMMERFALLOW, BASE YEAR 1966.

Barley yields in the Prairies for summerfallow crop are shown in Figure 3.2. The yield pattern is very similar to that for wheat. In Southwestern and Western Saskatchewan, they tend to be higher relative to wheat than for other regions in Saskatchewan and Manitoba. The strong competitive position of barley in Alberta, however, is emphasized by this Figure. In the foothills and North Central area of the province (regions 172, 174, 175, 176, and 181), yields are in excess of 41 bushels per acre. Compared with regions in Manitoba, with yields of about 30 bushels, these regions have a substantial competitive advantage.

Yields, however, cannot be used as the sole indicator of a region's competitive position in the production of a particular crop. For example, the long-term wheat yield in Southwestern Saskatchewan (region 164) for summerfallow crop is 13.5 bushels per acre. Yield for the same crop in Northern Alberta (region 180) is 29.4 bushels per acre. However, if one examines Tables C.2 and C.3, it can be seen that region 180 in Alberta is less competitive than region 164 in Saskatchewan under certain conditions. In Table C.2, when wheat exports are assumed to be 350 million bushels, all of the land in region 180 is competitive, while in region 164, 7.1 per cent is uncompetitive. With wheat exports assumed at a level of 300 million bushels rather than 350, the uncompetitive acreages for regions 180 and 164, respectively, are 74.4 and 10.4 per cent (Table C.3). Hence, one cannot merely assess the relative competitive position of different regions by examining crop yields. Production costs vary widely from one region to the next, even within the Prairies, not to mention the even larger differences between regions in Eastern and Western Canada. Transportation rates also have a bearing on the relative economic efficiency of different areas. Large local demands for cereals in some areas may partially offset an adverse geographical location with respect to export markets.

Production Costs

A number of factors lead to different production costs between regions. One of the basic reasons for higher per-acre costs in Eastern Canada, compared with the Prairies, is their considerably smaller farms. Implements are usually smaller and, hence, require a larger input of labour and machine time per acre; in addition, there are also few acres over which to spread machine overhead. Small field size in the East also leads to lower efficiency. Fertilizer use per acre in the Prairies tends to be considerably less than in most areas of Ontario and much of the Maritimes, although lower yields are also evident.

A major factor that reduces the competitive position of the West is the fairly high summerfallow requirement in many regions. In Southwestern Saskatchewan upwards of 45 per cent of the land must lie idle as summerfallow in order to retain sufficient moisture to produce a worthwhile crop the following year (Table B.19). Hence, in these regions, it takes virtually two acres to produce one of crop. However, production costs per acre tend to be low because of large farms and relatively few and very extensive tillage operations.

In this Study, the level of production and transportation costs and yields are fundamental to the estimation of optimal cereal production location. As was

outlined in Chapter 1, land costs were not included in this analysis. This Study identifies that land which is necessary to exactly meet the demand for cereals. Alternative uses for the remaining land are not specified. Current land prices have evolved on the basis of a cereal industry producing surplus stocks. To include a land cost would bias the analysis against regions that have bid land prices to relatively high levels because of their strong competitive position.

The costs used in this Study also do not include buildings and the trucking of grain from farm to elevator or feed mill. Both costs were excluded because of problems in obtaining relevant data and because it was considered that their exclusion would not materially affect the resulting conclusions.[6]

The labour cost used in this analysis does not include a return for management. It represents only the cost of the physical labour required for crop production.

Cereal production costs, less the above-noted exclusions, are included in Tables B.15 and B.16 for all regions and each size of farm considered. It must be re-emphasized that this Study does not suggest that a farmer could stay in operation with a return equal to these costs. What is implied is that they include those inputs relevant to the determination of the long-run competitive location of cereal production. No attempt was made in this Study to specify what price per bushel would be necessary for different grains to return an adequate level of living to farmers in different regions. The forestated per-acre costs have been related to a per-bushel basis in Table 3.2 for large farms in selected regions.[7] The per-bushel cost for all cereals, regions, and farm sizes are given in Tables B.17 and B.18. Because of the large number of figures involved, it is not possible to show the interrelationships between costs for all regions, crops, and farm sizes, in this discussion. It was for reasons such as this that the mathematical programming models were constructed and solved by advanced computer hardware. In this section, we will only be able to pick out a few salient aspects associated with regional differences in productive efficiency.

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[6] A conceptual problem also prevented the inclusion of off-farm trucking costs. If grain is consumed on the farm where it is produced, then this cost does not apply. Since it was not known *a priori* whether a region would be competitive, or whether it would import its feeds from other regions, this cost could not be included without first knowing the solution to the analysis. Programming techniques could have been used to overcome this problem; however, the increase in size of the linear programming model would have made computer costs prohibitive.

[7] In estimating cost per bushel for the Prairies, 80 per cent of the summerfallowing cost was attributed to the summerfallow crop and 20 per cent to the stubble crop. It was not relevant to determine an aggregate cost for each crop, based on historical stubble and summerfallow crop acreages. In this analysis, it was quite conceivable that a crop which had been traditionally grown on stubble would have a greater competitive advantage as a summerfallow crop, or vice versa.

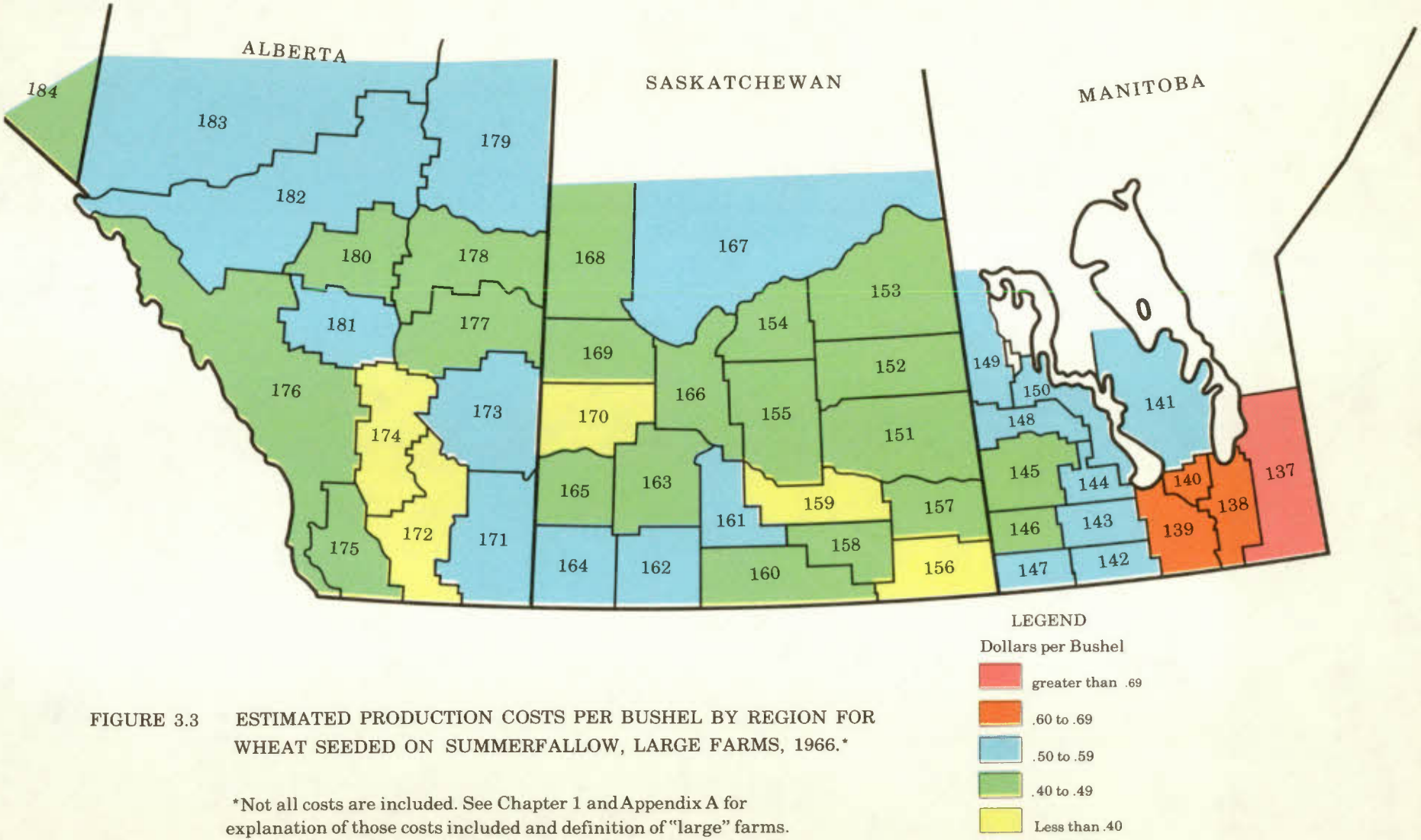

FIGURE 3.3 ESTIMATED PRODUCTION COSTS PER BUSHEL BY REGION FOR WHEAT SEEDED ON SUMMERFALLOW, LARGE FARMS, 1966.*

*Not all costs are included. See Chapter 1 and Appendix A for explanation of those costs included and definition of "large" farms.

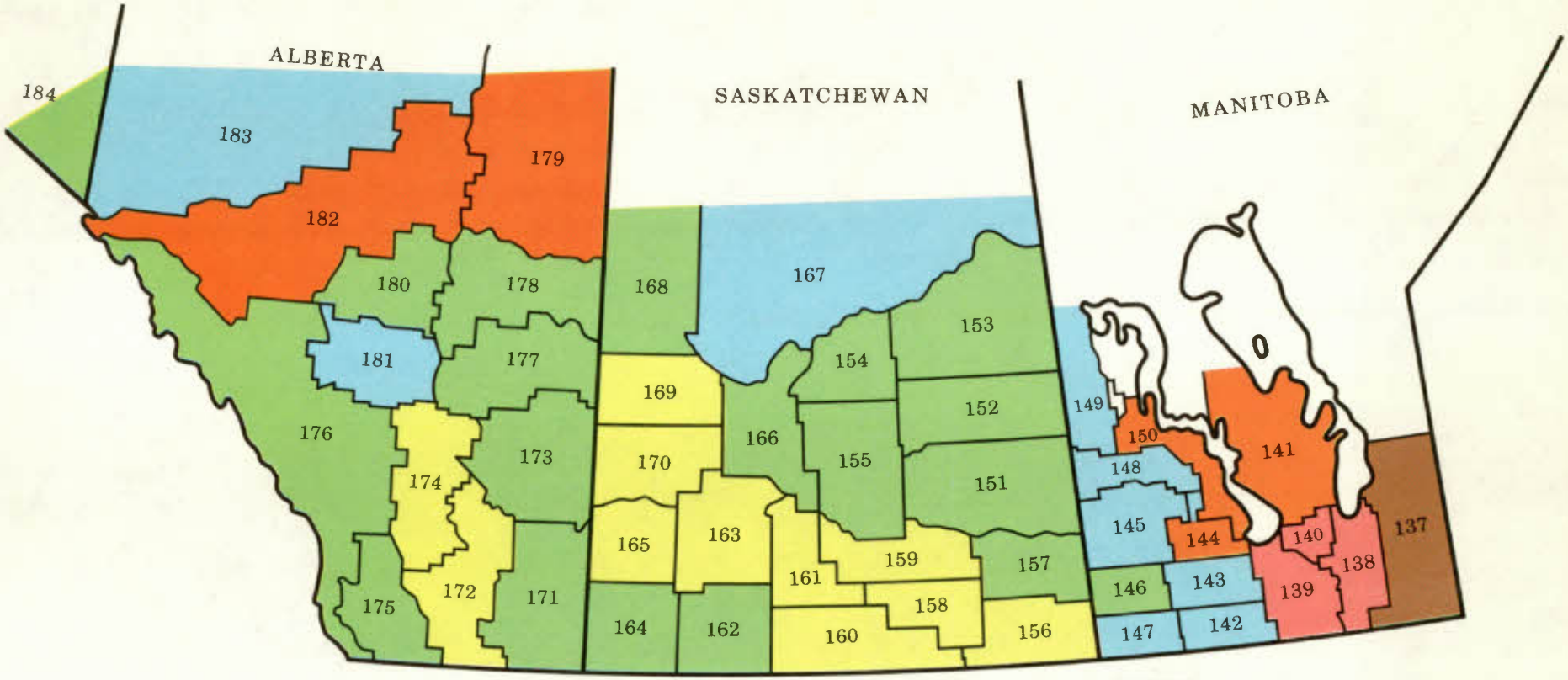

FIGURE 3.4 ESTIMATED PRODUCTION COSTS PER BUSHEL BY REGION FOR BARLEY SEEDED ON SUMMERFALLOW, LARGE FARMS, 1966.*

*Not all costs are included. See Chapter 1 and Appendix A for explanation of those costs included and definition of "large" farms.

TABLE 3.2

ESTIMATED COST OF PRODUCTION PER BUSHEL FOR CEREAL GRAINS, SELECTED PRAIRIE REGIONS, LARGE FARMS, 1966*

Producing Region		Summerfallow Crop				Stubble Crop			
No.	Description	Wheat	Oats	Barley	Rye	Wheat	Oats	Barley	Rye
		(Dollars per bushel)							
139	Red River Valley	.62	.31	.48	.67	.71	.36	.58	.81
141	Interlake, Manitoba	.58	.32	.45	.63	.83	.45	.63	.89
147	Southwestern Manitoba	.53	.26	.38	.49	.63	.30	.44	.57
149	Northwestern Manitoba	.51	.28	.39	.48	.51	.28	.40	.49
159	Regina Plains	.35	.18	.23	.41	.39	.19	.25	.45
164	Southwestern Saskatchewan	.52	.23	.30	.66	.66	.25	.37	.82
170	Rosetown-Kindersley, Sask.	.36	.20	.22	.46	.42	.22	.26	.57
174	Calgary, Alta.	.36	.19	.23	.57	.42	.21	.26	.66
180	North Central Alta.	.40	.21	.32	.63	.58	.30	.47	.94
181	Red Deer, Alta.	.52	.25	.36	.75	.69	.33	.48	1.06
183	Peace River, Alta.	.54	.28	.37	.50	.66	.32	.51	.70

*These estimates exclude all land costs including taxes, buildings, off-farm trucking of grain, and management return.

The lowest per-bushel production costs for wheat were found in the Regina Plains, the Rosetown-Kindersley area, and South Central Alberta (regions 159, 170, and 174, respectively).[8] This is not surprising in light of the historical dominance of these regions in wheat production. Their strong competitive position stems not only from above-average yields, but also from low per-acre costs. The importance of costs is evident from examining data for Southwestern Saskatchewan (region 164) where a wheat yield of only 13.5 bushels per acre is associated with a production cost of $0.52 per bushel, compared with $0.51 in Northwestern Manitoba (region 149) where the yield was 25.6 bushels.

Production costs per bushel for wheat and barley are illustrated in Figures 3.3 and 3.4. In general, regions tending to have low per-bushel costs for wheat, relative to other regions, have the same advantage with respect to barley production. However, barley appears to be more competitive than wheat in Southern and Western Saskatchewan and in Eastern Alberta. The high yields for both wheat and barley in northerly regions of Alberta are partially offset by relatively high per-acre production costs. This is in part due to more intensive cultivation requirements in these areas compared with regions such as Central Saskatchewan.

Per-bushel production costs for barley in Southwestern Saskatchewan and North Central Alberta are about equal (regions 162, 164, and 180). However, while transportation costs from each region to the Vancouver export market are about the same, the rate to Thunder Bay and the Eastern export and domestic market is several cents per bushel greater for the Alberta region. This would, therefore, in part explain the larger acreages of barley estimated by this Study for Southwestern Saskatchewan, compared with region 180 in Alberta.

[8] These figures are very low compared with production cost estimates of some other studies. It should be remembered, however, that this Study includes only those costs relevant to the determination of interregional comparative advantage. For example, while the estimated cost for wheat seeded on summerfallow was $0.35 per bushel in the Regina area, to include land at 1966 prices would increase it to $0.95 per bushel. Adding a management return, plus the minor items that were excluded, would further increase the production cost estimates.

The competitive position of different provinces across Canada in cereal production is shown in Table 3.3.[9] Production costs for all crops are, in general, significantly lower in the West compared with Quebec and the Maritimes. Ontario's competitive position compares favourably with that for the West (except for spring wheat which is of little importance in Ontario). The average cost of producing winter wheat is less than for spring wheat in Manitoba. However, these figures obscure wide variations that exist between regions and farm sizes within each province. For example, while the average production cost of corn in Ontario is $0.50 per bushel, this cost is as low as $0.35 in some regions and as high as $0.63 in others (Table B.17). Likewise, while the cost of producing barley in Nova Scotia is double that for Saskatchewan, larger farms in some of its regions can produce it as cheaply as the small farms in some regions in Saskatchewan.

TABLE 3.3

WEIGHTED AVERAGE COST OF PRODUCTION PER BUSHEL BY PROVINCE*

Province	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grains**	Corn
			(Dollars per bushel)				
Nova Scotia	.65		.53	.57		.51	
Prince Edward Island	.68		.43	.39		.37	
New Brunswick	.73		.54	.59		.51	
Quebec	.70		.51	.50	.77	.49	
Ontario	.79	.53	.40	.44	.81	.39	.50
Manitoba	.57		.32	.42	.52	.35	
Saskatchewan	.45		.23	.29	.47	.27	
Alberta***	.48		.26	.34	.60	.31	

*These cost estimates exclude all land costs including taxes, buildings, off-farm trucking of grain, and management returns. The weighting procedure was based on 1966 regional acreages. The estimates for the Prairie Provinces are for crops grown on summerfallow. Eighty per cent of the cost of summerfallowing was attributed to these crops.

**Even though mixed grains were not considered as a production alternative in the Prairie Provinces, yield and cost coefficients were estimated.

***The Peace River area of British Columbia is not included in the figures for Alberta.

Despite the wide differences in production costs between the Maritimes and the Prairies, a significant proportion of the land in these regions was competitive with the Prairies for some models. One reason is the transportation costs involved in moving grain from the Prairies to the livestock demands in the Maritime regions. For example, the cost of transporting barley from Southwestern Saskatchewan to Thunder Bay is about 11 cents per bushel (Table B.4). With present levels of the feed freight assistance subsidy, virtually no additional charges are involved in the

[9] The cost estimates in Table 3.3 have been aggregated from regional data for both farm sizes on the basis of 1966 acreages. The optimal allocation of crops by region as estimated by this Study would give slightly lower costs. The relative difference between provinces would not materially change, however.

movement from Thunder Bay to regions in Nova Scotia. Thus regions of Nova Scotia can be competitive with regions in Southwestern Saskatchewan for their domestic feed requirements if the differences in production costs are less than $0.11.

The strong competitive position of most areas in Ontario is evident from examining the production costs in Table 3.3, if one takes into account the cost of moving grain from Prairie regions to Thunder Bay. In this Study, it was found that Ontario winter wheat is very competitive with Western wheat for livestock feed in Quebec and Nova Scotia (Tables C.34 and C.37). The freight rate for winter wheat from Port Colborne to Halifax is less than four cents per bushel when the feed freight assistance subsidy is applied. Prior to the inclusion of winter wheat and corn under the terms of this Act, the cost for the same movement was 37 cents per bushel. Hence, transportation costs are now sufficiently low to permit Ontario winter wheat to compete in the Eastern Canadian feed grain markets, despite its somewhat higher production costs compared with the Prairies.

Conclusions

Regional comparative advantage in crop production depends on many factors. While favourable crop yields are important, they do not in themselves ensure low per-bushel costs. Production costs per acre vary significantly across Canada, and even within the Prairies wide differences are evident. Often differences in per-acre production costs between regions are sufficient to offset low relative yields. For example, many regions in Central and Southern Saskatchewan have low yields compared with regions in Northeastern Saskatchewan and Manitoba (Figures 3.1 and 3.2). However, when one takes into account the extensive type of production and small inputs of fertilizer used in these low-yield regions, their position measured in per-bushel production costs becomes very favourable. In Figure 3.3, the entire central part of Saskatchewan is shown to have relatively low per-bushel production costs despite its relatively low yields. This same area was also found to have low per-bushel production costs for barley (derived regional acreages of different crops are shown in Tables C.10 to C.20).

CHAPTER 4

IMPLICATIONS OF INTERREGIONAL COMPETITIVE EQUILIBRIUM FOR AGRICULTURAL POLICY

EXTENT OF IMBALANCE IN CEREAL PRODUCTION

Excess Production Capacity

It was estimated that with long-term average yields, the Canadian cereal economy in 1966 could have produced 465 million bushels of wheat for export, supplied average export demands of the past decade for feed grains, and met all domestic cereal requirements, without any reduction in stocks.[1] Wheat exports have been near this level in only four years in the history of Canadian agriculture. Even including these four years, wheat exports have averaged 406 million bushels per year over the past decade and only 360 million bushels since 1953. This comparison indicates the extent of imbalance between production potential as it existed in 1966 and demand. Unless Canadian agriculture can anticipate significantly greater future demands for wheat and feed than has been experienced in recent years, stock accumulation will continue if acreage is not diverted from cereal production.[2]

Several projections of prospective future wheat demands were cited in Chapter 2. These ranged from 235 to 400 million bushels. While these estimates were made several years ago, future prospects are no more optimistic from the vantage point of early 1970. If 1969-70 expectations of 375 million bushels of wheat exports are realized, about one billion bushels of wheat will be in store at the close of the current crop year. It would be a considerable understatement to say that further additions to wheat stocks are not necessary at this time.

The production-demand imbalance of the Canadian cereal economy did not suddenly arise in the past year. The spectre of large wheat inventories has existed for many years. Abnormally large wheat export sales for a few years in the 1960's temporarily lessened the pressure on the cereal economy. With a return of wheat exports to their previous levels, the imbalance between supply and demand has

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[1] This estimate was derived by increasing the wheat export demand in a mathematical model until only an insignificant acreage of uncompetitive land remained across Canada. The model was the same as Models 1 to 3 in terms of assumptions and mathematical structure except for the greater wheat export demand.

[2] As indicated earlier, the Prairie acreage of cereals and summerfallow has continued to increase since 1966. Domestic demands would be greater in recent years due to population growth and increased livestock numbers.

become even more pronounced, since productive capacity in terms of cereal acreage has expanded during the period of buoyant markets.

Many farmers in the Prairies reduced their acreage of wheat in 1969 in response to limited sales and large inventories. However, while total wheat acreage was declining by 4,460,000 acres from the previous year, much of this land was shifted into other cereals for which excess stocks already exist, and into summerfallow, increasing the potential for 1970.[3]

Required Adjustments

The type of adjustment suggested in this Study is a removal of certain land from all cereal production. This Study has not examined what the alternative uses for this land might be. It is unlikely that markets can be found for significant acreages of other crops so that all land can remain under cultivation. More likely, the alternative is for large-scale increases in grassland. Whether this land is allowed to compete in the livestock industry would depend on the means by which the adjustment took place, and on any adverse effects which it might have on livestock producers. It is not inconceivable that some surplus cereal land should remain out of all types of agricultural production. Much further research is necessary before any reasoned statements can be made as to its alternative prospective uses.

Acreage Withdrawal–This Study has identified those areas in which land is uncompetitive in cereal production. It is in these areas that land should be removed from cereal production if supply and demand are to be brought into equilibrium, while producing the total requirements at the lowest possible cost. When a 420-million-bushel wheat export market was assumed, 2.2 million acres were found to be redundant for cereal production (Table 2.2). This figure increased to 7.4 and 11.0 million acres with wheat exports of 350 and 300 million bushels, respectively.

The marginal land is distributed quite unevenly across the country. The largest acreage of uncompetitive cereal land is found in Alberta and secondly in Manitoba. While a large number of regions in the Maritimes and Quebec contain land that is inefficient in cereal production, the acreage involved is small compared with the total surplus acreage across the country. However, it is often a major part of the total land in the affected producing regions, and indeed, in several cases, constitutes a significant proportion of the provincial cereal acreage.

Number of Farms Affected–The concern of this Study has been with identifying land that is inefficient in cereal production under specified conditions. However, it must be recognized that the number of farms in each region that would become uncompetitive by long-run adjustments, as specified by this Study, would not be proportional to the regional acreage involved. Farm size varies widely across Canada. In Quebec, 38 per cent of the farms had less than 70 improved acres in 1966; whereas, in Saskatchewan, 45 per cent had greater than 560 acres, and 10 per

[3] Feed grains acreage in the Prairies increased by 989,000 acres and summerfallow by 2,140,000 acres in 1969 over 1968. Flaxseed and rapeseed together increased by 1,878,000 acres or 74 per cent between 1968 and 1969.

cent had more than 1,120 improved acres. Hence, for any given acreage of inefficient land, many more farmers would be affected in Quebec than in Saskatchewan. However, if this type of comparison is to be made, recognition must be given to the much greater importance of cereal production to the livelihood of farmers in Western Canada than of those in Quebec and the Maritimes. Futhermore, in all regions there is often a significant number of small holdings from which the operator receives only a minor part of his total income. In 1966, there were 22,470 farms in Canada with nine or fewer improved acres. There is little doubt that farms of this size do not depend on cereal production for much of their income. At the same time, their existence makes little difference to the problem of surplus cereal production.

Table C.45 shows the number of farms that should be removed from cereal production in each province if adjustments in land use correspond to the optimal production pattern necessary to meet exactly a wheat export demand of 350 million bushels.[4] In the construction of this Table, if only part of the land in a producing region was uncompetitive, it was assumed that the small farms became inefficient first.[5] If one ignores those farms with less than 10 acres, then 128,111 or 32 per cent of all such farms in Canada should be removed from cereal production if the specified cereal requirements are to be produced at lowest possible cost. Perhaps more of the farms included in this figure should be excluded because they represent noncommercial operations. Also, it is likely that many of the farms in the 10-to-69-acre size class in British Columbia are fruit growers rather than cereal producers. If one includes only those farms with 10 or more acres in the Maritimes, 70 acres in Central Canada and British Columbia, and 240 acres in the Prairies, then 69,275 farms are redundant across Canada. This represents a significant number of farm operations. If a 420-million-bushel wheat export market is anticipated, then the comparable figure is 33,571 farms. Considerable social upheaval would be associated with either level of adjustment. While this Study has not considered the monetary and other costs associated with such a transfer of labour from agriculture, this would be a very important consideration in the implementation of this type of adjustment compared with some other form.

ALTERNATIVE ADJUSTMENT POLICIES

Partial Competitive Equilibrium

The greatest number of farms identified as redundant or surplus are located in Eastern Canada and British Columbia. However, these farms account for a small percentage of the total uncompetitive cereal land in Canada. Model 7 of this Study was used to study the impact of agricultural policy formulated so that all

[4] The total number of farms within each size class of improved acres in 1966 is given in Table B.21.

[5] For any given region. it was assumed that all size classes of farms cultivated the same proportion of their improved acreage for cereal production.

reductions in cereal acreage would take place in the Prairies. In this model, cereal land in Eastern Canada and British Columbia (except for the Peace River area) was allowed to remain in full production regardless of its competitive position.[6] Other assumptions relating to this analysis were identical to those incorporated in Model 2 (350-million-bushel wheat export market).

The above-described analysis resulted in 8,070,481 acres of uncompetitive land compared with 7,413,312 acres for Model 2 (Table 2.2).[7] However, in this case, all such land, by definition, was concentrated in the Prairie Provinces. Within this framework, the uncompetitive land in Manitoba, Saskatchewan, and Alberta increased by 666,669, 651,733, and 223,354 acres, respectively. Table C.5 and Figure 4.1 indicate the regional location of the uncompetitive land. Two additional regions in Manitoba and two in Saskatchewan contained marginal land.

Since the results for Model 7 represent a restricted equilibrium analysis, it would be expected that the total cost of producing and distributing the national cereal requirements would be greater than those estimated for Model 2. This cost difference amounted to $3,104,658 or one-half of 1 per cent of the previous total cost of $603,243,500. This is clearly an insignificant increase in cost, given the magnitude of the figures involved. The production costs for cereals in Quebec and the Maritimes are considerably greater than for the Prairies. However, much of this cost difference (due to producing inefficiently in regions in the East) would be offset by the savings in transportation costs due to producing cereals locally rather than importing them from regions in the Prairies.

In Model 7, the uncompetitive acreage increased in three of the regions identified as marginal in Model 2. Four new regions also became partially uncompetitive. Associated with the additional uncompetitive land were 3,911 farms in Manitoba, 3,077 in Saskatchewan, and 513 in Alberta, or a total of 7,501 farms, with 10 or more improved acres. Offsetting this increase in the number of inefficient farms in the Prairies was the 82,454 additional farms of greater than 10 acres that were able to stay in production in British Columbia and Eastern Canada.

Extreme caution must be used in making comparisons such as the above. As was indicated earlier, the farms associated with the uncompetitive land in Eastern Canada might not be nearly so dependent on crop production for income as the additional redundant farms in the Prairies. Nevertheless, the slight deviation from the full competitive equilibrium, as expressed in the increase in total production and distribution cost, seems to be a small price for the considerably fewer total farms associated with this inefficient acreage.

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[6] The regional crop mix within Eastern Canada and British Columbia was optimized within the framework of total land use, however.

[7] The greater acreage of uncompetitive land in Model 7 resulted from the higher crop yields in previously redundant land in Eastern Canada compared with the new marginal land in the Prairies.

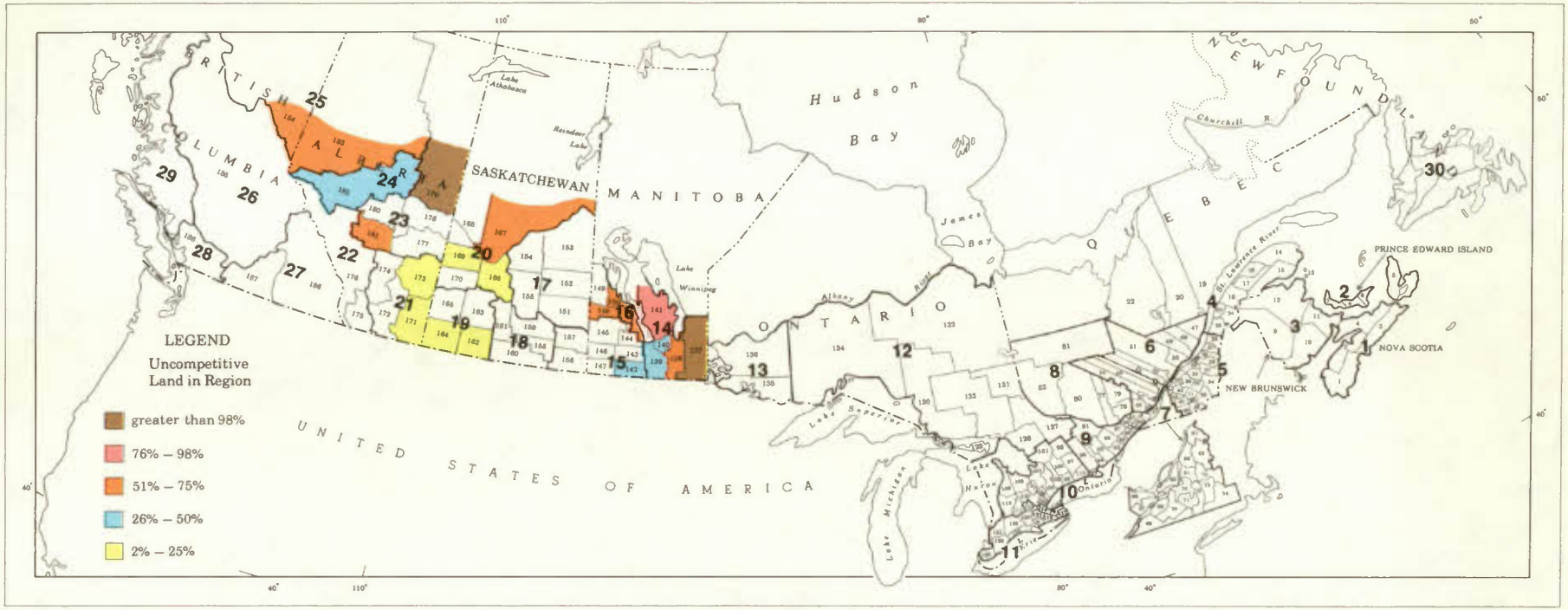

FIGURE 4.1 UNCOMPETITIVE LAND FOR CEREAL PRODUCTION BY REGION, MODEL 7.

Proportional Acreage Withdrawal by All Farms in Prairies

It has been necessary for the Canadian Wheat Board to levy grain marketing quotas each year during the past two decades. Commercial storage facilities have not been sufficient to absorb all surplus farm supplies by the end of most crop years. Quotas are administered in such a manner that all farms are treated more or less equally, regardless of their competitive position in cereal production. With per-acre quotas basically the same across the Prairies at the end of each crop year, virtually every cereal farmer is affected by the imbalance in productive capacity. All farmers must either shift production to alternative crops (including summerfallow and various forms of pasture) or be prepared to store excess stocks on their farms.

What is the impact of this implicit adjustment program where every farm is affected rather than just those in regions that are inefficient, as would be the case if a spatial competitive equilibrium was achieved? In the latter case, some farms would be removed from production entirely; however, those remaining would be able to market all their cereals in the year of production. If crop prices were the same as when there was excess production capacity, then the income position of the remaining farms would be improved through earlier realization of cash income from their cereal production and reduced farm storage costs. Model 8 of this Study is intended to determine the effect of a Prairie-wide adjustment process on total production and distribution costs. This analysis is identical to that of Model 7, except that the cereal acreage available to each farm in every region is reduced proportionally so that total production is just equal to domestic and export demands. As in the case of Model 7, all cereal land in Eastern Canada and British Columbia (excluding its Peace River area) was assumed to be utilized regardless of whether or not it was competitive with production in the Prairies. Wheat exports were again assumed at a level of 350 million bushels. Hence, Model 8 is directly comparable with Model 7 except for the difference in the type of Prairie acreage adjustment.

In this analysis, it was found that 12.5 per cent of the land on each farm in every region would have to be removed from cereal production (including summerfallow) to bring supply into balance with demand (when wheat exports were 350 million bushels).[8] Because of the large historical cereal acreage in Saskatchewan and because of its high productive efficiency, under this analysis, it contains a much greater percentage of the total unused acreage compared with the other models. Only half as much land would need to be withdrawn from production in Manitoba and 70 per cent as much in Alberta as under the comparable unrestricted competitive equilibrium (Model 8 versus Model 7, Table 2.2).

The cost of producing and distributing the total cereal requirements under the assumptions of Model 8 is $626,754,926 compared with $606,348,158 for Model 7. This increased cost of over 20 million dollars is the annual economic

[8] See, for example, Table 2.2.

loss if crop acreage is reduced proportionally in all regions compared with the removal of only uncompetitive land from production. This figure is again perhaps not particularly striking; however, it should be remembered that not all production costs were included in the cost estimates used in this Study. For example, in the Regina Plains area (region 159), it was found that the inclusion of land costs alone nearly tripled the estimated per-bushel production costs. Hence, this 20-million-dollar figure should be evaluated, bearing this fact in mind.

One further consideration that should not be lost sight of is that, while many farms would be removed from production under the restricted competitive equilibrium, the remaining ones would be able to sell all of their production. Under the proportional adjustment program, all production would also be market-clearing, but incomes per farm from the sale of farm products would be less because of the 12.5 per cent reduction in acreage. If government transfer payments were used to increase incomes to offset this loss of production, this cost would have to be weighed against any costs associated with the withdrawal of only uncompetitive land. There would be a further cost to society, however. Under the proportional withdrawal program, resources would be used inefficiently at least to the extent of the 20 million dollars. This does not consider the lost productivity from failing to use these redundant resources in other forms of agricultural or nonagricultural production.[9] This might, in the long run, be the greater cost to the Canadian economy.

EXPANDING PRAIRIE LAND BASE

Historical Changes

The base year for this Study was 1966. Yield technology, domestic demands, and cost estimates all pertain to this point in time. Total land available for the production of cereals in the Prairies[10] (including the necessary summerfallow) was assumed equal to the 1966 level of 69,067,262 acres. The total land used for all principal grain crops and summerfallow in 1966 amounted to 71,676,000 acres (Table B.26).[11] In 1969, only three years later, this acreage had increased to 73,826,000 or more than two million additional acres. During this period, wheat inventories were increasing rapidly. By the beginning of the 1968 crop year, wheat stocks were greater than in any other year, with the exception of 1957. The inventory of wheat increased a further 181 million bushels by July 31,

[9] While redundant land resources also might not be used productively if adjustments were enacted according to the restricted competitive equilibrium, capital and labour resources would be released from agricultural production rather than underemployed.

[10] The "Prairie" figures in this discussion do not include the British Columbia Peace River area.

[11] The total acreage for 1966-67 in Table B.26, less flaxseed and rapeseed, does not equal the figure of 69,067,262 acres used in this Study. To be comparable, it would be necessary to subtract the proportion of summerfallow required by oilseeds and minor crops from the summerfallow acres shown in Table B.26.

1969. However, despite the serious supply-demand imbalance that has existed for some years, the total productive capacity for grains as expressed in acreage has increased rather dramatically, even during the past several years. Over the eight-year period up to 1966, cultivated land in the Prairies increased by nearly five million acres or 7.3 per cent. While the yield potential of this new land is undoubtedly different from that identified as redundant in this Study, it is equal to 60 per cent of the land associated with the supply-demand imbalance estimated by the programming analysis for a 350-million-bushel export market (Model 7). However, as noted above, the land base has continued to grow, increasing a further two million acres in the past three years.

Changes in land use that are in the interest of agriculture in aggregate do not always correspond with what is most profitable for the individual farmer. Hence, while land supplies even prior to 1966 were more than adequate to meet prospective demands, farmers nevertheless continued to bring more land under cultivation. Their response was probably perfectly rational and consistent with maximizing or increasing their own income positions. However, the collective result of many farmers operating in this manner has accentuated the supply-demand imbalance in Prairie agriculture.

Government Policies Conflicting with Attainment of Supply-Demand Equilibrium

Some government policies either directly or indirectly encourage farmers to bring new land under cultivation. While the objectives of such policies might be to improve individual incomes or stimulate regional economic development, the means of attaining these goals may be in conflict with the broader interests of agriculture.

Agricultural and Rural Development Act and Fund for Rural Economic Development (ARDA-FRED) – These federal-provincial cost-sharing policies were initiated in part to alleviate the low-income levels in certain rural areas. Much of the initial force of ARDA programs tended to be on the manner in which land use could be improved, rather than on the more fundamental causes of distress in rural areas. In the Interlake area of Manitoba, an ARDA program was established which provided assistance for clearing and breaking. This program had the effect of reducing the cost of such land improvements by about 60 per cent, and up to mid-1966 had resulted in some 20,000 acres being cleared.[12] This program may have been entirely effective in attaining its stated objectives relative to this specific region. Nevertheless, the results of this Study indicate that this region is

[12] Helen Buckley and Eva Tihanyi, *Canadian Policies for Rural Adjustment, A Study of the Economic Impact of ARDA, PFRA and MMRA,* Special Study No. 7, Economic Council of Canada, October 1967. In May 1967, a FRED agreement was signed between the Government of Canada and the Province of Manitoba for development of the Interlake area. This program is much more comprehensive than the initial ARDA agreement. Nearly equal expenditures are being made for school education, adult education, and resource improvements (including road development and recreation). Nevertheless, considerable land resources continue to be improved for crop production. Between September 1, 1967 and December 20, 1968, a total of 21,527 acres of bush had been knocked down and piled. See Canada Department of Forestry and Rural Development, *Kah-Miss-Ahk,* Queen's Printer, 1969.

not fully competitive and a considerable acreage should be diverted from cereals if national economic efficiency in production and distribution is to be achieved.

Income Tax Incentives – Farmers who expand their improved acreage through clearing or leveling of land or installing tile drainage (after 1964)[13] may claim such costs as current expenditures in the filing of their income tax. The handling of these costs in this manner has stimulated land improvement as a means for some farmers to increase their land base. Farmers who are in a relatively high income tax bracket may effectively reduce the cost of such improvements in any given year through tax savings. For example, land clearing which costs $45.00 per acre can be reduced to $31.50 per acre if the farmer is in a 30 per cent tax bracket. If these expenditures were treated as capital improvements and the cost thereby spread over a number of years, some of the stimulus to land development would be removed. More farmers would be likely to increase their land base through the purchase of additional cultivated acreage rather than breaking new land.

THE ROLE OF YIELD TECHNOLOGY IN AN AGRICULTURAL INDUSTRY WITH SURPLUS CAPACITY

During the past 30 years yield improvements have varied from one bushel per decade for wheat in Prairie regions up to 15 or 16 bushels per decade for corn in Southern Ontario. These yield increases have undoubtedly had a major influence on the current excess capacity of the Canadian cereal economy–nevertheless, they are fundamental to a strong competitive position for Canadian cereals in world export markets. For this reason, continued emphasis must be placed on agricultural research to develop new higher-yielding varieties and even new grains. While this Study found that some low-yielding regions were strongly competitive with higher-yielding ones, this did not, in any way, imply that high yields were not important to competitive efficiency. New higher-yielding varieties of cereals usually do not significantly change per-acre production costs. Therefore, most of the yield increases is reflected in lower per-bushel production costs. While this would mean that further land would become redundant, given specified cereal demands, the overall competitive position of Canadian agriculture relative to other countries would be maintained or improved. If Canada is to ignore yield technology, it will eventually find itself unable to compete in world markets.

[13] Tile drainage installed in 1964 and earlier is treated as a capital cost and, as such, is depreciated over a period of years.

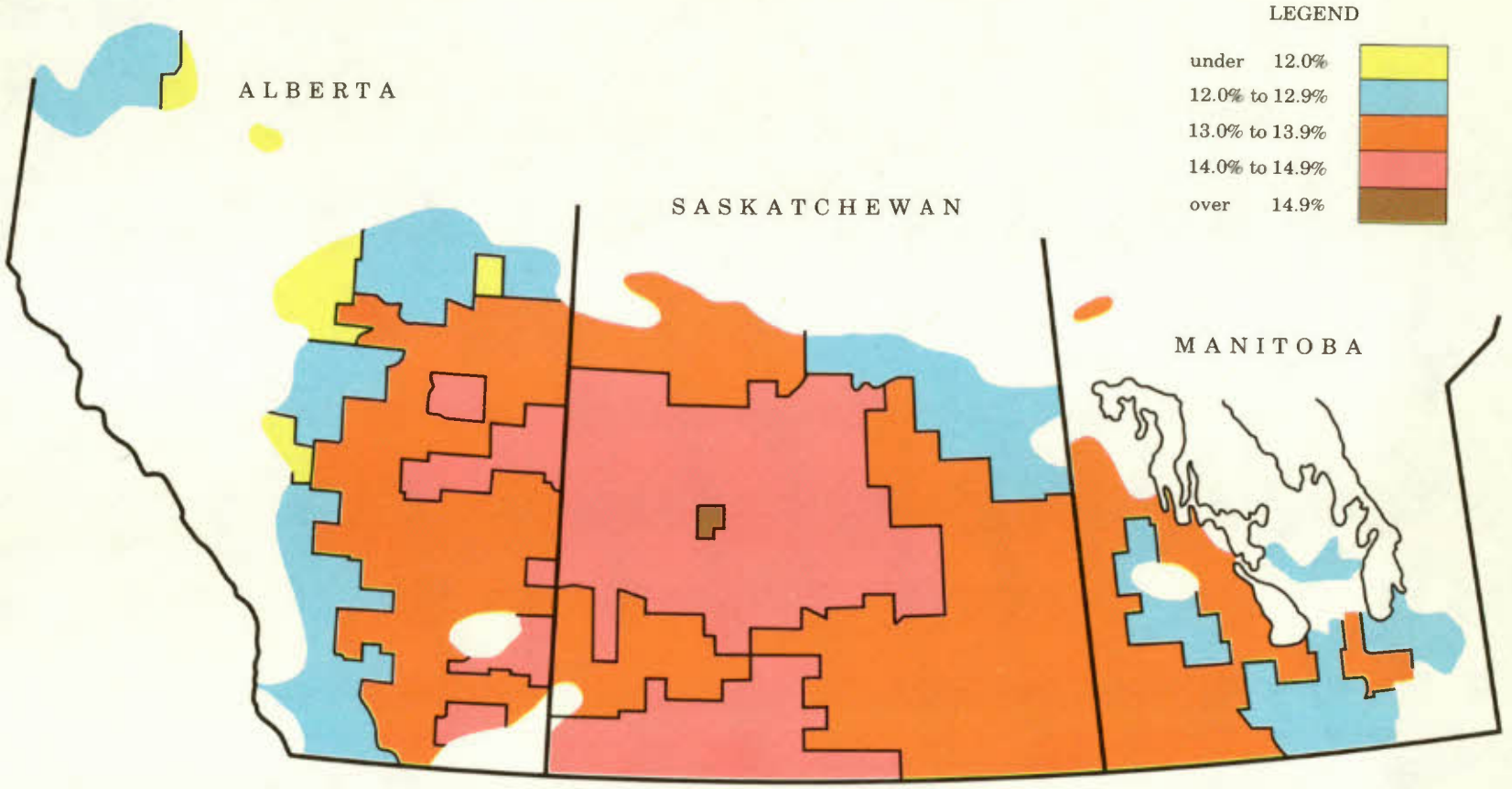

FIGURE 4.2 AVERAGE PROTEIN CONTENT OF WHEAT BY GRAIN RESEARCH LABORATORY DISTRICT, 1947-1966.

Source: V. Martens and I. Hlynka, Protein Content of Canadian Wheat 1927-1968, Board of Grain Commissioners for Canada, Canada Department of Agriculture, Winnipeg, Manitoba, 1969, p. 53.

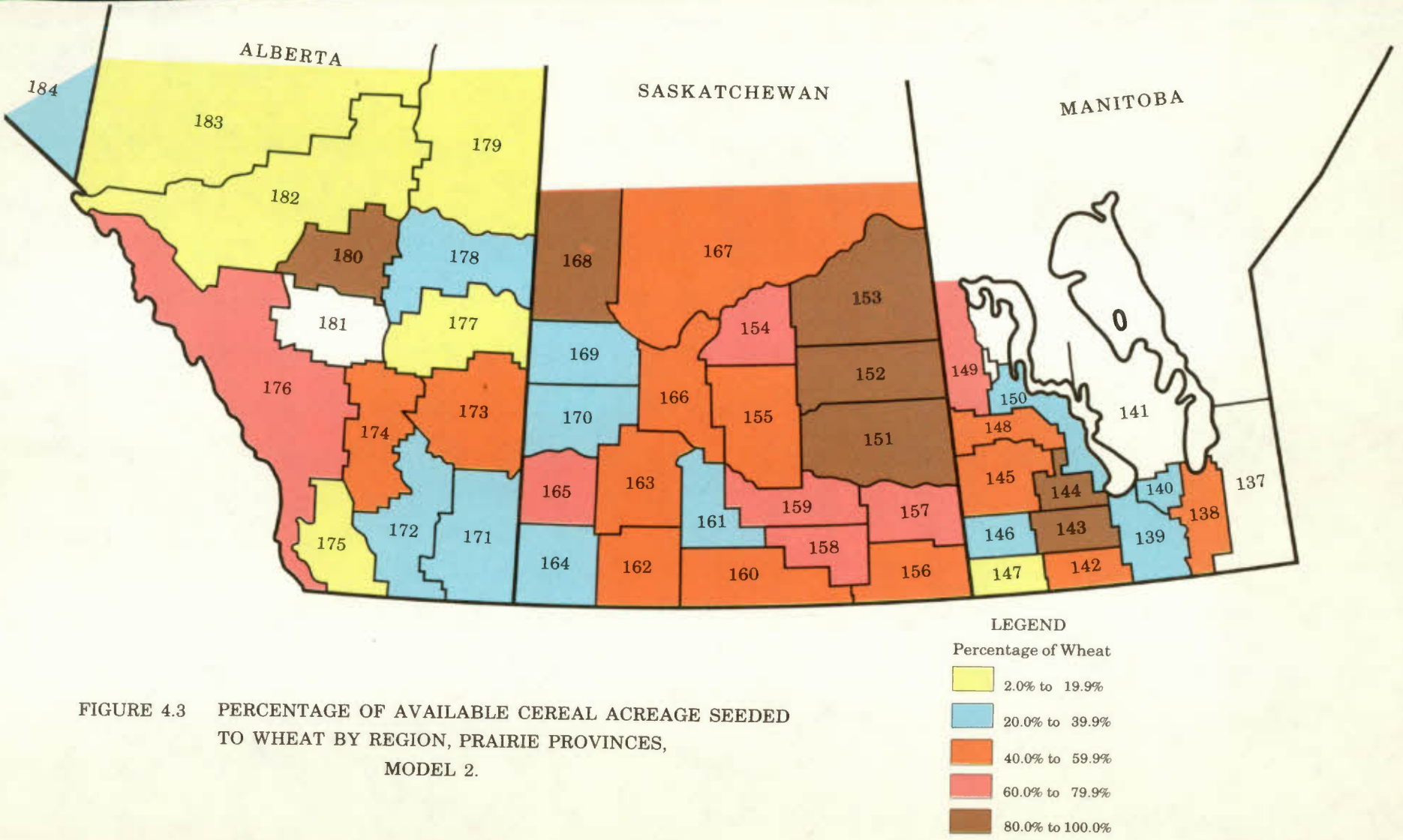

FIGURE 4.3 PERCENTAGE OF AVAILABLE CEREAL ACREAGE SEEDED TO WHEAT BY REGION, PRAIRIE PROVINCES, MODEL 2.

COMPETITIVE SPATIAL EQUILIBRIUM AND PROTEIN GRADING OF WHEAT

In a recent study, Hudson has concluded that greater attention must be given to protein quality if Canada is to remain competitive in world wheat markets.[14] Rather than rely on traditional grading standards to identify different qualities of wheat, importers are beginning to demand uniform guaranteed levels of protein. Canada has, in the past, enjoyed the reputation of being a source of high-protein wheat. However, considerable variation in protein content exists between different regions in most years. Martens and Hlynka, in a recent study, have reported historical regional protein levels based on data obtained from surveys and analyses conducted by the Board of Grain Commissioners Research Laboratory over the past 42 years.[15] While variability was found to exist from one year to the next, certain regions tended to have higher protein levels than others. The averages of protein levels over 1947 to 1966 by Grain Research Laboratory (GRL) districts are illustrated in Figure 4.2. Wheat produced in Central and Southern Saskatchewan was found to have the highest average protein content, with the lowest levels found on the western, northern and eastern fringes of the Prairie cropping area.

If grading standards for wheat are established on the basis of protein content, Canada's long-run competitive position in world wheat markets will be related to the correspondence between regions of high protein content and greatest comparative advantage in production. Figure 4.3 indicates the proportion of total land available for growing cereals which has a comparative advantage in wheat production given the assumptions of Model 2 (350 million bushels of wheat exports).[16] A positive relationship exists for some regions between the estimated comparative advantage in production and protein levels, although there are a number of discrepancies.

The northern areas of Alberta have had relatively low-protein wheat over the 1947-66 period. In this Study it was estimated that a small proportion of the land in these regions was competitive in wheat production. Likewise several of the regions of lower protein levels in the eastern half of Manitoba correspond to the relatively uncompetitive regions shown in Figure 4.3.

Eastern Saskatchewan and the Regina Plains area (regions 151, 152, 153, 157, 158, and 159) were found to be very competitive in wheat production, yet these regions have historically shown only moderate levels of protein. A relatively small wheat acreage was derived for regions such as the Rosetown-Kindersley area of Saskatchewan (region 170), although these areas have had high average protein levels. These results would probably have been different if more explicit recognition had been given to this additional variable in estimating optimal production location.

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[14] S. C. Hudson, *Future Market Outlets for Canadian Wheat and Other Grains,* Special Study No. 11, Economic Council of Canada, Ottawa, Queen's Printer, 1970.

[15] V. Martens and I. Hlynka, *Protein Content of Canadian Wheat 1927-1968,* Board of Grain Commissioners for Canada, Canada Department of Agriculture, Winnipeg, Manitoba, 1969.

[16] Figure 4.2 differs from Figure 2.6 in that the former indicates the competitive wheat acreage as a percentage of total land available for cereal production (excluding summerfallow) rather than a percentage of the land estimated to be competitive for all cereals.

Wheat production costs in the Rosetown-Kindersley area were estimated to be among the lowest in Canada. However, this region had an even greater comparative advantage in barley production; hence, a large acreage of barley was estimated in this Study. If this analysis had been undertaken with different qualities of wheat identified by region, the results would undoubtedly have been different in terms of the specific crops grown in each region. However, it is unlikely that the overall competitive position of different regions would have changed materially. That is, regions with high productive efficiency in one crop also tend to be in the same position with respect to other crops. The large acreages of barley estimated as competitive in Central Saskatchewan (regions 161 and 166) would probably have been replaced by wheat if recognition had been given to the high protein levels of wheat grown in these regions.

CHAPTER 5

SPATIAL EQUILIBRIUM ANALYSIS AS A TOOL FOR ANALYSING REGIONAL COMPETITIVE EFFICIENCY OF CANADIAN AGRICULTURE

CONCLUSIONS

This Study has attempted to determine the competitive spatial equilibrium for cereal production in Canada. In order to undertake such an analysis, a considerable amount of data was required, and it was necessary to make many assumptions. While a large research input was expended to obtain the results presented in this Study, they should nonetheless be interpreted with extreme caution. This was a pioneering study for nation-wide spatial equilibrium analysis as it relates to Canadian agriculture. The optimal regional production location of livestock, and crops other than cereals, was not determined. Much further research is required to assess the interactions of cereals with these other agricultural products. This is particularly true when assessing the impact of major changes in governmental policy (i.e. feed freight assistance subsidy).

The overall objective of this Study has been to assess the comparative advantage of different regions in cereal production. The results have indicated that wide differences in competitive efficiency exist across Canada. The most efficient areas were found to be in Southern Ontario and the plains areas of Saskatchewan. Many regions in Quebec were found to be uncompetitive in cereal production. Likewise, some regions in the Maritimes were not competitive with the rest of Canada. However, only a small proportion of the total uncompetitive land in Canada was located in Eastern regions.

Within the Prairies, Eastern Manitoba and Northern Alberta were identified as the most uncompetitive areas. When the analysis assumed 420 million bushels of wheat exports, no inefficient land was found in Saskatchewan. When lower wheat export demands were used, further regions were identified as marginal for cereal production in Manitoba and Alberta plus a part of the land in the drier regions of Saskatchewan.

The results of this Study as they pertained to the regional mix of cereals, in general, appeared consistent with regional trends over the past number of years. For example, oats were found to be uncompetitive with other crops in most Eastern Canadian regions. The acreage of this crop was usually found to be declining over time in these areas. Historical changes in the total acreage of

cereals in the Prairies were inconsistent with the results of this Study which indicated that excess productive capacity existed. For example, with wheat exports assumed at a level of 350 million bushels, over 6.5 million acres were identified as in excess supply, given the domestic cereal demands of 1966 and feed grains exports equal to their previous 10-year average. However, between 1966 and 1969, the cultivated land base of the Prairies increased by over two million acres.

It was found that the total cost of production and distribution changed only insignificantly if regions in Eastern Canada and Southern British Columbia were not required to be competitive with the Prairies. On the other hand, when cereal acreages in all regions in the Prairies were decreased proportionally, the total increase in annual cost amounted to 20 million dollars.[1]

LIMITATIONS OF STUDY

Many of the coefficients used in this Study were based on 1966 technology and land base. Domestic demands pertained to the 1966 population and livestock numbers. As such, the results relate specifically to this base year. No pretense was made that they represented a competitive analysis of excess productive capacity at some future date. The results indicate the competitive equilibrium that should have existed in 1966 had cereal production been located so as to minimize production and distribution costs. The comparative advantage of different regions would not be expected to change significantly over short periods of time (five to eight years). If one was concerned with the competitive interregional equilibrium for some future year such as 1980, it would be necessary to make further assumptions exogenous to the analysis. First, as was pointed out in Chapter 4, the cultivated land base has increased rather consistently and dramatically over the past decade despite the excess productive capacity. It would be necessary to make an estimate of future changes in this acreage. It would be inconsistent to assume that it would continue to increase at historical rates. Yield and cost coefficients would also need to be extrapolated to the future point in time for which the estimates were required. Much uncertainty is involved in such projections.

In this Study, only one level of fertilizer application and associated yield was considered for each crop and region. In reality, farmers use many different combinations and levels of fertilizer inputs. Their decision as to how much, and what to apply, depends in part on current economic conditions. The provision for applying fertilizer at different levels should be incorporated into future interregional analysis of Canadian agriculture. It is quite conceivable that a greater number of acres would thereby be found uncompetitive than were indicated by this Study. While the fertilizer coefficients were based on actual use,

[1] It was indicated that this figure was much more significant than its actual level, since only those production costs relevant to the determination of geographical location of production were included.

they would not reflect the heavier use of fertilizer by the more efficient farmers in most regions.

The machinery cost coefficients used in this Study were derived from a survey of tillage practices and implement sizes, by region, and from price and cost information obtained from the machinery, transportation, and petroleum industries. Considerably more research is required in the area of production cost estimation for studies such as this. However, research designed primarily to estimate production costs must be more representative if these estimates are to be of value in interregional analyses. No data relevant to the estimation of production costs were obtained from the Canadian Census. While the Census collects considerable information such as the number of various implements on farms, these data were found to be of little value in this Study.[2]

The major shortcoming of this analysis is its omission of the livestock sector and its restriction of cropping alternatives to cereals. The optimal location of livestock and crop production are interdependent. In this Study, regional livestock feed grain demands were assumed equal to their 1966 levels. The magnitude of the problem with respect to completing the analysis for crops within a reasonable period of time necessitated the exclusion of livestock in this first study of interregional comparative advantage. Likewise, the Study would have been improved if oilseeds, such as flaxseed and rapeseed, were considered as cropping alternatives. They were not explicitly considered in this analysis. The regional acreages of these two crops, as well as other minor crops, were assumed equal to their 1966 levels. Undoubtedly, a different regional pattern of production would have developed if they had been allowed to be grown in those regions where they had the greatest comparative advantage. Again, however, this simplification was made in order to keep this initial analysis within manageable bounds.

FURTHER RESEARCH REQUIREMENTS IN INTERREGIONAL COMPARATIVE ADVANTAGE

Research is currently in progress that will simultaneously estimate the optimal location of cereals, poultry, and hog production, consistent with their long-run competitive equilibrium.[3] However, to properly assess the interregional comparative advantage of Canadian agriculture, the analysis must be extended to cattle, including both cattle on feed and cow-calf enterprises. Once cattle are included in the analysis, detailed consideration of pasture and forage alternatives is required. Very little information is available with respect to cost and yield estimates relevant to these crops in different regions. When the optimal location of

[2] The Census does not, for example, distinguish between 30- and 120-horsepower tractors in their enumeration of tractor numbers.

[3] This research is being undertaken in the Department of Agricultural Economics, University of Manitoba.

cattle production is included, it might be necessary to extend the analysis to consider simultaneously the cereal and livestock sectors of the United States, since Canadian feeder cattle, and even finished cattle and dressed hogs, compete in a North American and not just Canadian market.

More detailed treatment of different land capabilities within regions is required. This is particularly true in the Prairies where regions are sometimes over a 100 miles across, and often contain in excess of two million acres of cultivated land. This is in contrast to Ontario where even the largest county has only 280,000 acres in cereals, but where some counties contain less than 10,000 acres. The lack of data pertinent to long-term yield estimation prevented a more detailed breakdown of regions in the Prairies.

Research is now under way to estimate crop-yield response to alternative fertilizer applications.[4] The estimated responses will eventually be used to determine interregional competitive efficiency while simultaneously optimizing the rate of fertilizer use by region.

In Chapter 4, it was shown that some correspondence exists between regions with high-protein wheat levels and comparative advantage in production. However, it was indicated that further research would be required which explicitly considered this additional variable. A number of complications arise, however. For example, it may be possible to improve protein content by increasing the application of nitrogen fertilizer. While conceptually this type of modification could be included relatively easily in an interregional competitive analysis, data problems would be considerable. For example, data would be required for every region to indicate the explicit quantitative relationship between fertilizer and protein.

Much research needs to be undertaken before we can specify in detail a long-term adjustment program to bring Canadian agricultural production into balance with demands. Changes in resource use should be undertaken in such a manner as to produce the greatest economic efficiency, providing it does not create undue social upheaval, if Canadian agricultural production is to remain competitive in the long run. Interregional analyses can provide the framework and information required for agricultural policy formulation. This Study represents a small start in this direction.

[4] This research is in progress at the Department of Agricultural Economics, University of Manitoba.

APPENDIX A

METHODOLOGY

APPENDIX A – METHODOLOGY

INTRODUCTION

The purpose of this Appendix is to provide a more rigorous explanation of the analytical methods used in the Study. The validity of the results presented earlier is entirely dependent upon the realism of the assumptions used to formulate the economic models, and the accuracy of the data used therein. Much of the research input for this Study was expended in the development of these economic models and the estimation of their coefficients. The procedure followed in this Appendix will be to first outline the general assumptions of the Study, then to present the mathematical model, and finally to discuss some of the sources of data and methods used to derive the programming coefficients.

GENERAL ASSUMPTIONS

Basic to the entire analysis was the assumption that the Canadian cereal grain economy could be realistically represented by a mathematical model. Since the overall objective of the Study was to quantitatively examine the comparative advantage of all regions in Canada, it was not possible to develop a model that included every primary producing unit and all of the factors that influence their individual farm operations. This Study deals with large regions as producing units (and areas of demand) with all farms therein considered homogeneous with respect to crop yields and cost structures. While intraregional detail is lost through use of this approach, the results can nevertheless indicate broad differences in economic efficiency between different areas of the country. The more disaggregated the analysis, the more research resources that are required. A research input of about six to seven professional man-years, a like input of clerical time, and extensive computer usage were required to obtain the results presented in the previous chapters. While further disaggregation would be desirable, the cost of such refinement must be weighed against any improvement in the quality of the results in relation to their possible uses. Many of the problems important to individual farmers and regional decision-makers can be answered by detailed studies specific to their farm or region in isolation from the rest of the country, once their overall relative position has been assessed.

Eight different linear programming models were utilized in this Study. The mathematical formulation of each model is basically the same. These models differ with respect to the values of certain variables and the signs of some restraints. These variations are discussed in a later section of this Appendix.

The regional framework for each model includes 188 cereal-producing regions and 30 cereal-consuming or -supplying regions. The criteria for selecting these regions are discussed in Chapter 1. The producing regions encompassed by each consuming (or supplying) region are identified in Table 1.1. In addition, Newfoundland was included as consuming region number 30; however, no production alternatives were considered for this province.

Grains produced in different regions were considered of the same quality in terms of their values as livestock feed. It was assumed that only grain from the Prairies could be utilized for domestic nonlivestock purposes and for export, with the exception of the distinct demands for Ontario winter wheat and corn.[1]

Grain demands within any consuming region were, in effect, established at the centre of the region. Interregional transportation rates were based on flows between these central points. No transportation costs were established for grain movement within or between producing regions within the larger consuming or supplying region.

One further major assumption is that the demand for all grains for export and domestic nonlivestock purposes is predetermined and does not change in response to changes in the cost of producing and distributing the product. Livestock feed demands are fixed in terms of total energy requirements that must be met by feed grains, but some degree of substitution is permitted in terms of the quantity of each grain utilized.

GENERAL MATHEMATICAL MODEL

The specific objective of this Study was to determine the production location and distribution patterns of cereals that would allow certain levels of cereal demand to be fulfilled at the smallest total production and transportation cost. The objective function of the linear programming model to solve this problem can be stated as:

$$\text{(A.1) Minimal Cost} = F(c) = \sum_{k=1}^{12}\sum_{f=1}^{188}\sum_{f=1}^{2} C_{kjf}\, X_{kjf} +$$

$$\sum_{g=1}^{4}\sum_{s=14}^{25}\sum_{d=1}^{2}\sum_{m=1}^{30} t^{i}_{gsdm}\, T^{i}_{gsdm} +$$

$$\sum_{g=1}^{4}\sum_{s=14}^{25}\sum_{e=1}^{4} t^{ii}_{gse}\, T^{ii}_{gse} + \sum_{g=1}^{4} w_g W_g +$$

$$\sum_{g=1}^{4}\sum_{r=1}^{12}\sum_{e=5}^{12} t^{iii}_{gre}\, T^{iii}_{gre} +$$

[1]This assumption did not materially alter the results since all consuming regions in Eastern Canada and British Columbia, except for the southwestern region of Ontario (supplying region 11), were deficit with respect to their ability to meet their own livestock feed demands.

$$\sum_{g=1}^{4}\sum_{r=1}^{12}\sum_{d=1}^{2}\sum_{m=1}^{13,30} t^{iv}_{grdm}\ T^{iv}_{grdm} +$$

$$\sum_{g=1}^{7}\sum_{s=9}^{11}\sum_{v=1}^{18}\sum_{m=1}^{13,30} t^{v}_{gsvm}\ T^{v}_{gsvm} +$$

$$\sum_{g=6}^{7}\sum_{s=9}^{11} t^{vi}_{gs}\ T^{vi}_{gs} + \sum_{g=1}^{7}\sum_{m=1}^{30} z_{gm}\ Z_{gm}$$

in which,

C_{kjf} = cost of producing one acre of the k-th crop in the j-th region for the f-th farm size,

X_{kjf} = level of production of the k-th crop in the j-th region for the f-th farm size,

X_{qjf} = level of production of summerfallow crop in the j-th region for the f-th farm size,

t^{i}_{gsdm} = cost per bushel of transporting the g-th cereal grain directly by rail from the s-th supplying region for the d-th purpose to the m-th consuming region,

T^{i}_{gsdm} = quantity of the g-th cereal grain transported directly by rail from the s-th supplying region for the d-th purpose to the m-th consuming region,

t^{ii}_{gse} = cost per bushel of transporting the g-th cereal grain from the s-th supplying region to the e-th terminal elevator,

T^{ii}_{gse} = quantity of the g-th cereal grain transported from the s-th supplying region to the e-th terminal elevator,

w_g = cost per bushel of transferring the g-th cereal grain into export position at Thunder Bay – assumed equal to zero,

W_g = quantity of the g-th cereal grain transferred into export position at Thunder Bay,

t^{iii}_{gre} = cost per bushel of transporting the g-th cereal grain from Thunder Bay via the r-th shipping route to the e-th export port,

T^{iii}_{gre} = quantity of the g-th cereal grain transported from Thunder Bay via the r-th shipping route to the e-th export port,

t^{iv}_{grdm} = cost per bushel of transporting the g-th cereal grain from Thunder Bay via the r-th shipping route for the d-th purpose to the m-th consuming region,

T^{iv}_{grdm} = quantity of the g-th cereal grain transported from Thunder Bay via the r-th shipping route for the d-th purpose to the m-th consuming region,

t^{v}_{gsvm} = cost per bushel of transporting the g-th cereal grain from the s-th Southern Ontario supplying region via the v-th shipping route to the m-th consuming region for livestock feed,

T^{v}_{gsvm} = quantity of the g-th cereal grain transported from the s-th Southern Ontario supplying region via the v-th shipping route to the m-th consuming region for livestock feed,

t^{vi}_{gs} = cost per bushel of transporting the g-th cereal grain from the s-th Southern Ontario supplying region to the Ontario domestic milling and industrial markets,

T^{vi}_{gs} = quantity of the g-th grain transported from the s-th Southern Ontario supplying region to the Ontario domestic milling and industrial markets,

z_{gm} = cost per bushel of transforming the g-th cereal grain into barley equivalents for livestock feeding in the m-th consuming region—assumed equal to zero,

Z_{gm} = quantity of the g-th cereal grain transformed into barley equivalents for livestock feeding in the m-th consuming region.

Equation A.1 is minimized, subject to the linear restraints:

(A.2) $L_{kjf} \geq X_{kjf}$ $\quad j = 1, 2, \ldots, 136, 185, 186, 187, 188$; $k = 5, 6, 7$; $f = 1, 2$

(A.3) $L_{kjf} \geq X_{kjf} + X_{k+7jf}$ $\quad j = 137, 138, \ldots, 184$; $k = 1, 2, 3, 4$; $f = 1, 2$

(A.4) $L'_{jf} = \sum_{k=1}^{4} X_{kjf} - X_{qjf}$ $\quad j = 137, 138, \ldots, 184$; $f = 1, 2$; $q = 12$

(A.5) $L''_{jf} \geq \sum_{k=1}^{11} a'_j X_{kjf} + X_{qjf}$ $\quad j = 137, 138, \ldots, 184$; $f = 1, 2$; $q = 12$

(A.6) $L'''_{jf} \geq \sum_{k=1}^{12} X_{kjf}$ $\quad j = 1, 2, \ldots, 188$; $f = 1, 2$

(A.7) $S_{gm} = \sum_{j=\alpha}^{\beta} \sum_{f=1}^{2} a_{kj} X_{kjf} + \sum_{r=1}^{12} T^{iv}_{grdm} +$

$$\sum_{s=9}^{11} \sum_{v=1}^{18} T^{v}_{gsvm} +$$

$$\sum_{s=14}^{25} T^{i}_{gsdm} - T^{vi}_{gm} - Z_{gm} \qquad \begin{array}{l} m = 1, 2, \ldots, 13, 30 \\ g = k = 1, 2, \ldots, 7 \\ d = 2 \end{array}$$

(A.8) $$S_{gm} = \sum_{j=\alpha}^{\beta} \sum_{f=1}^{2} (a_{kj} X_{kjf} + a_{k+7j} X_{k+7jf}) +$$

$$\sum_{s=14}^{25} T^{i}_{gsdm} - \sum_{s=1}^{13,30} T^{i}_{gsdm} -$$

$$\sum_{e=1}^{4} T^{ii}_{gme} - Z_{gm} \qquad \begin{array}{l} m = 14, 15, \ldots, 29 \\ g = k = 1, 2, 3, 4 \\ d = 2 \end{array}$$

(A.9) $$F_m = \sum_{g=1}^{7} G_g Z_{gm} \qquad m = 1, 2, \ldots, 30$$

(A.10) $$H_{gm} = \sum_{s=14}^{25} T^{i}_{gsdm} + \sum_{r=1}^{12} T^{iv}_{grdm} \qquad \begin{array}{l} m = 1, 2, \ldots, 13, 30 \\ g = 1, 2, 3, 4 \\ d = 1 \end{array}$$

(A.11) $$H_{gm} = \sum_{s=14}^{25} T^{i}_{gsdm} \qquad \begin{array}{l} m = 14, 15, \ldots, 29 \\ g = 1, 2, 3, 4 \\ d = 1 \end{array}$$

(A.12) $$E_{ge} = \sum_{s=14}^{25} T^{ii}_{gse} \qquad \begin{array}{l} e = 1, 2, 3 \\ g = 1, 2, 3, 4 \end{array}$$

(A.13) $$E_{g4} = W_g \qquad g = 1, 2, 3, 4$$

(A.14) $$E_{ge} = \sum_{r=1}^{12} T^{iii}_{gre} \qquad \begin{array}{l} e = 5, 6, \ldots, 12 \\ g = 1, 2, 3, 4 \end{array}$$

(A.15) $$A_g = \sum_{s=14}^{25} T^{ii}_{gs4} - W_g -$$

$$\sum_{e=5}^{12} \sum_{r=1}^{12} T^{iii}_{gre} -$$

$$\sum_{m=1}^{13,30} \sum_{r=1}^{12} \sum_{d=1}^{2} T^{iv}_{grdm} \qquad g = 1, 2, 3, 4$$

(A.16) $$D_g = \sum_{s=9}^{11} T^{vi}_{gs} \qquad g = 6, 7$$

(A.17) $$P_4 \geq \sum_{g=1}^{4} \sum_{s=14}^{25} T^{ii}_{gs4}$$

$$\text{(A.18)}\quad P_z \geq \sum_{g=1}^{4}\sum_{d=1}^{2}\sum_{m=1}^{13,30} T^{iv}_{grdm} + \sum_{g=1}^{4} T^{iii}_{gre} + \sum_{g=1}^{7}\sum_{s=9}^{11}\sum_{v=1}^{18*}\sum_{m=1}^{13,30} T^{v}_{gsvm} \qquad z = e = (r+4) = 5, 6, \ldots, 16$$

$$\text{(A.19)}\quad M_{1m} \leq Z_{1m} + Z_{6m} \qquad m = 1, 2, \ldots, 30$$

$$\text{(A.20)}\quad M_{gm} \leq Z_{gm} \qquad m = 1, 2, \ldots, 30;\ g = 2, 3, 4, 5, 7$$

Finally, feasibility conditions are defined as:

$$\text{(A.21)}\quad X_{kjf} \geq 0\,;\ T^{i}_{gsdm} \geq 0\,;\ T^{ii}_{gse} \geq 0\,;\ W_g \geq 0\,;\ T^{iii}_{gre} \geq 0\,;\ T^{iv}_{grdm} \geq 0\,;\ T^{v}_{gsvm} \geq 0\,;\ T^{vi}_{gs} \geq 0\,;\ Z_{gm} \geq 0\,.$$

The variables in equations A.2 to A.20 are defined as follows:

L_{kjf} = amount of land available for the production of the k-th cereal in the j-th production region on the f-th farm size,

L'_{jf} and L''_{jf} = restraints to ensure that at least a'_j of each acre is maintained in summerfallow in the j-th production region on the f-th farm size,

L'''_{jf} = total amount of land available for the production of cereals and summerfallow on the f-th farm size in the j-th production region,

a'_j = proportion of an acre that must be maintained in summerfallow in the j-th producing region,

S_{gm} = supply of the g-th cereal available for livestock consumption in the m-th consuming region,

a_{kj} = yield of the k-th crop in the j-th production region,

α = first production region number within the m-th consuming region,

β = last production region number within the m-th consuming region,

F_m = demand for livestock feed (in terms of barley equivalents) in the m-th consuming region,

G_g = barley equivalent of one bushel of the g-th grain,

H_{gm} = demand for the g-th cereal grain for domestic milling and industrial purposes in the m-th consuming region,

*Summation only for those routings which include port z.

E_{ge} = export demand for the g-th cereal grain at the e-th terminal elevator,

A_g = supply of the g-th cereal grain at Thunder Bay,

D_g = demand for the g-th cereal grain for domestic milling and industrial purposes in Ontario and for export,

P_z = maximum handling capacity of cereals at the z-th port,

M_{gm} = minimum quantity of the g-th grain used for livestock feed in the m-th region–spring and winter wheat considered identical in meeting wheat requirements.

All other terms are defined as before.

The producing regions and consuming (or supplying) regions are illustrated in Figure 1.2 in the text. The crops are identified by number, as follows:

1 = wheat (spring wheat in Ontario)
2 = oats
3 = barley
4 = rye
5 = mixed grains
6 = winter wheat (Ontario)
7 = corn
8 = stubble wheat (Prairies)
9 = stubble oats (Prairies)
10 = stubble barley (Prairies)
11 = stubble rye (Prairies)
12 = summerfallow (Prairies)

In the Prairies, numbers 1 to 4 apply to crops grown on summerfallow, while in Eastern Canada, numbers 1 to 7 represent stubble crops. Crops 8 to 12 are only relevant to the Prairies.[2]

Cereal grains are numbered the same as crops 1 to 7 above.

The transportation routings from Thunder Bay to ports in Eastern Canada are numbered as:

1 = Kingston
2 = Montreal
3 = Sorel
4 = Quebec

[2]The Peace River area of British Columbia was treated the same as the Prairie regions.

5 = Trois-Rivières
6 = Baie Comeau
7 = Saint John
8 = Halifax
9 = Bay ports*
10 = Port Colborne
11 = Prescott
12 = Toronto

Routings from supplying regions 9, 10 and 11 to consuming regions in Eastern Canada are identified as:

1 = supplying regions 10 or 11 to Halifax via Bay ports*
2 = supplying regions 10 or 11 to Montreal via Bay ports*
3 = supplying regions 10 or 11 to Quebec via Bay ports*
4 = supplying regions 10 or 11 to Trois-Rivières via Bay ports*
5 = supplying regions 10 or 11 to Sorel via Bay ports*
6 = supplying regions 10 or 11 to Prescott via Bay ports*
7 = supplying region 10 to Halifax via Toronto
8 = supplying region 10 to Montreal via Toronto
9 = supplying region 10 to Quebec via Toronto
10 = supplying region 10 to Trois-Rivières via Toronto
11 = supplying region 10 to Sorel via Toronto
12 = supplying region 10 to Prescott via Toronto
13 = supplying region 9 or 10 to Halifax via Port Colborne
14 = supplying region 9 or 10 to Montreal via Port Colborne
15 = supplying region 9 or 10 to Quebec via Port Colborne
16 = supplying region 9 or 10 to Trois-Rivières via Port Colborne
17 = supplying region 9 or 10 to Sorel via Port Colborne
18 = supplying region 9 or 10 to Prescott via Port Colborne

Export demand ports are identified by number as:

1 = Vancouver (including Victoria)
2 = Prince Rupert
3 = Churchill
4 = Thunder Bay
5 = Kingston
6 = Montreal
7 = Sorel
8 = Quebec
9 = Trois-Rivières
10 = Baie Comeau
11 = Saint John (including West Saint John)
12 = Halifax

The ports for which capacity constraints were established are numbered the same as export ports 4 to 12 above, plus:

*Bay ports include Collingwood, Midland and Port McNicoll.

13 = Bay ports*
14 = Port Colborne
15 = Prescott
16 = Toronto

Not all variables identified in equations A.1 through A.20 could assume non-zero values for certain ranges of their subscripts. Some of these variables and conditions are outlined below:

C_{kjf} and X_{kjf} = 0, if: $k = 4, 6, 7, \ldots, 12$, and $1 \leq j \leq 12$,
$k = 6, 7, \ldots, 12, 13 \leq j \leq 82$, or $f = 2$,
$k = 8, 9, \ldots, 12, 83 \leq j \leq 136$,
$k = 5, 6, 7$, and $136 \leq j \leq 184$,
$k = 5, 6, \ldots, 12$, and $185 \leq j \leq 187$,
$k = 5, 6, 7$, and $188 \leq j \leq 188$,

t^{i}_{gsdm} = 0, if: $5 \leq g \leq 7$, and $14 \leq s \leq 30$,
$6 \leq g \leq 7$, and $1 \leq s \leq 8$,
$s = m$,
$1 \leq s \leq 13$, and $14 \leq m \leq 29$,
$26 \leq s \leq 30$, and $1 \leq m \leq 25$,
$1 \leq s \leq 8$, and $1 \leq m \leq 13$,

T^{i}_{gsdm} = 0, if: $5 \leq g \leq 7$, and $14 \leq s \leq 30$,
$6 \leq g \leq 7$, and $1 \leq s \leq 8$,
$1 \leq s \leq 13$, and $14 \leq m \leq 29$,
$26 \leq s \leq 30$, and $1 \leq m \leq 25$,
$1 \leq s \leq 8$, and $1 \leq m \leq 13$,

t^{ii}_{gse} and T^{ii}_{gse} = 0, if: $1 \leq s \leq 13$, or $26 \leq s \leq 30$,

t^{iii}_{gre} and T^{iii}_{gre} = 0, if: $1 \leq e \leq 4$, or $13 \leq e \leq 16$,

t^{iv}_{grdm} and T^{iv}_{grdm} = 0, if: $14 \leq m \leq 25$,

t^{v}_{gsvm} = 0, if: $1 \leq s \leq 8$, or $12 \leq s \leq 30$, or $s = m$,

T^{v}_{gsvm} = 0, if: $1 \leq s \leq 8$, or $12 \leq s \leq 30$,

t^{vi}_{gs} and T^{vi}_{gs} = 0, if: $1 \leq g \leq 5$, or $1 \leq s \leq 8$, or $12 \leq s \leq 30$.

Z_{gm} = 0, if: $14 \leq m \leq 30$, and $g = 5, 6, 7$.

To facilitate the understanding of the model's restraints, a brief explanation of some of these equations will be given. Equations A.2 through A.6 place limitations on the acreage of each crop that can be produced on a particular farm size in a given region. The first equation applies to Eastern Canada and

*Bay ports include Collingwood, Midland and Port McNicoll.

British Columbia where no summerfallowing operations are assumed to take place. Equations A.3, A.4, and A.5 apply to the Prairies where summerfallowing operations are practised and, hence, crops can be produced on both stubble and summerfallowed land. As specified in equation A.3, the land restraint for any particular cereal applies to both the stubble and summerfallow crop. Equation A.6 states that for any farm size in a particular region, the total land used for all crops (including summerfallowing where relevant) cannot exceed the total amount of land available to representative farms of that size.

Equation A.7 specifies that the supply of a particular grain available for livestock feed in a consuming region in Eastern Canada is equal to the amount produced by both sizes of farms for all producing regions within the consuming region, plus the quantity of grain shipped in from Thunder Bay (via all different routings), plus shipments from Southern Ontario, minus any outshipments (if $m = 9$, 10, or 11) to other regions, plus direct rail shipments from the Prairies, less shipments to the Ontario domestic industrial and human market (if $m = 9$, 10, or 11, and $g = 6$ or 7), less the amount transformed into feed equivalents within the region. This equation is, in effect, a transfer row in the linear programming matrix to facilitate the operation of the model. By definition, it is always equal to zero, with production plus inshipments equal to outshipments and feed use. Equation A.8 is similar to A.7 except, since it applies to Western Canada, the production activities include summerfallow and stubble crops, and the transportation flows are different.

Equation A.9 states that the quantity of grain transformed into feed (in a conceptual sense only) must equal the feed demand (in terms of barley equivalents) in that particular region. One bushel of different grains was assumed convertible into a common unit on the following basis: one bushel of wheat, oats, rye, mixed grains, and corn equals 1.27, .62, 1.14, .81, and 1.21 bushels of barley, respectively.

The domestic cereal demand for milling and industrial purposes (equations A.10 and A.11) could be met either by shipments from other regions or from grain originating within the consuming region. While a "transportation" activity was used to effect the movement of grain from within a region to its own milling and industrial demands, its transportation cost was assumed equal to zero. It should be re-emphasized, however, that only Prairie regions could fulfil these demands from local production.

Equation A.13 warrants a brief explanation. The variable E_{g4} is the export demand for the g-th cereal at Thunder Bay (not to be confused with grain moving through Thunder Bay for export from other ports). Since the transportation rate is the same for all grain moving eastward to Thunder Bay regardless of whether it is exported or consumed domestically, only one set of transportation activities was used to move grain to Thunder Bay (one from each supplying region for each grain). The variable W_g is simply the activity in the model that takes grain from the Thunder Bay supply, A_g, to meet the export demand at that port.

The variable D_g is the combined milling and industrial demand for Ontario winter wheat ($g = 6$) and corn ($g = 7$).

Equations A.17 and A.18 represent the handling capacities of different ports. The amount of grain flowing through any port cannot exceed a specified maximum number of bushels (Table A.7).

The final two equations place lower bounds on the quantity of each grain consumed by livestock within a region. While livestock feed demands were specified in terms of barley equivalents, each grain comprising this feed unit had to exceed a minimum level, M_{gm}.

The model, as outlined, includes a coefficient matrix of 2,632 rows and 5,251 columns without slack vectors (a matrix of 2,632 by 8,021 with the slack vectors included). The number of rows (restraints) for each of equations A.2 through A.20 and the number of columns (activities) are shown in Table A.1.

TABLE A.1

NUMBER OF ROWS AND COLUMNS IN EACH MODEL BY TYPE OF RESTRAINT AND ACTIVITY

Equation Number	Restraint	Number of Rows	Variable	Number of Columns
A.2 and A.3	L_{kjf}	1,618	X_{kjf}	2,098
A.4	L'_{jf}	96	T^{i}_{gsdm}	1,524
A.5	L''_{jf}	96	T^{ii}_{gse}	287
A.6	L'''_{jf}	306	W_g	4
A.7 and A.8	S_{gm}	159	T^{iii}_{gre}	32
A.9	F_m	30	T^{iv}_{grdm}	614
A.10 and A.11	H_{gm}	120	T^{v}_{gsvm}	513
A.12, A.13, and A.14	E_{ge}	52	T^{vi}_{gs}	18
A.15	A_g	4	Z_{gm}	161
A.16	D_g	2		
A.17 and A.18	P_z	11		
A.19 and A.20	M_{gm}	138		
Total		2,632	Total	5,251

COEFFICIENT DETERMINATION

Crop Yields

In all regions of Canada, crop yields vary from one year to the next due to weather and other factors. In the Prairies, yearly yield fluctuations can be very pronounced. Since this is a study of long-run interregional comparative advantage, the actual yields of the base year could not be used. Rather, long-term trend yields

were established by regression analysis. A linear equation, as described below, was estimated for every cereal grain considered in each producing region:

(A.22) $Y_{kjt} = a_{kj} + b_{kj} X_t$

where Y_{kjt} = yield of the k-th crop in the j-th region in the t-th year,
a_{kj} = intercept of the equation for the k-th crop in the j-th region,
b_{kj} = regression coefficient indicating the annual change in yield of the k-th crop in the j-th region, and X_t = a monotonically increasing variable such as $X_t = 1$ for 1939, $X_{t+1} = 2, \ldots, X_{t+n} + 1$.

In general, the equations were estimated over the period 1939 through 1965. When the actual estimation was undertaken, data for 1966 were not yet available. Yields for 1966 were therefore estimated by extending the trend that existed up to 1965. For example:

(A.23) $\hat{Y}_{kj1966} = a_{kj} + \hat{b}_{kj} X_{1966}$

where $\hat{Y}_{kj1966}$ = estimated trend yield for the k-th crop in the j-th region in 1966,
$\hat{a}_{kj}$ and b_{kj} = regression coefficients for the k-th crop in the j-th region estimated from equation A.22.

A significant proportion of the yield data were obtained from unpublished records of the Dominion Bureau of Statistics. All yield data for Manitoba prior to 1962 were obtained from the files of the Manitoba Crop Insurance Corporation. Published data sources could not be used for this earlier period because of a different definition of crop districts in Manitoba.

For some regions, particularly in Quebec, it was impossible to obtain yield estimates for certain crops in some years. Various methods were used to estimate these missing yields prior to fitting the regression equations. For example, in some instances yields of other crops were related to yields in contiguous regions for which all yields were available.

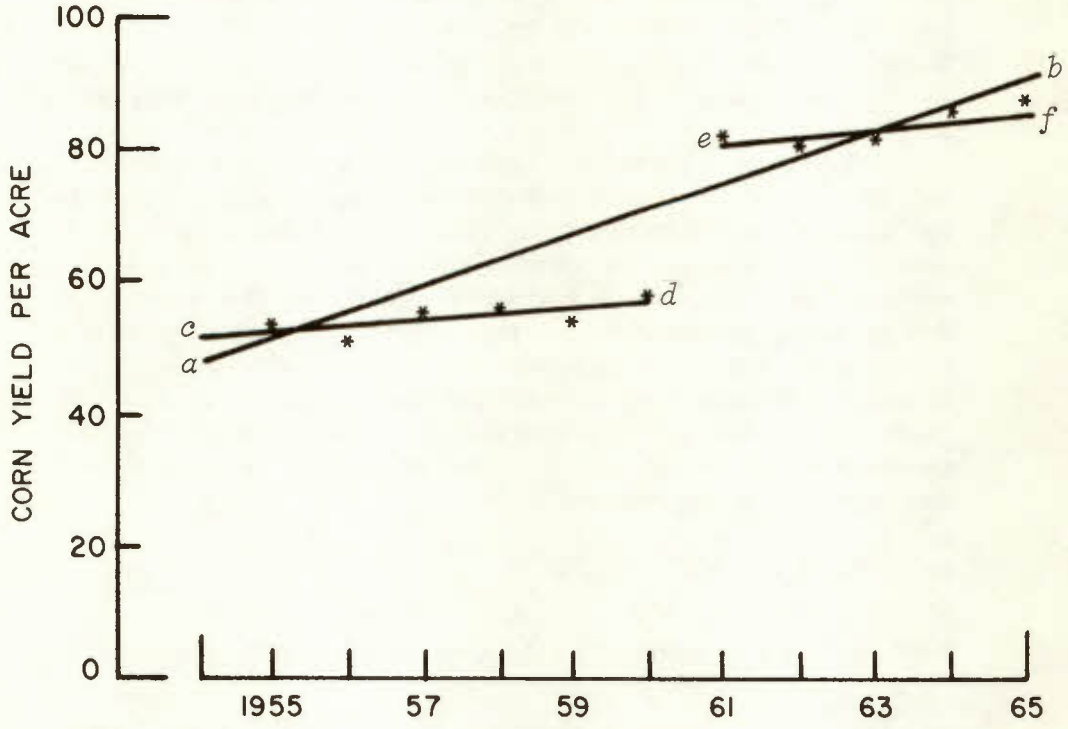
Trend yields for corn in Ontario regions were estimated by an equation different from A.22. In examining corn-yield data, a significant upward shift in yields appeared to take place about 1961. For example, the yield for a region might increase over time as illustrated in Figure A.2. In estimating the trend yield, a dummy variable was included in the equations to capture this apparent shift in the trend. The following equation was used to estimate the regression coefficients necessary for the estimation of 1966 trend yields for corn:

(A.24) $Y_{kjt} = a_{kj} + b_{kj} X_t + c_{kj} D_t$

where D_t = a variable consisting of zeros through 1960, and ones for 1961 through 1965, and
c_{kj} = intercept for the k-th crop in the j-th region if the 1961-65 trend had begun in 1939,
with other terms as previously defined.

FIGURE A. I

HYPOTHETICAL EXAMPLE OF TREND IN CORN YIELDS



In Figure A.1 the trend yield, estimated without consideration of this shift, would take the form of curve *ab*. With the introduction of the dummy variable, curves approximately equal to *cd* and *ef* would be estimated.[3]

Two restrictions were placed on all estimated yields. First, if a negative yield trend was found, the average yield for the period was used. It seemed unlikely that a long-term declining yield was realistic. These estimates may have resulted because of either very favourable production in early years of the analysis, or a localized drought in one of the latter years. This adjustment was necessary for only about 5 per cent of the coefficients.

The second restriction placed on the estimated yields was that a trend yield estimated for 1966 could not exceed the highest yield ever realized for that crop in the particular region. In the event that this did occur, the maximum yield over the 1939-65 period was used. This adjustment was applied only seven times in the entire analysis.

In the Prairies, it was necessary to identify both a stubble and summerfallow yield for every crop. Historical regional data are not available prior to 1957 on the basis of stubble and summerfallow crop yields. A time period of this length was considered to be unreliable for estimating long-term yields. Hence the yield data, which included crops grown on both stubble and summerfallow, were used to estimate a long-term trend for a composite acre. Next, stubble yields as a proportion of summerfallow crop yields were estimated for the period 1963-64 through 1967-68 for each crop and region. The average proportion over this period, together with the estimated 1966 trend yield and stubble and summerfallow crop acreages, was then used to estimate a 1966 yield for the summerfallow crop according to the following equation:

$$\text{(A.25)}\quad \hat{Y}_{ksj1966} = \frac{\left(\hat{Y}_{kj1966}(A_{ksj1966} + A_{kbj1966})\right)}{\left(A_{ksj1966} + \bar{P}_{kj}A_{kbj1966}\right)}$$

where $\hat{Y}_{ksj1966}$ = estimated 1966 yield for the k-th summerfallow crop in the j-th region,

$\hat{Y}_{kj1966}$ = estimated trend yield for the k-th crop in the j-th region in 1966,

$A_{ksj1966}$ = acreage of the k-th crop sown on summerfallow in the j-th region in 1966,

$A_{kbj1966}$ = acreage of the k-th crop sown on stubble in the j-th region in 1966, and

$\bar{P}_{kj}$ = average of stubble yields as a proportion of summerfallow yields over the period 1963-64 to 1967-68 for the k-th crop in the j-th region.

[3]Several reasons could be advanced for this apparent abrupt change in yield trends. For example, widespread improvements in management practices or adoption of technological advancements in a short period of time would have such an effect.

Stubble crop yields were then estimated by the following equation:

(A.26) $\hat{Y}_{kbj1966} = \bar{P}_{kj} \hat{Y}_{ksj1966}$

where $\hat{Y}_{kbj1966}$ = estimated 1966 yield for the k-th crop sown on stubble in the j-th region,

with the other terms defined as before.

Production Costs

A considerable amount of research has been undertaken across Canada to estimate production costs for different crops. It was not possible to utilize the results of any of these studies, however, for several reasons. First, such analyses are often directed at cost structures that are relevant to a particular point in time. Some studies are based on years of favourable crop yields while, in other cases, the opposite is true. Secondly, significant differences often exist in the procedures and assumptions used to estimate cost items. For example, it is not unusual for different researchers to use different machinery depreciation schedules and capital investment charges. As a result, differences in production costs may be observed between two regions when comparing different studies, due entirely to differences in either the time period of analysis or the basic underlying assumptions. Many production cost estimates are not based on farm organizations that are representative of the region. Often the large-scale, more progressive farms are selected for analysis. Finally, while extensive studies have been completed in some areas for certain crops, little or nothing in the way of production cost estimates has been undertaken in other regions. This is particularly true for crops that have been of minor historical importance in a region. Since production costs per bushel are a major determinant of any region's competitive position relative to any other region, it was not possible to use any of the great number of production cost estimates that have been derived by various researchers over the past number of years.

In this Study, production costs per acre were estimated for each farm size, and for every cereal crop that was considered to be a realistic alternative in a region. While per-bushel production costs were not explicitly utilized in the mathematical model, the inclusion of per-acre costs and yields in the manner described in the previous section had the same effect.

Some of the basic regional data necessary for production cost estimates were obtained by a mail survey of informed members of agricultural communities, such as extension specialists, farm credit supervisors, machinery dealers and, in some instances, farmers. The respondent was asked to indicate the typical tillage and harvesting operations carried out in the region, and the associated sizes of implements and power units. An estimate of the proportion of farmers in the region following any practice was requested. Information was also sought on typical field sizes, on whether stones were a problem in the region, about common fertilizer usage in terms of pounds per acre and analysis, and the usual distance from field to farmstead. This information was required for both sizes of farms for each crop considered in a region. The respondent did not always complete questionnaires for

all crops. These data were used, together with additional data, such as machinery and fuel costs, obtained from other sources, to estimate production costs.

Four hundred and ninety-three or 55 per cent of the questionnaires were returned with data that could be utilized in subsequent analyses. While the data obtained from the questionnaires were of a highly subjective nature, they nevertheless gave a reasonable indication of the prevailing agronomic practices in a region. In some regions up to 14 different people responded to the questionnaire. In cases such as this, it was often found that the resulting estimates of per-acre costs (for example, power and machinery) were very similar for a given farm size and crop. A completed questionnaire, together with the resulting analysis, is shown in Tables A.4 and A.5 for illustrative purposes.

Power and Machinery—The forestated survey provided basic information with respect to tillage practices and power and machinery use in a region for any particular farm size and crop. To utilize this information, it was necessary to determine the regional cost for as many as 50 different implements of up to 12 different sizes. The procedure followed was to assemble representative implements of each size for different makes of machines. Representative implements of each type and size were selected from the product lines of the major implement manufacturers. Where necessary, optional equipment was added to the standard machines so that the selected machine corresponded more nearly to the type usually purchased by a farmer. For all implements, representative units were selected from the product lines of John Deere, International Harvester, Massey-Ferguson, and J. I. Case. In Western Canada, Versatile Manufacturing Limited's swathers, combines, and tractors were also used. Representative farm trucks were selected from the products of Ford Motor Company, General Motors of Canada, Chrysler Canada Limited, and International Harvester Company Limited.

The cost and weight of each representative unit were determined from the 1966 catalogues of the various companies. The cost of shipping each respective piece of equipment to the four major distribution centres of Fredericton, Montreal, Windsor, and Winnipeg was added to the factory price. At these distribution centres, the products of the different companies were aggregated into a composite or representative unit in terms of price and weight. The cost of transporting this unit to a central point in each producing region was then added to the cost at the distribution centre.[4] This estimate was taken as the typical regional price of the piece of equipment in question.

A total power and machinery cost was estimated for each crop and farm size within each producing region. The procedure followed was to estimate a total cost for each piece of equipment, and then to weight this cost by the estimated proportion of farmers following this practice, and in the case of tillage operations (in contrast with harvesting or weed-spraying) by the number of times the operation was undertaken. These weighted costs were then summed for all

[4] Transportation charges were derived from data obtained from the Canadian Transport Tariff Bureau.

implements used in the production of the particular crop. To facilitate the explanation of the estimation procedures, the various components of the per-acre machinery costs (i.e. depreciation, repair costs) will be discussed separately.

The estimation of depreciation, interest, and repair costs, involved first the determination of total use of the particular machine for the farm size in question in a given region. The acreage of each crop for which a machine was used in a region was found by expressing the trend acreage[5] (for 1966) of each crop as a proportion of the acreage available for cereal crops (and summerfallow) on the representative farm sizes discussed in Chapter 1 and specified in Table B.3.[6] Depreciation charges for all equipment, except trucks, wagons and tractors, were estimated by the following equations:

$$\text{(A.27)}\quad AD_{smfjkn} = \frac{P_{smj} - .1\,P_{smj}}{\text{minimum}\,(TUH_{smfj},\ TLH_m)}$$

$$\text{(A.28)}\quad TUH_{smfj} = \sum_{k=1}^{12} \sum_{n=1}^{\beta} AH_{smfjkn} TLY_m$$

$$\text{(A.29)}\quad AH_{smfjkn} = \sum_{k=1}^{12} \sum_{n=1}^{\beta} (A_{smfjkn} / APH_{smfjkn})$$

$$\text{(A.30)}\quad APH_{smfjkn} = \left(\frac{S_m W_{mfjkn}}{8.25}\right) FE_{smkn}$$

where

AD_{smfjkn} = annual depreciation per hour for the s-th size of the m-th machine used on the f-th farm size in the j-th producing region in the production of the k-th crop for the n-th field operation,

P_{smj} = the price of the s-th size of the m-th machine in the j-th region,

TUH_{smfj} = total hours of use of the s-th size of the m-th machine used on the f-th farm size in the j-th region,

TLH_m = total wear-out life in hours of the m-th machine,

β = the number of different field operations for which the s-th size of the m-th machine was used on the f-th farm size in the j-th region in the production of the k-th crop,

AH_{smfjkn} = annual hours of use of the s-th size of the m-th machine used on the f-th farm size in the j-th region in the production of the k-th crop by the n-th field operation,

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[5] The acreage trends were, in general, estimated over the period 1939-65. The estimation of trend acreages is discussed in more detail in a later section of this Appendix.

[6] The acreage of each crop was adjusted so that the total acreage of the representative farm was exhausted by all crops.

TLY_m = total life in years of the m-th machine,

A_{smfjkn} = acres of the k-th crop in the j-th region for which the s-th size of the m-th machine was used for the n-th field operation by the f-th farm size,

APH_{smfjkn} = acres per hour for the s-th size of the m-th machine used on the f-th farm size in the j-th region for the k-th crop and n-th field operation,

S_m = speed in miles per hour of the m-th machine when used for field operations,

W_{mfjkn} = width in feet of the m-th machine used on the f-th farm size in the j-th region in the production of the k-th crop by the n-th field operation, and

FE_{smkn} = field efficiency of the s-th size of the m-th machine used in the production of the k-th crop by the n-th field operation.

Equation A.27 states that annual per-hour depreciation is equal to the net price of a machine after taking account of its salvage value, divided by hours of use. Using the minimum of TUH_{smfj} and TLH_m recognizes the fact that machines become obsolete after a certain period of time regardless of use, or are worn out after so many hours of operation. In the estimation of acres per hour (APH_{smfjkn}), the field efficiency factor was calculated so that it would recognize the different time requirements for fields of different sizes, and the loss in effective cut of a tillage implement by overlapping on previously worked land.

Except for combines, the field speed of any given machine was assumed the same in all regions and for both sizes of farms. Combining capacity depends not only on the size of machine but also on the yield of the crop being harvested. Therefore, the acres per hour for combining operations were estimated by regression analysis for three sizes of combines from data obtained from the Saskatchewan Agricultural Machinery Administration for the years 1961 to 1965.[7] The estimated relationships are as follows:

Large combines (3,600 square inches of threshing area):

(A.31) $APH_{smfjkn} = 8.740 - \underset{(.091)}{.058}\ Y_{kj}$ $\qquad R^2 = .64$

Medium-sized combines (3,000 square inches of threshing area):

(A.32) $APH_{smfjkn} = 7.471 - \underset{(.100)}{.048}\ Y_{kj}$ $\qquad R^2 = .46$

Small combines (2,500 square inches of threshing area):

(A.33) $APH_{smfjkn} = 7.870 - \underset{(.160)}{.076}\ Y_{kj}$ $\qquad R^2 = .56$

[7] Saskatchewan Agricultural Machinery Administration, *Report on Grain Combines*, Regina, Saskatchewan, 1961 to 1965.

where

Y_{kj} = yield of the k-th crop in the j-th region,

and other terms are the same as previously defined. When these equations were used in the analysis to estimate acres per hour, the results were multiplied by the field efficiency factor, FE_{smkn}, for reasons similar to those described for equation A.30.

Tractors, trucks and wagons are used for non-crop purposes on many farms. Since this Study did not concern itself with the input requirements for livestock operations, it was not possible to estimate the actual use of this equipment for these purposes. Therefore, their depreciation charges were estimated by the following equation:

$$\text{(A.34)}\quad AD_{smfjkn} = \frac{P_{smj} - .1\,P_{smj}}{TLH_m}$$

The use of equation A.34 rather than A.27 had the effect of assuming that this equipment would be completely depreciated during its useful lifetime.

Investment costs for equipment were estimated by the following equation:

$$\text{(A.35)}\quad I_{smfjkn} = \left(\frac{P_{smj} + .1\,P_{smj}}{2}\right) \frac{i}{\text{minimum}\,(TUH_{smfj}, TLH_m)}$$

where

I_{smfjkn} = investment cost per hour for the s-th size of the m-th machine used on the f-th farm size in the j-th region in the production of the k-th crop by the n-th field operation, and

i = rate of interest.

For tractors, trucks and wagons, a modification of equation A.35 was used, whereby TUH_{smfj} was excluded. An interest charge of 6 per cent was used for all equipment.

Repair costs were assumed to be a constant proportion of the purchase price of the equipment. This proportion was increased by 10 per cent for tillage operations in those regions in which stones were a problem. Equation A.36 was used to estimate repair costs:

$$\text{(A.36)}\quad R_{smfjkn} = \frac{C_{sm}\,P_{smj}}{\text{minimum}\,(TUH_{smfj}, TLH_m)}$$

where

R_{smfjkn} = repair cost per hour for the s-th size of the m-th machine used on the f-th farm size in the production of the k-th crop in the j-th region for the n-th field operation, and

C_{sm} = total repair costs over the life of the s-th size of the m-th machine as a proportion of its purchase price.

Again, TUH_{smfj} was excluded from the equation in the estimation of repair costs for trucks, tractors, and wagons.

Regional prices for gasoline, diesel fuel, oil, and grease were obtained from Shell Canada Limited and the Gulf Oil Company. The data used in this Study represent an average of the quoted regional prices for these two companies. Fuel costs for tractors were estimated from these prices and the draft requirements of the tillage implement. Horsepower requirements for different implements were assumed to be a function of their size, field speed, and the soil texture in the region. The horsepower requirement per foot of each implement for a given draft speed was estimated for five different soil textures. A regional power requirement per foot of each implement was estimated by weighting these requirements by the proportion of each soil texture in a region.

For any given implement, fuel use was estimated to be a function of the total power requirement in relation to a tractor's available horsepower. The following equation was estimated by regression analysis for each of six sizes of gasoline tractors and seven sizes of diesel tractors:

(A.37) $FU_{st} = a_{st} + b_{st}HPP_{st}$

where

FU_{st} = fuel use in gallons per hour for the s-th size of the t-th type of tractor (gasoline or diesel),

a_{st} = intercept of equation

b_{st} = regression coefficient indicating the increase in fuel use (in gallons) for each 1 per cent increase in workload for the s-th size and t-th type of tractor, and

HPP_{st} = workload of the s-th size and t-th type of tractor expressed as percentage of available horsepower required for any particular field operation.

The coefficients for each size and type of tractor are summarized in Table A.2. These coefficients were then used to estimate the fuel use for the particular size of tractor being analysed and piece of equipment being pulled, first assuming all tractors were diesel-powered, and then assuming all were gasoline-powered. The fuel cost was obtained by multiplying use by price per unit. A weighted proportion of gasoline and diesel costs was taken on the basis of the sales of the two types of tractors in the province over the period 1953 to 1966.[8]

For each size of self-propelled combine and swather, the hourly fuel consumption estimates published by J. L. Thompson were utilized.[9] Truck fuel used for grain hauling was based on the distance from the field to farm storage, assuming a gasoline consumption of eight miles per gallon.

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[8] Dominion Bureau of Statistics, *Farm Equipment and Implement Sales,* Catalogue No. 63-203, 1953 to 1966.

[9] J. L. Thompson, *Farm Machinery Use and Cost,* Publication 1040, Canada Department of Agriculture, 1968.

TABLE A.2

REGRESSION COEFFICIENTS FOR FUEL USE ESTIMATED AS A FUNCTION OF AVAILABLE HORSEPOWER, BY TRACTOR TYPE AND SIZE CLASS (EQUATION A.37)

Tractor Size Class	Tractor Type			
	Gasoline		Diesel	
	a_{st}	b_{st}	a_{st}	b_{st}
(Horsepower)	(Gallons)			
30–40	1.45	.0274	0.85	.0192
40–50	1.88	.0266	1.11	.0253
50–60	2.30	.0325	1.34	.0302
60–70	2.71	.0385	1.60	.0354
70–80	3.14	.0442	1.84	.0409
80–90	3.50	.0503	2.10	.0465
Greater than 90	–	–	2.35	.0519

Grease requirements for combines were assumed equal to one pound for every six hours of operation. For all other equipment, a figure of one pound for every 20 hours of operation was used. The cost of engine lubrication was assumed equal to 4.5 per cent of fuel costs.[10]

Labour–No management or supervisory labour was included in the labour costs for this Study. Labour requirements were related to the machine time for any particular field operation. Labour time as a multiple of machine time took into account the time required for greasing and fueling equipment, and for filling seed boxes, and the typical unscheduled stoppages in tillage, spraying, and harvesting operations. These coefficients were calculated from published research findings.[11]

Labour wage rates for each producing region were based on the associated provincial farm wage rate. To remove the influence of short-run fluctuations in wage rates, a linear regression was fitted to quarterly data (January, June and September) over the period 1953 through 1966 for each province or group of provinces.[12] This equation took the form:

(A.38) $W_{pt} = a_p + b_p X_t$

where

W_{pt} = farm wage rate per hour in the p-th province (or group of provinces) in the t-th time period,

[10] E. L. Barger, W. M. Carlton, E. G. McKib, and R. Bainer, *Tractors and Their Power Units*, New York, Wiley, 1952, Chapter 26.

[11] J. G. MacKenzie and J. C. Brown, *How Labor is Used on Red River Farms*, Economics Division, Canada Department of Agriculture, 1954.

[12] Dominion Bureau of Statistics, *Quarterly Bulletin of Agricultural Statistics*, Catalogue No. 21-003, January-March, April-June, July-September, 1953 to 1966

a_p = intercept of the equation for the p-th province,

b_p = regression coefficient indicating the quarterly change in farm wage rate in the p-th province, and

X_t = a monotonically increasing variable such as $X_t = 1$ for 1939, $X_{t+1} = 2, \ldots, X_{t+n} = n+1$.

The wage estimated from these equations for June 1966 was taken as representative of 1966 regional farm labour wage rates. The coefficients and associated tests of "goodness of fit" estimated from these regressions are summarized in Table A.3.

TABLE A.3

REGRESSION STATISTICS FOR LINEAR TRENDS FITTED TO QUARTERLY FARM LABOUR WAGE RATES OVER THE PERIOD 1953-66, BY PROVINCE OR GROUP OF PROVINCES (EQUATION A.38)

Region	$\hat{a}_p$	$\hat{b}_p$	$\hat{S}_{bp}$	R^2
	(Dollars per hour)			
Maritimes	.5712	.0089	.0005	.87
Quebec	.6464	.0105	.0004	.92
Ontario	.8049	.0106	.0106	.93
Manitoba	.8176	.0090	.0006	.82
Saskatchewan	.8973	.0088	.0006	.81
Alberta*	.9118	.0087	.0007	.77
British Columbia*	1.0100	.0081	.0007	.75

*The data for Alberta were used to estimate farm labour wage rates in the Peace River area of British Columbia.

A single computer program was used to calculate the total power and machinery and labour costs for each crop and farm size for which a survey questionnaire was obtained. When more than one questionnaire was available for any particular crop and farm size in a region, a simple average of the total power and machinery and labour costs was used as the regional estimate. In cases where respondents completed questionnaires for only one or two crops, the costs for other crops that could be produced in the region were estimated from the tillage practices, implement sizes, etc., for the reported crops. For example, it was assumed that the field operations, etc., for stubble oats would be the same as stubble wheat. This did not imply that the associated costs would be the same for these two crops. Rather, since the complete cost analysis was carried out for the second crop, assuming that the same implements and field operations, etc. would be utilized as for the first crop, the power and machinery and labour costs for each crop would differ for several reasons. For example, it has been shown that combining costs were related to the yield of the crop. Since the yield of oats is greater than for wheat, it would be expected that they would have greater harvesting costs. Table A.5 indicates the type of information that was obtained from the computer analysis by farm size for each crop that could be produced in a region.

TABLE A.4

COMPUTER PRINT-OUT FOR ONE COMPLETED QUESTIONNAIRE

RECORD NUMBER 716
REGION NO. 171, ALBERTA 1 CROP: BARLEY, STUBBLE
FARM SIZE NO. 1

	NO. OF TIMES OVER	% OF FARMERS	IMPLEMENT WIDTH	TRACTOR H.P.
TILLAGE PRACTICES				
AFTER HARVEST AND PRE-SEEDING				
CULTIVATOR (HEAVY DUTY)	1	40	12	70
NOBLE BLADE	1	30	14	70
SEEDING				
DISCER	1	60	12	70
DISCER PACKER	1	40	12	70
AFTER SEEDING PERIOD				
SPRAYER	1	90	30	70
HARVEST				
SWATHER		90	15	70
SWATHER (S.P.)		70	15	
TRACTOR & COMBINE(A.M.)		40	12	70
TRACTOR & COMBINE (P.T.O.)		20	12	70
COMBINE(S.P.)		40	14	
GRAIN HAULING				
			CAPACITY	
TRUCK		90	150	
TRUCK		10	50	

TYPICAL DISTANCE FROM FIELD TO FARM STORAGE 0.5 MILES

TYPICAL SIZE OF FIELD IN THIS CROP 40 ACRES

ARE STONES PREVALENT IN FIELDS YES __X___ NO _____

WHAT % OF THE AC. OF THIS CROP IS FERT.? 20 %

WHAT IS THE AV. RATE OF FERT. USE? 80 LBS/ACRE

WHAT IS THE MOST COMMON FERT. ANALYSIS? N __33_ P ___0_ K ___0_

DATE= 3/08/69 TIME= 9:45 AM

TABLE A.5

COMPUTER PRINT-OUT FOR ANALYSIS OF QUESTIONNAIRE IN TABLE A.4

RECORD NUMBER 716 REGION NO. 171, ALBERTA 1 DATE= 3/08/69 TIME= 9:45 AM CROP AS REPORTED ON RECORD 2
CROP: BARLEY, STUBBLE FARM SIZE NO. 1

TILLAGE OPERATION	LABOR TIME	HP REQD	BY IMP	% HP USED	AC/ HOUR	COST PER ACRE: GAS $	DIESEL $	OIL $	GREASE ¢	TRACTOR VAR. $	TRACTOR FXD $	MACHINES FXD (1) $	(2) $	(3) $	TOTAL $	PROP $	NO TMS OVER	%
CULTIVATOR (HEAVY DUTY)	0.23	42.0	0.0 0.0	60.0	5.12	0.24	0.16	0.07	0.06	0.20	0.32	0.29	0.0	0.0	0.81	0.33	1	40
NOBLE BLADE	0.20	41.6	0.0 0.0	59.5	5.82	0.21	0.14	0.06	0.05	0.18	0.28	0.27	0.0	0.0	0.73	0.22	1	30
POST-HARVEST & PRE-SEEDING			LABOR: HOURS 0.15					MACHINERY: HOURS 0.13		COST $ 0.55								
DISCER	0.23	29.3	0.0 0.0	41.8	4.65	0.23	0.15	0.07	0.06	0.18	0.35	0.59	0.0	0.0	1.13	0.68	1	60
DISCER PACKER	0.25	29.3	1.2 0.0	43.5	4.65	0.23	0.15	0.07	0.06	0.19	0.35	0.59	0.10	0.0	1.23	0.49	1	40
SEEDING			LABOR TIME 0.25					MACHINERY: HOURS 0.21		COST $ 1.17								
SPRAYER	0.07	12.0	0.0 0.0	17.1	17.45	0.05	0.03	0.01	0.02	0.04	0.09	0.19	0.0	0.0	0.32	0.29	1	90
POST-SEEDING			LABOR TIME 0.06					MACHINERY: HOURS 0.05		COST $ 0.29								
SWATHER	0.17	22.5	0.0 0.0	32.1	6.56	0.15	0.09	0.04	0.05	0.12	0.25	0.25	0.0	0.0	0.62	0.49	1	80
SWATHER (S.P.)	0.17	0.0	0.0 0.0	0.0	6.56	0.07	0.0	0.01	0.03	0.0	0.0	0.52	0.0	0.0	0.60	0.42	1	70
TRACTOR & COMBINE(A.M.)	0.25	31.0	0.0 0.0	44.3	4.65	0.24	0.15	0.07	0.18	0.19	0.35	0.94	0.0	0.0	1.48	0.59	1	40
TRACTOR & COMBINE (P.T.O)	0.25	31.0	0.0 0.0	44.3	4.65	0.24	0.15	0.07	0.18	0.19	0.35	0.94	0.0	0.0	1.48	0.30	1	20
COMBINE(S.P.)	0.25	0.0	0.0 0.0	0.0	4.65	0.17	0.0	0.04	0.12	0.0	0.0	2.86	0.0	0.0	3.08	1.23	1	40
HARVEST			LABOR TIME 0.50					MACHINERY: HOURS 0.44		COST $ 3.04								
COMBINING			LABOR TIME 0.25					MACHINERY: HOURS 0.22		COST $ 2.12								
TRUCK	0.01	0.0	0.0 0.0	0.0	110.29	0.01	0.0	0.00	0.0	0.0	0.0	0.04	0.0	0.0	0.05	0.04	1	90
TRUCK	0.03	0.0	0.0 0.0	0.0	36.76	0.02	0.0	0.00	0.0	0.0	0.0	0.07	0.0	0.0	0.09	0.01	1	10
GRAIN HAULING			LABOR TIME 0.01					MACHINERY: HOURS 0.01		COST $ 0.05								
TOTAL MACHINERY & TRUCKING			LABOR: HOURS 0.98			COST $ 1.24				MACHINERY: HOURS 0.85		COST $ 5.09						
FERTILIZER			GROSS COST $ 2.84					PROPORTIONATE COST $ 0.57										
WEED SPRAY			COST $ 0.24															

Fertilizer–In Western Canada, 1966 fertilizer use was based on information obtained from the survey questionnaire and 1965-66 regional fertilizer sales. The major source of data for Ontario fertilizer use was a confidential market study undertaken by Canadian Industries Limited. Provincial surveys, extension recommendations, and regional sales were used to estimate fertilizer use in Quebec and the Maritimes.

The survey questionnaire provided estimates of fertilizer analysis and application per acre that were considered to be of sufficient validity for use in the estimation of Western Canadian regional fertilizer use by crop. Estimates of analysis and application per acre for spring wheat sown on stubble and summerfallow were available for all regions. In those regions for which no questionnaire estimates were available for oats, barley, and rye, regression techniques were used to estimate these values from the wheat crops. An equation of the following form was fitted for each of oats, barley, and rye sown both on stubble and summerfallow, using as observations data from those regions in the Prairies for which an estimate of fertilizer use on coarse grains was available:

$$(A.39)\quad F_{kfj} = a_{kfj} + b_{kfj} F'_{fj}$$

where

F_{kfj} = per-acre application of fertilizer on the k-th crop (oats, barley, or rye sown on summerfallow or stubble) in the j-th region,

a_{kfj} = intercept of the fertilizer use equation for the k-th crop grown on the f-th farm size in the j-th region,

b_{kfj} = regression coefficient indicating the relationship between fertilizer use for the k-th crop (oats, barley, or rye sown on summerfallow or stubble) in the j-th region, and

F'_{fj} = per-acre application of fertilizer on wheat (stubble or summerfallow crop) on the f-th farm size in the j-th producing region.

These equations were then used to estimate fertilizer use on coarse grains in those regions for which no estimates were available from the questionnaires. This estimation was undertaken by the following equation:

$$(A.40)\quad \hat{F}_{kfj} = \hat{a}_{kfj} + \hat{b}_{kfj} F'_{fj}$$

where the terms are defined as before, except that a circumflex (ˆ) above a coefficient indicates an estimated value.

The fertilizer analysis for these estimated application rates was assumed equal to the average analysis for the same crop in regions of the province that had an estimate available from the questionnaire.

All estimated fertilizer application rates were multiplied by the associated 1966 acreage of the particular crop on each farm size in a region. The application

rates were then adjusted so that the estimated fertilizer use was equal to fertilizer sales[13] in the region in 1966.[14]

While the survey questionnaires were used to estimate regional fertilizer use, they in effect only served to establish the proportion of fertilizer used on the various crops. The level of use was determined by fertilizer sales in a region. No data are available from other sources on fertilizer use by crop for all regions in the Prairies. Hence, techniques such as this were the only means of obtaining consistent regional estimates.

Since the crop yields used in this Study were the same for both sizes of farms, it was considered to be inappropriate to attribute a greater fertilizer cost to one farm size compared with the other. Hence, a weighted average cost was calculated for each crop on the basis of its regional acreage on each farm size.

The basic data for fertilizer use in Ontario were obtained from the aforementioned marked study that was conducted in 1961. This study estimated fertilizer use by county for grain corn, all cereals, all vegetables, tobacco, and fruit. These per-acre estimates were updated to correspond with the 1966 fertilizer sales and acreages of these crops. The analyses applied on each crop in 1966 were assumed the same as in 1961.

In Quebec, fertilizer use was based on recommended rates and on the results of a published study.[15] The application per acre was adjusted to correspond to 1966 regional sales. Similar techniques were used to estimate fertilizer use in the Maritime Provinces.

Regional farm prices for nitrogen, phosphorous, and potassium were obtained from the National Grain Company Limited in Western Canada. In Ontario these prices were gleaned from the Ontario farm management handbook.[16] Brockville Chemical Industries Limited provided the regional prices for Quebec and the Maritimes.

Seeding Rates–The yields used in this Study were net of seed requirements. This procedure was necessary since the demand for seed depends upon the acreage of each crop sown, yet this is not known prior to the solution of the mathematical model. Seeding rates per acre for all crops except corn were estimated by linear regressions fitted to provincial data over the period 1955 to 1967.[17] Regional seeding rates were equal to the estimated 1966 seeding rate for the province within which the producing region was located. It was assumed that seed replacement

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[13] Unpublished data on fertilizer sales by producing regions in Western Canada were obtained from the Crops Section of the Agriculture Division of the Dominion Bureau of Statistics.

[14] Estimated fertilizer use on crops, such as flaxseed and tame hay, were subtracted from the regional fertilizer sales prior to this analysis.

[15] N. Parent, *Les Coûts de Production des Produits de la Ferme,* Ministère de l'Agriculture et de la Colonisation du Québec.

[16] Ontario Department of Agriculture and Food, *Farm Business Management,* 1966.

[17] Seeding rates were obtained from Dominion Bureau of Statistics, *Quarterly Bulletin of Agricultural Statistics,* Catalogue No. 21-003, April-June 1955 to 1967.

was necessary every fourth year. This purchased seed was expressed in terms of bushels of farm grain by finding the difference in price between purchased seed and farm-stored grain. Hence, the annual seed requirements were somewhat greater than the estimated 1966 trend seeding rate, to reflect the additional cost of seed replacement.

It was assumed that corn was seeded at recommended rates and all seed was purchased. The cost of this seed was expressed in terms of bushels of corn on the basis of prevailing corn prices in recent years.

Seed Cleaning and Treatment–It was estimated that in Manitoba about 15 per cent of seed is cleaned at co-operative seed plants, 25 per cent in privately owned or commercial plants and 60 per cent in country elevators. The respective costs per bushel for cleaning in these plants were estimated to be $.07, $.10, and $.02 per bushel. The cost per bushel, weighted by the proportion that each facility is used, amounted to $.04 per bushel. A figure of $.03 was used since seed-cleaning is not necessary in those years when replacement seed is purchased. This cost was used for all crops and regions in Western Canada. In Eastern Canada, it was assumed that all cleaning was done at commercial plants, with the cost of $.075 per bushel therefore applying.[18]

Undoubtedly some farmers do not clean their seed, while others do this operation on their farms. No special account was given to these considerations. Since seed-cleaning costs are a very minor item in total production costs, it was felt that the added precision from a more detailed analysis could not be justified.

Seed-treatment costs were estimated to be $.05 per bushel for all crops and regions. Again, because of the inconsequential size of this figure, only a minimal research effort was expended in its estimation.

Chemicals–This item basically represents the cost of weed spray. A cost per acre for each province and crop was estimated from recommended applications and published research findings. The proportion of farmers spraying different crops reported on the survey questionnaire was multiplied by the appropriate provincial costs to find the regional chemical cost per acre. Because crop yields were assumed to be the same on both sizes of farms, and since different applications of weed spray can affect yields, the same cost per acre was used for both farm sizes for any given crop in a region. This cost was obtained by weighting the cost for each farm size according to its 1966 regional acreage of the particular crop.

Summary of Production Cost Estimation–The cost estimates discussed in this section are summarized in Tables B.15 and B.16 for the relevant crops in each producing region and the associated representative farm sizes. These costs are also expressed on a per-bushel basis in Tables B.17 and B.18. It should be stressed that not all costs relevant to cereal production have been included. No management costs have been considered, nor have any land investment costs or land taxes. Furthermore, as discussed in a previous chapter, charges for buildings and off-farm trucking costs were also excluded. It was not the objective of this Study to provide

[18] This cost is three-fourths of $.10, again reflecting the fact that purchased seed does not need to be cleaned.

estimates of cereal production costs which might be useful for many purposes. These cost estimates were developed for use in a mathematical model to estimate the optimal location of cereal production. It is felt that the costs items included in this Study are appropriate for this type of analysis.

Available Crop Acreage

The production of crops within each region was constrained by the total land seeded to cereals in 1966, and the required summerfallow acreage.[19] Regional summerfallow acreages were based on the average proportion of land summerfallowed in 1963 through 1965.[20] The total land supply available for cereal production in any region was then increased to reflect this summerfallow requirement. By means of this procedure, the summerfallow requirements for oilseeds and other crops not considered in the analysis were excluded from the regional land supply.

Not all land is equally suited to the production of each crop. This is particularly true in the case of corn. Since the crop yields used in this Study were related to historical land use, it was necessary to restrict the acreage of each crop that could be produced by each farm size within a region. The restraints on individual crop acreages were determined by first estimating the trends in the regional acreage of each crop over the period 1939 to 1965.[21] Equations of the following form were estimated by regression analysis:

$$(A.41)\quad Y_{kjt} = a_{kj} + b_{kj} X_t$$

where

Y_{kjt} = acreage of the k-th crop in the j-th producing region in the t-th year,

a_{kj} = intercept of the equation,

b_{kj} = regression coefficient indicating the annual change in the acreage of the k-th crop in the j-th region, and

X_t = a monotonically increasing variable.

Trend acreages for 1966 were then estimated by the following equation:

$$(A.42)\quad \hat{Y}_{kj1966} = \hat{a}_{kj} + \hat{b}_{kj} X_{1966},$$

where the circumflex (ˆ) over a term indicates that it is an estimated value. The 1966 trend acreages for all cereals within a region were adjusted so that their total, plus the necessary summerfallow, equaled the regional supply of cereal cropland. In the mathematical programming models, the restraint on the production of each crop was equal to the adjusted trend acreage, plus one standard deviation of the

[19] Although mixed grains were not considered as a production alternative in the Prairies, their 1966 acreage was included in the total cropland supply used in this Study.

[20] Regional summerfallow requirements are specified in Table B.19.

[21] In some cases, the period 1952 to 1965 was used because of data limitations.

regression coefficient, $\bar{b}_{kj}$, as estimated through equation A.41.[22] Therefore, in the solutions to the mathematical programming models, the regional acreage of any crop could be greater than its adjusted trend acreage. However, since total acreage was constant, the acreage of some other crop would then have to be less than its adjusted trend acreage.

The regional acreage restraints were allocated to the representative farm sizes according to the proportion of the crop grown on each farm size in 1966.[23]

Cereal Grain Demands

Regional cereal demands were established for milling and industrial purposes and for livestock feed needs. Hence, while this study did not concern itself with determining the optimal location of livestock production, the feed requirements for the livestock located in each consuming region were given explicit recognition. Export demands were established at 12 different ports.

Export–Average export demands for oats, barley, and rye, over the period 1957-58 to 1966-67, were found to be 12,264,184; 50,050,185; and 5,584,021 bushels, respectively. In this Study, these average exports were rounded to 13; 50; and 6 million bushels for oats, barley, and rye, respectively. Three different levels of spring wheat exports were used in the Study. These wheat export demands are discussed in Chapter 2.

Export demands were allocated to ports according to the average proportion of each grain shipped from each port over the period 1963-64 to 1967-68. This period was selected since it was considered to reflect typical marketing patterns since the opening of the St. Lawrence Seaway and the development of Asiatic grain markets. The distribution of exports by ports for each cereal is given in Table B.23. It was assumed that all exports of spring wheat, oats, barley, and rye originated in the Prairies.

Milling and Industrial–These demands include cereal grains that were used for both food purposes and for the production of alcoholic beverages. Regional food demands for spring wheat were estimated by first fitting a linear regression to the Canadian per capita consumption over the period 1949 to 1966. The analysis yielded the following equation:

$$\text{(A.43)}\quad Y_t = 80.6145 - .03971\,X_t \qquad R^2 = .62$$
$$\qquad\qquad\qquad\quad (.00769)$$

[22] The standard error of the regression coefficient gives some indication of the historical variation in the acreage of a crop. An alternative procedure would have been to place an upper constraint on the regional acreage of each crop according to its maximum acreage in any one year over the 1939-65 interval.

[23] Unpublished data obtained from the Census Division of the Dominion Bureau of Statistics were used for this allocation.

where

Y_t = per capita consumption of spring wheat in the t-th year, and

X_t = 1949 in the year 1949, . . . , 1966 in the year 1966.

Regional demands were then established by multiplying the estimated 1966 per capita consumption by the 1966 regional populations.

The milling demand for Ontario winter wheat was also estimated by fitting a linear regression to 1949 through 1966 per capita consumptions. The resulting equation was:

$$(A.44)\quad Y_t = 4.4408 - .002079\ X_t \qquad R^2 = .05$$
$$(.002157)$$

where

Y_t = per capita consumption of Ontario winter wheat in the t-th year, and

X_t is defined as in equation A.43.

Regional demands were not established for Ontario winter wheat.

The human demand for corn was assumed equal to the 1966 disposition. As in the case of Ontario winter wheat, regional demands were not established. Consuming regions 9, 10, and 11 in Southern Ontario were given equal access to the markets for corn and winter wheat.

The total human demand for oats was assumed equal to the 1966 consumption.[24] This demand was allocated to consuming regions according to their 1966 population.

The total Canadian industrial demands for wheat, barley, and rye were assumed equal to the 1966 disposition.[25] Demands for barley were established in those consuming regions which contained breweries, and for wheat and rye where distilleries were located. The regional demands were assumed proportional to the regional payrolls of breweries or distilleries.

The milling and industrial demands for each cereal were added together for use in the mathematical programming models. While regional demands, for milling and industrial purposes, were established in Eastern Canada and British Columbia for spring wheat, oats, barley, and rye, it was assumed that only the Prairies could supply this grain.[26] The regional and national domestic demands for cereals are given in Table B.24.

Livestock–The total feed demands for cereal grains were assumed equal to the 1966-67 livestock consumption.[27] The feeding value of each grain was

[24]Dominion Bureau of Statistics, *Grain Trade of Canada, 1966-67,* Catalogue No. 22-201, August 1968.

[25]*Ibid.*

[26]Except for the previously noted special consideration for Ontario winter wheat and corn.

[27]Dominion Bureau of Statistics, *Grain Trade of Canada, 1966-67,* Catalogue No. 22-201, August 1968.

expressed in relation to the nutrient value of barley.[28] Regional demands were specified in terms of bushels of barley equivalents. The quantity of each grain fed in a region could differ within specified limits from its estimated historical level.

The regional feed demands were estimated by first determining the number of grain-consuming animal units in each consuming region. These were determined from the June 1, 1966, Census estimates of livestock numbers[29] and Dominion Bureau of Statistics weighting coefficients.[30]

The provincial consumptions of feed grains in Eastern Canada and British Columbia were estimated from their 1966 provincial productions, net of seed and nonlivestock use, plus shipments under feed freight assistance. The difference between the published estimates of Canadian feed grain disposition and the total of these provincial requirements was assumed fed in the Prairies. This residual was allocated to each of the Prairie Provinces on the basis of the estimated number of grain-consuming animal units in each province.

The final step was to allocate these estimates of provincial feed grain use to the consuming regions within each province. This was done on the basis of regional livestock numbers. These regional estimates of feed grain use are given in Table B.25 in terms of bushels of both barley equivalents and the specific grains comprising this total.

In the mathematical programming models, the regional feed demands were equal to these bushels of barley equivalents. Different grains could be used to meet these regional demands; however, the regional consumption of each grain was required to be at least 50 per cent of its historical level. This latter restraint was placed on the feeding requirements, because the barley equivalent figure represents the demands for a number of classes of livestock, each of which might have certain minimums and maximums as to each type of grain that can be consumed. In the absence of this restraint, it is conceivable that an entire regional demand would be met by one grain. It is unlikely that a single grain would provide a balanced ration for all classes of livestock. No upper limit was placed on the regional feed consumption of each grain. However, an implicit limit was given for any one grain due to the minimal restraints for the others.

Transportation Costs

Transportation charges were established for interregional shipments of grain within Canada. Once grain was cleared for export, there was no further consideration of transportation costs. This Study does not answer the question as to which port of final clearance is the most desirable. As indicated in the previous

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[28] The common unit used in this Study was: one bushel of wheat, oats, rye, mixed grains, and corn equals 1.27, .62, 1.14, .81, and 1.21 bushels of barley, respectively.

[29] Dominion Bureau of Statistics, *Livestock and Poultry on Census Farms, for Provinces and Counties, 1966,* Catalogue No. 96-603, June 1967.

[30] Milk cows were given a weight of 1.0 grain-consuming animal unit, other cattle 0.51, horses 0.5, hogs 0.87, sheep 0.04, and poultry .045.

section, explicit demands for different grains were identified at different ports. This Study does, however, specify the lowest cost routing of grain between supply and demand locations within Canada.

Transportation charges were estimated only for combinations of supply and demand locations that appeared realistic. For example, it seemed inappropriate to consider shipments from Maritime regions to Western Canada, since these regions did not have the productive capacity even to meet their own internal demands.

Interregional movements of grain for domestic consumption were considered between all regions within the Prairies, and from Prairie regions to regions in British Columbia (excluding the Peace River area). Direct shipments from Prairie regions to Eastern consuming regions were permitted. However, in the construction of the mathematical model, Western grain consumed in the East was first shipped to Thunder Bay, and then moved forward, with no recognition given to its regional origin. Several different routings and modes of transportation were included for these shipments. For example, each grain could move by direct rail from Thunder Bay to the domestic market in Nova Scotia,[31] or go by lake and rail combinations through Halifax, Montreal, Prescott, etc. (see Table B.8). Transportation charges were estimated for grain shipments from supplying or consuming regions 9, 10, and 11 in Southern Ontario to other Eastern regions. Several different routings were again included.

Most regions within the Prairies were considered as potential suppliers of grain for Western export demands. The demands at Eastern ports were met by shipments from Thunder Bay, with several alternative routings and modes of transportation.

Transportation charges included freight tariffs and handling charges at terminal or transfer elevators. No charges for country elevator operations were included. Explicit recognition was given to the potentially different freight rates for grain used for livestock consumption, milling and industrial purposes, and for export. All costs pertained to 1966, except for shipments from Southern Ontario for which the 1967 level of feed freight assistance subsidy was used (except in Models 5 and 6 where the subsidy was excluded for all regions).

All interregional shipments within Western Canada were assumed to be by rail. The interregional movement of grain in Western Canada for domestic consumption does not take place under the Crowsnest Pass rate structure, except for shipments to Thunder Bay. Rail freight costs between regions for which no published rates were available were calculated, using the competitive rail miles of Canadian National Railway and Canadian Pacific Railway. Freight costs from Prairie regions to terminal elevators were obtained from published data.[32]

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[31] In the case of rail shipments from Thunder Bay, transportation charges were estimated as though the grain had moved forward directly from a Prairie region and had not been unloaded at the Lakehead.

[32] Dominion Bureau of Statistics, *Grain Trade of Canada, 1966-67*, Catalogue No. 22-201, August 1968.

The freight rates for both shipments were derived from semi-monthly bulletins of the Board of Grain Commissioners.

Rail freight rates in Eastern Canada were derived through the following equation which was estimated by regression analysis:

$$\text{(A.45)} \quad \log R_{ij} = .42 + .27 \log M_{ij} \qquad R^2 = .96$$
$$(.02)$$

where

$\log R_{ij}$ = the logarithm of the freight rate between points i and j in Eastern Canada,[33] and

$\log M_{ij}$ = the logarithm of the distance in miles between points i and j in Eastern Canada.

TABLE A.6

MAXIMUM FEED FREIGHT ASSISTANCE SUBSIDY AVAILABLE TO EASTERN CANADIAN CONSUMING REGIONS, 1967*

Consuming Region	All Western Feed Grains and Ontario Winter Wheat**	Corn
	(Dollars per hundredweight)	
1	.56	.26
2	.74	.44
3	.74	.44
4	.47	.17
5	.44	.14
6	.37	.07
7	.37	.07
8	.37	.07
9	.27	–
10	.24	–
11	.24	–
12	.45	–
13	–	–
30	1.17	.87

*The data in this Table were derived from feed freight assistance regulations in effect October 25, 1967.

**Ontario winter wheat is not eligible for a subsidy on shipments for consumption within Ontario.

[33] Rates were used that reflected the Montreal Freight Rate Zone, and the agreement between the CNR and CPR with the Ralston-Purina Company of Canada Ltd., 1961, to ship all grain at reduced rates to the Maritimes if the company guarantees to ship 90 per cent of their total volume by rail.

In all models except 5 and 6, the amount of the feed freight assistance subsidy was taken into consideration for grain shipped for livestock consumption. This subsidy amounted to $4.40 per ton, less the rate from the point of origin for shipments from Alberta to British Columbia regions. Feed grain shipped from Thunder Bay and Southern Ontario for domestic use is eligible for the feed freight assistance subsidy. The maximum subsidy available in each region is given in Table A.6. It should be noted that winter wheat shipments from Southern Ontario are eligible for the same level of subsidy as grain originating in Thunder Bay, despite the shorter distance to all Eastern markets from Ontario regions.

Transportation costs used in this Study are given in Tables B.4 through B.8. To determine the cost of Eastern shipments for those models where the feed freight assistance subsidy was not included, one would have to add the subsidy specified in Table A.6 to the data in Table B.8.

Port Capacities

Limits were placed on the number of bushels of all grains that could move through Eastern terminals. This was done because the terminals at any one port are restricted in handling capacity due to the length of shipping season, storage space, and the speed at which grain is received and dispatched. The maximum grain allowed to flow through any port was set at its peak level over the period 1958-59 to 1967-68. These restraints are specified in Table A.7.

TABLE A.7

MAXIMUM GRAIN FLOWS PERMITTED
THROUGH EASTERN CANADIAN TERMINAL ELEVATORS

Port Location	Number of Bushels
Thunder Bay	1,063,211,100
Kingston	9,400,000
Montreal	200,358,000
Sorel	49,500,000
Quebec	72,000,000
Trois-Rivières	83,700,000
Halifax	25,762,500
Bay ports*	115,799,286
Port Colborne	17,800,000
Prescott	22,000,000
Toronto	16,045,000

*Bay ports include Collingwood, Midland and Port McNicoll.

SOLUTION PROCEDURES FOR DIFFERENT MODELS

The general mathematical model and the estimated coefficients described in the previous sections of this Appendix were basically the same for each of the eight models. The purpose of this section is to briefly outline how these models differ, and how the estimation procedures were carried out for each model.

The mathematical structures of Models 1, 2, and 3 are identical. The coefficients of these models differ only with respect to wheat exports (variable E_{ge}). The exogenously determined wheat exports associated with each model were allocated to ports of final demand according to the procedures described above.

Model 4 differs from Model 2 to the extent that the possibility of corn imports from the United States are excluded in Model 4. These imports of 22.8 million bushels were allocated by use and region on the basis of the research findings of G. G. Pearson.[34] Of the 22.8 million bushels of imported corn, 9.3 million were allocated to the industrial and milling demands; 13.5 million bushels, to livestock demand. Human demands for corn were not identified by region in the models. Hence the 9.3 million bushels were added to the 10.9 million of domestically produced corn used in the other models (variable D_g). Eight million bushels of the imported corn used for livestock feed were allocated to Quebec; and 5.5 million bushels, to Ontario. These demands were distributed to consuming regions within each province according to regional livestock numbers. The regional demands associated with imported corn are indicated in Table A.8. Minimum consumption levels of corn were specified only for regions 5, 7, 9, 10, and 11. This modification of equation A.20 applied to all eight models.

TABLE A.8

ASSUMED REGIONAL LIVESTOCK CONSUMPTION OF IMPORTED CORN, 1966

Consuming Region	Corn	Barley Equivalents
	(Bushels)	
4	1,000,960	1,211,161
5	3,753,360	4,541,566
6	774,320	936,927
7	2,033,280	2,460,269
8	438,080	530,077
9	808,555	978,352
10	2,581,535	3,123,657
11	1,949,475	2,358,865
12	140,635	170,168
13	19,800	23,958
Total	13,500,000	16,335,000

[34] G. G. Pearson, "Grain Corn and Orderly Marketing", *Canadian Farm Economics*, Vol. 4, No. 2, June 1969.

Models 5 and 6 were identical to Models 1 and 2, respectively, except that in Models 5 and 6 the feed freight assistance subsidy was removed, where relevant, from the transportation rates for cereal movement between regions.

The restricted equilibrium analysis of Model 7 was achieved by changing the sign of the restraints for equation A.6 from a greater than or equal value to a strict equality for Eastern Canadian and British Columbia regions. This change made it necessary for all land in these regions to be included in the solution, regardless of its comparative advantage in production, relative to Western Canada. The solution procedures continued to optimize the regional mix of crops.

Model 8 differed from Model 7, in that total land supplies (variable L_{jf}''' of equation A.6) for Prairie regions were proportionally reduced until the model's solution indicated only a trivial surplus acreage. It was found that the initial regional total acreages could be reduced 12.5 per cent before the adjusted land supplies available in the model were fully utilized. It was necessary to solve the model a large number of times before these results were obtained.

APPENDIX B

SUPPORTING DATA

TABLE B.1

SUPPLY AND DISPOSITION, CANADIAN WHEAT
1945-46 TO 1969-70

Crop Year	Production	Exports, Wheat and Wheat Flour	Apparent Domestic Disappearance	Total Disappearance	Carryover at End of Crop Year
			(Thousand bushels)		
1945-46	316,320	343,186	157,682	500,868	73,600
1946-47	411,601	239,421	159,655	399,076	86,141
1947-48	338,506	194,982	152,779	347,761	77,710
1948-49	381,413	232,329	124,672	357,001	102,411
1949-50	366,028	225,137	131,107	356,244	112,200
1950-51	466,490	240,961	148,538	389,499	189,203
1951-52	553,678	355,825	169,895	525,720	217,178
1952-53	701,973	385,527	150,456	535,983	383,185
1953-54	634,040	255,081	143,926	399,007	618,675
1954-55	331,981	251,909	162,176	414,085	536,748
1955-56	519,178	312,260	164,113	476,373	579,574
1956-57	573,040	264,396	154,820	419,216	733,546
1957-58	392,719	320,293	157,519	477,812	648,454
1958-59	398,077	294,546	163,988	458,534	588,001
1959-60	445,077	277,291	156,206	433,497	599,588
1960-61	518,379	353,249	156,384	509,633	608,341
1961-62	283,394	358,022	142,660	500,682	391,058
1962-63	565,585	331,367	138,042	469,409	487,247
1963-64	723,500	594,548	156,762	751,310	459,440
1964-65	600,726	399,594	147,558	547,152	513,024
1965-66	649,412	584,906	157,415	742,321	420,122
1966-67	827,338	515,307	155,407	670,714	576,751
1967-68	592,920	336,010	168,150	504,160	665,510
1968-69	649,800	305,800	163,300	469,100	848,300
1969-70	684,800	N/A	N/A	N/A	N/A

N/A: Data not available.

Source: Dominion Bureau of Statistics, *Handbook of Agricultural Statistics, Part 1 – Field Crops,* Catalogue No. 21-507, 1908-63; Dominion Bureau of Statistics, *Grain Trade of Canada 1966-67,* Catalogue No. 22-201, August 1968; Dominion Bureau of Statistics, *Grain Trade of Canada 1967-68,* Catalogue No. 22-201, June 1969; and Canada Department of Agriculture, *Canadian Agricultural Outlook Conference, 1969, Part 1,* Ottawa, November 24-25, 1969.

TABLE B.2

SUPPLY AND DISTRIBUTION, CANADIAN BARLEY AND OATS, 1945-46 TO 1969-70

Crop Year	Oats				Barley				Oats and Barley			
	Domestic	Exports Minus Imports	Ending Year Stocks	Production	Domestic	Exports Minus Imports	Ending Year Stocks	Production	Domestic	Exports Minus Imports	Ending Year Stocks	Production
	(Million bushels)				(Million bushels)				(Million tons)			
1945-46	358.5	43.9	77.5	381.6	152.9	3.9	29.9	157.8	9.76	0.84	2.04	10.27
1946-47	349.1	29.7	69.7	371.1	142.4	7.3	29.1	148.9	9.35	1.22	1.88	9.88
1947-48	290.1	10.2	47.9	278.7	135.2	3.5	31.4	141.4	8.18	0.26	1.57	8.13
1948-49	323.1	23.1	60.5	358.8	132.8	24.0	29.7	155.0	8.68	0.97	1.74	9.82
1949-50	313.4	20.1	44.9	317.9	109.0	20.7	20.4	120.4	8.68	0.84	1.25	8.29
1950-51	335.3	34.4	95.2	419.9	110.9	27.4	53.5	171.4	8.36	1.24	2.90	11.25
1951-52	404.4	70.6	108.4	488.2	145.8	73.4	79.5	245.2	10.37	2.96	3.75	14.18
1952-53	365.4	65.3	144.4	466.8	137.2	122.0	111.7	291.4	9.50	4.04	5.13	14.93
1953-54	354.9	70.7	125.8	407.0	134.1	93.7	145.9	262.1	9.25	3.45	5.64	13.21
1954-55	326.0	22.2	84.0	306.4	148.8	80.9	91.5	175.2	9.11	2.32	3.62	9.41
1955-56	360.2	4.1	119.1	399.5	163.0	68.7	110.9	251.1	10.03	1.72	4.69	12.82
1956-57	356.7	18.7	211.2	467.5	155.7	81.5	142.8	269.1	9.80	2.27	7.02	14.41
1957-58	345.0	26.2	156.9	316.9	160.4	80.2	118.2	216.0	9.71	2.37	5.50	10.57
1958-59	365.2	7.5	130.0	345.7	154.4	70.4	131.2	237.8	9.91	1.82	5.36	11.58
1959-60	367.3	6.1	100.8	344.2	154.6	63.7	128.5	215.6	9.95	1.63	4.80	11.03
1960-61	381.5	2.7	115.2	398.5	162.2	47.2	112.6	193.5	10.38	1.18	4.66	11.42
1961-62	322.1	(-2.0)	79.1	284.0	124.5	42.9	57.8	112.6	8.46	1.0	2.73	7.53
1962-63	400.7	15.4	150.3	493.6	119.1	15.4	89.2	165.9	9.67	0.63	4.70	12.37
1963-64	405.2	18.8	179.4	453.1	144.7	46.9	118.3	220.7	13.84	1.44	5.89	13.0
1964-65	390.9	15.5	130.1	357.2	159.3	37.0	88.8	166.8	10.47	1.15	4.43	10.08
1965-66	402.0	15.9	127.2	415.0	167.7	37.9	97.8	214.6	11.10	1.18	4.51	9.40
1966-67	387.3	4.8	109.8	374.7	208.8	58.4	131.8	301.2	11.59	1.48	5.03	13.60
1967-68	333.5	3.5	77.0	304.2	208.2	41.3	130.9	248.7	10.67	1.05	4.45	11.14
1968-69	308.9	2.5	128.1	362.5	237.5	20.5	198.0	325.4	10.95	0.92	6.93	13.97
1969-70	N/A	N/A	N/A	381.2	N/A	N/A	N/A	380.0	N/A	N/A	N/A	15.60

N/A: Data not available.

Source: Dominion Bureau of Statistics, *Grain Trade of Canada,* Catalogue No. 22-201, 1945-46 to 1967-68; and Canada Department of Agriculture, *Canadian Agricultural Outlook Conference 1969,* Ottawa, November 24-25, 1969.

TABLE B.3

REPRESENTATIVE FARM SIZES IN TERMS OF CEREAL AND SUMMERFALLOW ACREAGE, BY PROVINCE

Province	Small Farm	Large Farm
	(Acres)	
Nova Scotia	62	138
Prince Edward Island	62	138
New Brunswick	62	138
Quebec*	112	–
Ontario	112	238
Manitoba	250	650
Saskatchewan	350	850
Alberta	350	850
British Columbia**	62	138

*Only one farm size was assumed for Quebec.

**The farm sizes for the Peace River area of British Columbia were the same as for Manitoba.

TABLE B.4

ESTIMATED TRANSPORTATION CHARGES PER BUSHEL FOR SHIPMENTS OF CEREAL GRAINS FROM SUPPLY LOCATIONS TO EXPORT PORTS, 1966

Supply Location	Export Port	Wheat	Oats	Barley	Rye
			(Dollars per bushel)		
14	Vancouver	.204	.116	.163	.190
15	Vancouver	.192	.109	.154	.179
16	Vancouver	.198	.112	.158	.185
17	Vancouver	.174	.099	.139	.162
18	Vancouver	.168	.095	.134	.157
19	Vancouver	.144	.082	.115	.134
20	Vancouver	.126	.071	.101	.118
21	Vancouver	.126	.071	.101	.118
22	Vancouver	.120	.068	.096	.112
23	Vancouver	.132	.075	.106	.123
24	Vancouver	.132	.075	.106	.123
25	Vancouver	.180	.102	.144	.168
14	Prince Rupert	.204	.116	.163	.190
15	Prince Rupert	.192	.109	.154	.179
16	Prince Rupert	.186	.105	.149	.174
17	Prince Rupert	.150	.085	.120	.140
18	Prince Rupert	.168	.129	.182	.213
19	Prince Rupert	.174	.099	.139	.162
20	Prince Rupert	.126	.071	.101	.118
21	Prince Rupert	.126	.071	.101	.118
22	Prince Rupert	.120	.068	.096	.112
23	Prince Rupert	.132	.075	.106	.123
24	Prince Rupert	.132	.075	.106	.123
25	Prince Rupert	.180	.102	.144	.168
14	Churchill	.138	.078	.110	.129
15	Churchill	.138	.078	.110	.129
16	Churchill	.120	.068	.096	.112
17	Churchill	.126	.071	.101	.118
18	Churchill	.132	.075	.106	.123
19	Churchill	.138	.078	.110	.129
20	Churchill	.132	.075	.106	.123
21	Churchill	.156	.088	.125	.146
22	Churchill	.156	.088	.125	.146
23	Churchill	.150	.085	.120	.140
24	Churchill	.162	.092	.130	.151
14	Thunder Bay	.084	.048	.067	.078
15	Thunder Bay	.096	.054	.077	.090
16	Thunder Bay	.108	.061	.086	.101
17	Thunder Bay	.126	.071	.101	.118
18	Thunder Bay	.114	.065	.091	.106
19	Thunder Bay	.132	.075	.106	.123
20	Thunder Bay	.144	.082	.115	.134
21	Thunder Bay	.150	.085	.120	.140
22	Thunder Bay	.156	.088	.125	.146
23	Thunder Bay	.156	.088	.125	.146
24	Thunder Bay	.174	.099	.139	.162
25	Thunder Bay	.210	.119	.168	.196
Thunder Bay	Kingston	.132	.119	.125	.129
Thunder Bay	Montreal	.150	.126	.144	.151
Thunder Bay	Sorel	.150	.126	.144	.151
Thunder Bay	Trois-Rivières	.150	.126	.144	.151
Thunder Bay	Quebec	.150	.126	.144	.151
Thunder Bay	Halifax	.228	.184	.216	.230
Thunder Bay	Baie Comeau	.156	.129	.149	.157
Thunder Bay	Saint John	228	.184	.216	.230

TABLE B.5

ESTIMATED TRANSPORTATION CHARGES PER HUNDREDWEIGHT FOR SHIPMENTS OF CEREAL GRAINS FOR DOMESTIC LIVESTOCK FEED BETWEEN SUPPLYING AND CONSUMING REGIONS IN WESTERN CANADA (FEED FREIGHT ASSISTANCE LEVY SUBTRACTED), 1966

Supplying Region	Consuming Region															
	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	(Cents per hundredweight)*															
14	0	28	32	51	41	56	59	70	75	75	71	89	87	82	94	–
15	28	0	29	44	32	50	55	62	67	67	77	86	80	78	91	–
16	32	29	0	44	46	54	51	68	70	65	73	82	86	80	93	99
17	51	44	44	0	37	39	38	55	59	51	56	76	77	76	86	96
18	41	32	46	37	0	33	44	52	56	56	67	78	77	75	86	96
19	56	50	54	39	33	0	54	37	41	54	73	77	67	62	77	98
20	59	55	51	38	44	54	0	57	51	40	50	72	72	76	79	86
21	70	62	61	55	52	37	57	0	18	37	52	68	22	22	22	22
22	75	67	70	59	56	41	51	18	0	29	49	65	22	22	22	22
23	75	67	65	51	56	54	40	37	29	0	32	54	22	22	22	22
24	71	77	73	56	67	73	50	52	49	32	0	66	22	22	22	22
25	89	86	82	76	78	77	72	68	65	54	66	0	22	22	22	22
26	87	80	86	77	77	67	72	54	50	57	49	38	0	30	16	55
27	82	78	80	76	75	62	76	56	52	61	75	52	30	0	39	57
28	–	–	–	–	–	–	–	–	–	–	–	45	–	–	0	64
29	–	–	–	–	–	–	–	–	–	–	–	45	–	–	64	0

*A dash indicates that shipments between the associated regions were not considered in the analysis.

TABLE B.6
ESTIMATED TRANSPORTATION CHARGES PER HUNDREDWEIGHT
FOR SHIPMENTS OF CEREAL GRAINS
FOR DOMESTIC MILLING AND INDUSTRIAL PURPOSES
BETWEEN SUPPLYING AND CONSUMING REGIONS IN WESTERN CANADA, 1966

Supplying Region	Consuming Region															
	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	(Cents per hundredweight)*															
14.	0	28	32	51	41	56	59	70	75	75	71	89	87	82	94	–
15.	28	0	29	44	32	50	55	62	67	67	77	86	80	78	91	–
16.	32	29	0	44	46	54	51	68	70	65	73	82	86	80	93	99
17.	51	44	44	0	37	39	38	55	59	51	56	76	77	76	86	96
18.	41	32	46	37	0	33	44	52	56	56	67	78	77	75	86	96
19.	56	50	54	39	33	0	54	37	41	54	73	77	67	62	77	98
20.	59	55	51	38	44	54	0	57	51	40	50	72	72	76	79	86
21.	70	62	61	55	52	37	57	0	18	37	52	68	54	56	68	89
22.	75	67	70	59	56	41	51	18	0	29	49	65	50	52	65	86
23.	75	67	65	51	56	54	40	37	29	0	32	54	57	61	73	79
24.	71	77	73	56	67	73	50	52	49	32	0	66	49	75	65	75
25.	89	86	82	76	78	77	72	68	65	54	66	0	38	52	45	45

*A dash indicates that shipments between the associated regions were not considered in the analysis.

TABLE B.7

ESTIMATED TRANSPORTATION CHARGES PER BUSHEL
FOR SHIPMENTS OF CEREAL GRAINS
FOR DOMESTIC MILLING AND INDUSTRIAL PURPOSES
BETWEEN THUNDER BAY AND CONSUMING REGIONS IN EASTERN CANADA, 1966

Transfer Port(s) or Transportation Mode	Consuming Region	Wheat	Oats	Barley	Rye
		(Dollars per bushel)*			
All rail	1	.324	–	.259	.610
Halifax	1	–	.184	–	–
Quebec	1	.564	–	.475	.532
Trois-Rivières	1	.582	–	.490	.554
Sorel	1	.588	–	.494	.560
Montreal	1	.600	–	.509	.571
Prescott	1	.612	–	.514	.582
Kingston	1	.612	–	.514	.582
Toronto	1	–	–	.533	.605
Port Colborne	1	.660	–	.547	.622
Bay ports**	1	.648	–	.542	.610
All rail	2	.438	–	.350	.438
Halifax	2	–	–	.509	–
Quebec	2	–	–	.461	–
Trois-Rivières	2	–	–	.480	–
Sorel	2	–	–	.490	–
Montreal	2	–	–	.494	–
Prescott	2	–	–	.499	–
Kingston	2	–	–	.499	–
Toronto	2	–	–	.523	–
Port Colborne	2	–	–	.533	–
Bay ports**	2	–	–	.533	–
All rail	3	.438	–	.350	.409
Halifax	3	.534	–	–	.515
Quebec	3	.480	–	–	.459
Trois-Rivières	3	.510	–	–	.487
Sorel	3	.528	–	–	.504
Montreal	3	.504	–	–	.482
Prescott	3	.528	–	–	.498
Kingston	3	.528	–	–	.498
Toronto	3	–	–	–	.543
Port Colborne	3	.588	–	–	.560
Bay ports**	3	.588	–	–	.554
Quebec	4	.408	.272	.358	.449
Sorel	5	.336	.207	.275	.341
All rail	6	.456	–	.365	.426
Quebec	6	.150	.126	.149	.151
Trois-Rivières	6	.330	–	.288	.319
Sorel	6	.360	–	.312	.347
Montreal	6	.384	–	.331	.370
Prescott	6	.426	–	.360	.403
Kingston	6	.450	–	.379	.426
Toronto	6	–	–	.413	.470
Port Colborne	6	.516	–	.432	.487
Bay ports**	6	.492	–	.422	.465
All rail	7	.456	–	.365	.426

TABLE B.7 (continued)

Transfer Port(s) or Transportation Mode	Consuming Region	Wheat	Oats	Barley	Rye
		(Dollars per bushel)*			
Quebec	7	.384	–	.331	.370
Trois-Rivières	7	.426	–	.370	.409
Sorel	7	.408	–	.350	.386
Montreal	7	.126	.105	.125	–
Prescott	7	.348	–	.298	.330
Kingston	7	.378	–	.326	.364
Toronto	7	–	–	.360	.414
Port Colborne	7	.462	–	.389	.442
Bay ports**	7	.450	–	.389	.431
All rail	8	.456	–	–	.426
Quebec	8	.432	–	–	.414
Trois-Rivières	8	.402	–	–	.386
Sorel	8	.378	–	–	.364
Montreal	8	.342	–	–	–
Prescott	8	.360	–	–	.347
Kingston	8	.348	–	.315	.330
Toronto	8	–	–	–	.381
Port Colborne	8	.432	–	–	.414
Bay ports**	8	.432	–	–	.414
All rail	9	.456	–	.365	.426
Prescott	9	.360	–	.307	.342
Kingston	9	.312	.221	.274	.302
Toronto	9	–	–	.322	.358
Port Colborne	9	.414	–	.350	.392
Bay ports**	9	.402	–	.350	.381
All rail	10	.456	–	.365	.426
Prescott	10	.396	–	.336	.375
Kingston	10	.360	–	.307	.342
Toronto	10	–	–	.240	.269
Port Colborne	10	.294	–	.254	.280
Bay ports**	10	.264	.190	.240	.252
All rail	11	.456	–	.365	.426
Prescott	11	.450	–	.384	.431
Kingston	11	.408	–	.350	.392
Toronto	11	–	–	.264	.291
Port Colborne	11	.300	.221	.259	.286
Bay ports**	11	.324	–	.283	.308
All rail	12	–	–	.365	–
Prescott	12	–	–	.413	–
Kingston	12	–	–	.384	–
Toronto	12	–	–	.341	–
Port Colborne	12	–	–	.370	–
Bay ports**	12	.390	.221	.346	.365
All rail	30	.228	.184	.216	–
Halifax	30	–	–	.446	–
Bay ports**	30	–	–	.499	–

*A dash indicates that shipments of the associated grain by the specified routing were not considered in the analysis.

**Bay ports include Collingwood, Midland and Port McNicoll.

TABLE B. 8

ESTIMATED TRANSPORTATION CHARGES PER BUSHEL FOR SHIPMENTS OF CEREAL GRAINS FOR DOMESTIC LIVESTOCK FEED BETWEEN SUPPLYING LOCATIONS AND CONSUMING REGIONS IN EASTERN CANADA (FEED FREIGHT ASSISTANCE TAKEN INTO CONSIDERATION), 1966

Supplying Region or Terminal	Transfer Port(s) or Transportation Mode	Consuming Region	Wheat	Winter Wheat	Oats	Barley	Rye	Corn
			(Dollars per bushel)*					
Thunder Bay	All rail	1	.0	.0	.0	.0	.0	–
Thunder Bay	Halifax	1	.0	–	.0	.0	.0	–
Thunder Bay	Montreal	1	.252	–	.187	.230	.246	–
Thunder Bay	Prescott	1	.264	–	.197	.235	.258	–
Thunder Bay	Kingston	1	.264	–	.197	.235	.258	–
Thunder Bay	Toronto	1	.288	–	.207	.254	.280	–
Thunder Bay	Port Colborne	1	.312	–	.218	.269	.297	–
Thunder Bay	Bay ports**	1	.300	–	.207	.264	.286	–
9	All rail	1	.480	.168	.272	.384	.448	.325
10	All rail	1	.516	.180	.292	.413	.482	.336
11	All rail	1	.540	.204	.306	.432	.504	.358
13	All rail	1	.0	.0	.0	.0	.0	.0
11	Port Colborne, Halifax	1	.372	.036	.248	.322	.358	.213
11	Port Colborne, Quebec	1	.678	.342	.411	.562	.638	.493
11	Port Colborne, Sorel	1	.708	.372	.428	.586	666	.521
11	Port Colborne, Trois-Rivières	1	.702	.366	.422	.576	622	.510
11	Port Colborne, Montreal	1	.720	.408	.435	.595	.678	.532
10	Toronto, Halifax	1	.342	.006	.231	.298	.330	.185
10	Toronto, Quebec	1	.660	.324	.401	.547	.622	.476
10	Toronto, Sorel	1	.690	.354	.418	.571	.650	.504
10	Toronto, Trois-Rivières	1	.684	.348	.411	.562	.638	.493
10	Toronto, Montreal	1	.702	.390	.425	.581	.661	.515
Thunder Bay	Halifax	2	.144	–	.136	.389	.151	–
Thunder Bay	Quebec	2	.096	–	.095	.101	.095	–
Thunder Bay	Sorel	2	.132	–	.112	.130	.129	–

TABLE B. 8 (continued)

Supplying Region or Terminal	Transfer Port(s) or Transportation Mode	Consuming Region	Wheat	Winter Wheat	Oats	Barley	Rye	Corn
			(Dollars per bushel)*					
Thunder Bay	Trois-Rivières	2	.120	–	.109	.120	.123	–
Thunder Bay	Montreal	2	.138	–	.119	.134	.140	–
Thunder Bay	Prescott	2	.150	–	.133	.144	.151	–
Thunder Bay	Kingston	2	.150	–	.129	.139	.151	–
Thunder Bay	Toronto	2	.180	–	.146	.163	.179	–
Thunder Bay	Port Colborne	2	.192	–	.150	.173	.185	–
Thunder Bay	Bay ports**	2	.180	–	.143	.173	.179	–
9	All rail	2	.468	.018	.265	.374	.437	.185
10	All rail	2	.510	.060	.289	.408	.476	.224
11	All rail	2	.528	.084	.299	.422	.493	.246
13	All rail	2	.0	–	.0	.0	.0	–
10	Toronto, Quebec	2	.642	.198	.391	.533	.605	.358
10	Toronto, Sorel	2	.678	.234	.411	.562	.638	.392
10	Toronto, Trois-Rivières	2	.672	.228	.405	.552	.627	.381
10	Toronto, Montreal	2	.690	.246	.415	.571	.644	.398
11	Port Colborne, Quebec	2	.660	.216	.401	.547	.622	.375
11	Port Colborne, Sorel	2	.696	.252	.422	.576	.655	.409
11	Port Colborne, Trois-Rivières	2	.690	.246	.415	.566	.644	.398
11	Port Colborne, Montreal	2	.708	.246	.425	.586	.661	.414
Thunder Bay	Halifax	3	.096	–	.109	.110	.101	–
Thunder Bay	Quebec	3	.042	–	.065	.062	.050	–
Thunder Bay	Sorel	3	.066	–	.092	.082	.073	–
Thunder Bay	Trois-Rivières	3	.072	–	.082	.086	.078	–
Thunder Bay	Montreal	3	.066	–	.119	.086	.073	–
Thunder Bay	Prescott	3	.090	–	.095	.091	.090	–
Thunder Bay	Kingston	3	.090	–	.095	.091	.090	–
Thunder Bay	Toronto	3	.138	–	.119	.130	.134	–
Thunder Bay	Port Colborne	3	.150	–	.126	.139	.151	–
Thunder Bay	Bay ports**	3	.144	–	.122	.144	.146	–
9	All rail	3	.396	.0	.224	.317	.370	.123

TABLE B. 8 (continued)

Supplying Region or Terminal	Transfer Port(s) or Transportation Mode	Consuming Region	Wheat	Winter Wheat	Oats	Barley	Rye	Corn
			(Dollars per bushel)*					
10	All rail	3	.450	.0	.255	.360	.420	.168
11	All rail	3	.474	.030	.269	.379	.442	.196
13	All rail	3	.0	–	.0	.0	.0	–
10	Toronto, Quebec	3	.582	.138	.357	.485	.549	.302
10	Toronto, Sorel	3	.630	.186	.381	.518	.588	.342
10	Toronto, Trois-Rivières	3	.612	.168	.374	.509	.577	.330
10	Toronto, Montreal	3	.606	.162	.371	.504	.571	.325
11	Port Colborne, Quebec	3	.600	.156	.367	.499	.566	.319
11	Port Colborne, Sorel	3	.648	.204	.391	.533	.605	.358
11	Port Colborne, Trois-Rivières	3	.630	.186	.384	.523	.594	.347
11	Port Colborne, Montreal	3	.624	.180	.381	.518	.588	.342
Thunder Bay	Quebec	4	.126	–	.112	.130	.129	–
Thunder Bay	Sorel	4	.186	–	.146	.173	.179	–
Thunder Bay	Trois-Rivières	4	.168	–	.082	.158	.168	–
Thunder Bay	Montreal	4	.192	–	.153	.178	.190	–
Thunder Bay	Prescott	4	.222	–	.173	.202	.218	–
Thunder Bay	Kingston	4	.222	–	.170	.202	.218	–
Thunder Bay	Toronto	4	.264	–	.194	.230	.258	–
Thunder Bay	Port Colborne	4	.288	–	.201	.240	.274	–
Thunder Bay	Bay ports**	4	.270	–	.342	.245	.263	–
9	All rail	4	.372	.090	.211	.298	.347	.252
10	All rail	4	.426	.144	.241	.341	.398	.246
11	All rail	4	.252	.168	.143	.202	.235	.348
13	All rail	4	.312	–	.177	.250	.291	–
10	Toronto, Quebec	4	.510	.228	.316	.427	.482	.420
10	Toronto. Sorel	4	.564	.282	.350	.475	.538	.442
10	Toronto. Trois-Rivières	4	.552	.270	.340	.461	.521	.426
10	Toronto, Montreal	4	.576	.294	.354	.480	.543	.448
11	Port Colborne, Quebec	4	.528	.246	.326	.442	.498	.403
11	Port Colborne, Sorel	4	.582	.300	.360	.490	.554	.454

TABLE B. 8 (continued)

Supplying Region or Terminal	Transfer Port(s) or Transportation Mode	Consuming Region	Wheat	Winter Wheat	Oats	Barley	Rye	Corn
			(Dollars per bushel)*					
11	Port Colborne, Trois-Rivières	4	.570	.288	.350	.475	.538	.442
11	Port Colborne, Montreal	4	.594	.312	.364	.494	.560	.465
Thunder Bay	Quebec	5	.096	–	.099	.101	.101	–
Thunder Bay	Sorel	5	.072	–	.082	.082	.078	–
Thunder Bay	Trois-Rivières	5	.096	–	.099	.106	.101	–
Thunder Bay	Montreal	5	.096	–	.095	.106	.101	–
Thunder Bay	Prescott	5	.126	–	.119	.125	.129	–
Thunder Bay	Kingston	5	.150	–	.136	.144	.151	–
Thunder Bay	Toronto	5	.210	–	.160	.187	.202	–
Thunder Bay	Port Colborne	5	.234	–	.173	.206	.224	–
Thunder Bay	Bay ports**	5	.222	–	.163	.206	.213	–
10	Toronto, Quebec	5	.462	.198	.286	.384	.431	.364
10	Toronto, Sorel	5	.438	.174	.275	.370	.414	.347
10	Toronto, Trois-Rivières	5	.462	.198	.289	.389	.437	.370
10	Toronto, Montreal	5	.462	.198	.289	.389	.437	.370
11	Port Colborne, Quebec	5	.480	.216	.296	.398	.448	.381
11	Port Colborne, Sorel	5	.456	.192	.286	.384	.431	.364
11	Port Colborne, Trois-Rivières	5	.480	.222	.299	.403	.454	.386
11	Port Colborne, Montreal	5	.480	.216	.299	.403	.454	.386
9	All rail	5	.264	.0	.150	.211	.246	.168
10	All rail	5	.348	.084	.197	.278	.325	.246
11	All rail	5	.378	.114	.214	.302	.353	.274
13	All rail	5	.318	–	.180	.254	.297	–
9	All rail	6	.294	.072	.167	.235	.274	.235
10	All rail	6	.372	.150	.211	.298	.347	.308
11	All rail	6	.402	.180	.228	.322	.375	.336
13	All rail	6	.318	–	.133	.187	.218	–
Thunder Bay	Quebec	6	.0	–	.0	.0	.0	–
Thunder Bay	Montreal	6	.162	–	.133	.154	.162	–
Thunder Bay	Prescott	6	.204	–	.160	.182	.196	–

TABLE B. 8 (continued)

Supplying Region or Terminal	Transfer Port(s) or Transportation Mode	Consuming Region	Wheat	Winter Wheat	Oats	Barley	Rye	Corn
			(Dollars per bushel)*					
Thunder Bay	Kingston	6	.228	–	.173	.202	.218	–
Thunder Bay	Toronto	6	.270	–	.197	.240	.263	–
Thunder Bay	Port Colborne	6	.294	–	.207	.254	.280	–
Thunder Bay	Bay ports**	6	.270	–	.190	.240	.258	–
10	Toronto, Quebec	6	.252	.030	.170	.221	.241	.202
10	Toronto, Sorel	6	.462	.240	.428	.389	.437	.398
10	Toronto, Trois-Rivières	6	.432	.210	.269	.360	.403	.364
10	Toronto, Montreal	6	.486	.264	.303	.408	.459	.420
11	Port Colborne, Quebec	6	.270	.048	.180	.235	.258	.218
11	Port Colborne, Sorel	6	.480	.258	.299	.403	.454	.414
11	Port Colborne, Trois-Rivières	6	.450	.228	.279	.374	.420	.381
11	Port Colborne, Montreal	6	.504	.282	.313	.422	.476	.437
Thunder Bay	Montreal	7	.0	–	.0	.0	.0	–
Thunder Bay	Prescott	7	.126	–	.116	.120	.123	–
Thunder Bay	Kingston	7	.156	–	.136	.149	.157	–
Thunder Bay	Toronto	7	.210	–	.163	.187	.202	–
Thunder Bay	Port Colborne	7	.126	–	.177	.211	.235	–
Thunder Bay	Bay ports**	7	.228	–	.170	.211	.224	–
10	Toronto, Montreal	7	.252	.030	.170	.221	.241	.202
11	Port Colborne, Montreal	7	.270	.048	.180	.235	.258	.218
9	All rail	7	.210	.0	.119	.168	.196	.157
10	All rail	7	.306	.084	.173	.245	.286	.246
11	All rail	7	.348	.126	.197	.278	.325	.286
13	All rail	7	.318	–	.133	.187	.218	–
Thunder Bay	Montreal	8	.120	–	–	.120	.123	–
Thunder Bay	Prescott	8	.138	–	.126	.130	.140	–
Thunder Bay	Kingston	8	.156	–	.116	.120	.123	–
Thunder Bay	Toronto	8	.234	–	.143	.158	.196	–
Thunder Bay	Port Colborne	8	.210	–	.160	.048	.218	–
Thunder Bay	Bay ports**	8	.210	–	.160	.197	.207	–

TABLE B. 8 (continued)

Supplying Region or Terminal	Transfer Port(s) or Transportation Mode	Consuming Region	Wheat	Winter Wheat	Oats	Barley	Rye	Corn
			(Dollars per bushel)*					
10	Toronto, Montreal	8	.444	.222	.279	.374	.420	.381
11	Port Colborne, Montreal	8	.462	.240	.289	.389	.437	.398
9	All rail	8	.132	.0	.075	.106	.123	.084
10	All rail	8	.270	.048	.153	.216	.252	.213
11	All rail	8	.312	.090	.177	.250	.291	.252
13	All rail	8	.318	–	.133	.187	.218	–
Thunder Bay	Prescott	9	.198	–	.160	.178	.190	–
Thunder Bay	Kingston	9	.156	–	.133	.144	.151	–
Thunder Bay	Toronto	9	.216	–	.167	.192	.213	–
Thunder Bay	Port Colborne	9	.252	–	.184	.221	.241	–
Thunder Bay	Bay ports**	9	.240	–	.177	.221	.230	–
9	All rail	9	.0	.0	.0	.0	.0	.0
10	All rail	9	.252	.252	.143	.202	.235	.235
11	All rail	9	.300	.300	.170	.240	.280	.280
13	All rail	9	.324	–	.167	.235	.274	–
9	All rail	10	.252	.252	.143	.202	.235	.235
10	All rail	10	.0	.0	.0	.0	.0	.0
11	All rail	10	.180	.180	.102	.144	.168	.168
13	All rail	10	.324	–	.167	.235	.274	–
Thunder Bay	Toronto	10	.132	–	.119	.125	.134	–
Thunder Bay	Port Colborne	10	.150	–	.126	.139	.146	–
Thunder Bay	Bay ports**	10	.120	–	.109	.125	.118	–
Thunder Bay	Toronto	11	.162	–	.136	.149	.157	–
Thunder Bay	Port Colborne	11	.156	–	.129	.144	.151	–
Thunder Bay	Bay ports**	11	.180	–	.139	.168	.174	–
9	All rail	11	.300	.300	.170	.240	.280	.280
10	All rail	11	.180	.180	.102	.144	.168	.168
11	All rail	11	.0	.0	.0	.0	.0	.0
13	All rail	11	.324	–	.167	.235	.274	–
Thunder Bay	Toronto	12	.198	–	.119	.130	.134	–

TABLE B. 8 (continued)

Supplying Region or Terminal	Transfer Port(s) or Transportation Mode	Consuming Region	Wheat	Winter Wheat	Oats	Barley	Rye	Corn
			(Dollars per bushel)*					
Thunder Bay	Port Colborne	12	.168	–	.136	.154	.162	–
Thunder Bay	Bay ports**	12	.126	–	.112	.130	.123	–
9	All rail	12	.300	.300	.170	.240	.280	.280
10	All rail	12	.282	.282	.160	.226	.263	.263
11	All rail	12	.318	.318	.180	.254	.297	.297
12	All rail	12	.0	–	.0	.0	.0	–
13	All rail	12	.318	–	.105	.149	.174	–
9	All rail	13	–	.456	–	–	–	.426
13	All rail	13	.0	–	.0	.0	.0	–
13	All rail	30	.0	–	.0	.0	.0	–

*A dash indicates that shipments of the associated grain by the specified routing were not considered in the analysis.

**Bay ports include Collingwood, Midland and Port McNicoll.

TABLE B.9

ANNUAL CHANGES IN REGIONAL CEREAL CROP ACREAGES IN ONTARIO*

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total Cereals
				(Acres)**				
83	−23	−1	145	−311	−7	−37	−6	−240
84	−40	0	231	−313	−4	−70	8	−188
85	12	0	276	−229	−4	−240	7	−178
86	−17	−2	161	−197	−4	−214	3	−270
87	−115	19	−403	−467	−6	−574	74	−1,472
88	−22	7	745	−296	−7	−542	23	−92
89	−10	7	−154	−93	2	−194	22	−420
90	−87	23	−217	−221	−5	−340	−5	−852
91	−268	46	−63	−308	−149	21	−5	−726
92	−19	30	−290	−148	−2	−241	−5	−675
93	−24	35	170	−100	−12	−175	15	−91
94	−60	90	−371	−197	−34	−532	10	−1,094
95	−17	125	278	−186	−181	−231	74	−138
96	−30	−55	−793	−334	−121	−434	51	−1,716
97	−18	−274	−386	−184	−50	−143	7	−1,048
98	−2	−1	−194	−12	−15	−10	−2	−236
99	−51	−371	61	−202	−206	−1,021	115	−1,675
100	−32	−390	−447	−460	−50	−408	17	−1,770
101	0	−2	−224	−14	−2	2	−1	−241
102	−71	−308	−224	−444	−130	−1,198	112	−2,263
103	−78	−840	−338	−687	−63	−1,544	175	−3,375
104	−118	−1,336	−861	−874	−124	314	122	−2,877
105	−41	−340	−23	−261	−10	−484	64	−1,095
106	−52	−336	110	−439	−26	−689	46	−1,386
107	−56	−85	−363	−285	−69	183	19	−656
108	−66	−1,120	−1,744	−857	−2	1,328	38	−2,423
109	−23	−1,130	−998	−394	15	1,575	78	−877
110	−70	−332	155	−495	−5	−436	92	−1,091
111	−35	−1,011	−527	−838	14	340	318	−1,739
112	−57	−1,348	−108	−752	0	1,437	1,018	190
113	−42	−344	−160	−186	−314	−654	75	−1,625
114	−5	−280	180	−121	−3	−820	307	−742
115	−8	−407	387	−224	1	−609	380	−480
116	−5	−357	−155	−35	−8	−113	12	−661
117	1	−298	−302	−42	−12	−68	78	−643
118	−20	−49	499	−172	−24	−358	252	128
119	23	77	−545	−85	595	−238	767	594
120	1	−464	1,467	−248	186	−1,890	1,479	531
121	−9	−241	211	−160	163	−588	591	−33
122	−15	−542	−668	−289	−30	−639	1,741	−442
123	−30	−405	120	−402	101	−932	2,515	967
124	4	252	−293	−120	243	−681	1,924	1,329
125	−5	304	−1,284	−257	−47	−64	638	−715
126	−29	252	−962	−416	−64	−420	4,256	2,617
127	−4	−2	86	−88	−2	−20	0	−30
128	−6	−2	−276	−52	−3	−12	−1	−352
129	−16	−41	107	−41	−1	72	0	80
130	−43	−12	16	−84	−3	−34	−1	−161
131	−27	8	460	−121	−1	−34	0	285
132	−6	−5	256	−68	0	62	0	239
133	−13	−1	59	−90	−1	8	−1	−39
134	−42	−5	164	−59	−2	49	0	105
135	−46	−13	280	−230	−1	15	−2	3
136	−17	0	70	−58	0	9	0	4

*The figures in this Table were estimated from crop acreage trends over the period 1939 through 1965. They do not necessarily represent an average of the difference between 1939 and 1965 acreages. The estimation procedure is discussed in Appendix A.

**A minus figure represents a declining trend in acreage.

TABLE B.10

ANNUAL CHANGES IN REGIONAL CROP ACREAGES IN MANITOBA*

Producing Region	Wheat	Oats	Barley	Rye	Flaxseed	Mixed Grain	Summer-fallow	Total Cereals	Total Cereals, plus Flaxseed	Total Cereals, Flaxseed and Summer-fallow
					(Acres)**					
137	257	320	−589	−244	212	68	731	−188	24	755
138	2,186	2,936	−7,046	−462	2,414	1,196	1,511	−1,190	1,224	2,735
139	1,570	3,390	−11,236	−631	14,048	−1,713	4,662	−8,620	5,428	10,090
140	469	990	−2,535	−78	869	868	1,177	−286	583	1,760
141	731	944	−465	−22	1,177	453	4,567	1,641	2,818	7,385
142	1,883	332	−6,998	−547	3,919	632	3,515	−4,698	−779	2,736
143	639	766	−4,944	279	1,114	436	1,801	−2,824	-1,710	91
144	3,224	1,806	−2,968	133	520	474	4,454	2,669	3,189	7,643
145	2,939	−2,321	540	−261	770	440	7,604	1,337	2,107	9,711
146	1,645	−803	−2,621	−262	1,135	332	5,446	−1,709	−574	4,872
147	−1,089	−1,093	−2,588	503	5,302	89	4,703	−4,178	1,124	5,827
148	3,745	662	−612	−200	1,146	652	5,419	4,247	5,393	10,812
149	1,197	446	1,003	1,460	302	308	4,798	4,414	4,716	9,514
150	1,176	549	−646	−282	514	81	2,645	878	1,392	4,037

*The figures in this Table were estimated from crop acreage trends over the period 1939 through 1965. They do not necessarily represent an average of the difference between 1939 and 1965 acreages. The estimation procedure is discussed in Appendix A.

**A minus figure represents a declining trend in acreage.

TABLE B.11

ANNUAL CHANGES IN REGIONAL CROP ACREAGES IN ALBERTA*

Producing Region	Wheat	Oats	Barley	Rye	Flaxseed	Mixed Grain	Summer-fallow	Total Cereals	Total Cereals, plus Flaxseed	Total Cereals, Flaxseed and Summer-fallow
					(Acres)**					
171	5,580	−263	2,313	202	−223	88	20,185	7,920	7,697	27,882
172	10,814	−230	7,782	100	4,530	587	34,106	19,053	23,583	57,689
173	3,015	−540	1,239	148	−351	144	17,993	4,006	3,655	21,648
174	14,586	−322	8,718	−206	4,238	496	49,668	23,272	27,510	77,178
175	−49,370	−4,799	1,791	−265	−3,991	255	−46,541	−52,388	−56,379	−102,920
176	−30,915	−8,447	2,014	−556	−1,222	654	−50,793	−37,250	−38,472	−89,265
177	2,383	−2,874	3,830	−165	102	2,322	11,574	5,496	5,598	17,172
178	8,084	1,321	8,253	−226	−191	2,922	28,266	20,354	20,163	48,429
179	−2,760	463	1,881	−56	633	2,361	−1,728	1,889	2,522	794
180	−18,812	−8,721	6,666	−187	−405	2,267	−15,818	−18,787	−19,192	−35,010
181	−9,926	−3,391	10,739	−305	−128	2,239	−19,853	−644	−772	−20,625
182	−2,157	−431	7,851	−92	1,007	2,183	−189	7,354	8,361	8,172
183	−4,078	−6,725	12,080	112	5,972	693	10,308	2,082	8,054	18,362

*The figures in this Table were estimated from crop acreage trends over the period 1939 through 1965. They do not necessarily represent an average of the difference between 1939 and 1965 acreages. The estimation procedure is discussed in Appendix A.

**A minus figure represents a declining trend in acreage.

TABLE B.12

ANNUAL CHANGES IN REGIONAL CROP ACREAGES IN SASKATCHEWAN*

Producing Region	Wheat	Oats	Barley	Rye	Flaxseed	Mixed Grain	Summer-fallow	Total Cereals	Total Cereals, plus Flaxseed	Total Cereals, Flaxseed and Summer-fallow
					(Acres)**					
151	29,802	−6,692	−10,437	−397	50	364	13,626	12,640	12,690	26,316
152	39,072	−14,956	−20,510	−362	1,773	314	13,903	3,558	5,331	19,234
153	14,022	−6,800	−10,356	−264	2,482	388	13,530	−3,010	−528	13,002
154	3,574	−2,978	−5,046	−273	1,805	844	11,760	−3,879	−2,074	9,686
155	12,079	−5,644	−4,976	−1,229	266	347	26,248	577	843	27,091
156	28,589	−14,760	−14,266	−82	−8,916	123	20,958	−396	−9,312	11,646
157	26,756	−8,679	−8,763	−27	−826	307	7,099	9,594	8,768	15,867
158	12,171	−3,040	−2,587	−232	189	95	5,668	6,407	6,596	12,264
159	9,624	−1,866	−4,872	−312	1,294	63	9,396	2,637	3,931	13,327
160	6,075	−1,804	−8,433	−2,018	37	205	22,989	−5,975	−5,938	17,051
161	7,193	−1,541	−6,191	−1,682	−2,577	61	11,596	−2,160	−4,737	6,859
162	7,367	−501	−5,960	−746	−2,998	152	14,785	312	−2,686	12,099
163	−138	−602	−5,026	−2,556	−800	122	29,492	−8,200	−9,000	20,492
164	1,349	1,222	−591	−5,141	−2	163	9,730	−2,998	−3,000	6,730
165	−554	125	−3,246	−6,828	191	75	24,492	−10,428	−10,237	14,255
166	7,710	−5,934	−6,681	−3,362	−660	446	29,029	−7,821	−8,481	20,548
167	11,574	−11,000	−1,681	−2,972	512	642	13,756	−3,437	−2,925	10,831
168	2,062	−4,758	−3,323	−1,830	−56	615	13,250	−7,234	−7,290	5,960
169	10,778	−15,947	−116	−424	−502	294	16,055	−5,415	−5,917	10,138
170	14,701	−2,338	196	−305	−2,098	114	24,602	12,368	10,270	34,872

*The figures in this Table were estimated from crop acreage trends over the period 1952 through 1965. They do not necessarily represent an average of the difference between 1952 and 1965 acreages. The estimation procedure is discussed in Appendix A.

**A minus figure represents a declining trend in acreage.

TABLE B.13

ESTIMATED NET YIELDS PER ACRE FOR CEREAL GRAINS BY PRODUCING REGION IN EASTERN CANADA, 1966*

Producing Region	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Bushels)			
1	26.5	–	42.0	32.2	–	36.3	–
2	34.4	–	45.8	37.9	–	46.3	–
3	29.0	–	39.5	34.9	–	41.6	–
4	29.2	–	41.2	36.2	–	41.6	–
5	29.2	–	41.2	36.2	–	41.6	–
6	25.5	–	41.6	38.3	–	43.9	–
7	27.8	–	45.6	40.9	–	47.0	–
8	32.6	–	49.9	45.6	–	52.6	–
9	32.5	–	44.3	38.7	–	43.4	–
10	23.0	–	38.0	33.1	–	41.7	–
11	23.0	–	38.0	33.1	–	41.7	–
12	21.2	–	37.2	27.6	–	38.0	–
13	23.1	–	34.3	31.2	25.7	32.7	–
14	19.3	–	24.3	23.6	17.8	36.1	–
15	21.0	–	29.1	29.7	19.7	29.9	–
16	23.9	–	31.9	32.5	21.0	32.5	–
17	20.9	–	30.8	29.5	19.4	34.3	–
18	23.2	–	35.3	31.3	20.7	35.2	–
19	20.8	–	26.1	27.2	20.5	24.9	–
20	23.7	–	30.2	27.1	21.1	31.9	–
21	23.2	–	33.9	31.0	20.4	33.1	–
22	22.2	–	30.4	28.9	20.7	30.9	–
23	23.0	–	36.3	35.0	23.0	36.9	–
24	23.8	–	33.7	33.7	21.5	36.3	–
25	23.3	–	35.8	32.6	19.5	36.9	–
26	19.4	–	33.1	29.8	18.2	36.2	–
27	18.5	–	34.9	33.5	22.6	37.3	–
28	23.3	–	33.7	28.0	21.1	36.6	–
29	23.3	–	37.3	32.4	21.4	39.6	–
30	24.9	–	31.7	31.4	22.2	34.8	–
31	21.1	–	30.9	28.7	18.9	35.0	–
32	25.8	–	33.2	33.0	22.7	30.6	–
33	21.0	–	34.5	31.0	20.5	36.2	–
34	19.9	–	36.3	31.1	20.6	39.3	–
35	28.1	–	36.8	33.5	27.3	35.4	–
36	25.5	–	38.9	34.7	25.0	39.9	–
37	21.5	–	35.4	30.6	20.8	36.9	–
38	24.7	–	39.2	36.9	20.4	41.0	–
39	25.7	–	39.5	36.0	20.2	38.9	–
40	21.8	–	35.6	30.3	18.2	35.1	–
41	23.9	–	35.5	27.3	19.9	41.2	–
42	26.6	–	35.7	34.1	28.6	34.2	–
43	28.2	–	41.4	41.0	31.6	42.5	–
44	31.5	–	43.3	37.9	29.0	44.2	–
45	30.5	–	38.5	37.7	29.0	39.5	–

TABLE B.13 (continued)

Producing Region	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Bushels)			
46	27.6	–	40.3	35.6	23.2	40.8	–
47	24.8	–	31.3	35.4	28.6	29.2	–
48	26.2	–	36.5	34.5	22.9	38.5	–
49	22.9	–	35.3	32.3	20.8	33.0	–
50	30.6	–	37.9	36.5	24.1	39.7	–
51	25.2	–	36.3	37.0	24.0	36.0	–
52	23.3	–	37.0	35.7	26.5	38.2	–
53	27.7	–	38.6	36.9	29.0	39.0	–
54	27.7	–	37.4	37.8	22.9	43.0	–
55	29.0	–	42.2	42.2	28.0	41.3	–
56	28.0	–	39.0	41.8	24.5	36.2	–
57	28.0	–	40.0	42.3	26.2	37.8	–
58	28.6	–	36.2	35.0	24.5	39.7	–
59	27.6	–	40.7	38.3	24.1	42.2	–
60	32.7	–	43.8	45.7	29.9	47.6	–
61	26.2	–	38.3	35.9	25.1	42.4	–
62	31.7	–	40.4	36.9	27.8	41.6	–
63	25.8	–	40.0	37.7	24.8	41.0	–
64	28.1	–	39.3	36.4	25.9	36.8	–
65	25.3	–	38.9	34.5	27.2	32.5	–
66	24.1	–	36.5	37.1	29.8	36.6	–
67	23.5	–	38.4	40.1	29.2	38.6	–
68	29.7	–	40.6	38.9	25.7	40.0	–
69	27.7	–	44.1	38.4	27.4	44.3	–
70	28.0	–	42.4	43.5	26.0	43.2	–
71	25.1	–	37.7	35.6	22.8	39.3	–
72	25.9	–	44.1	41.4	27.0	47.1	–
73	24.5	–	40.0	40.5	26.0	36.8	–
74	29.4	–	41.4	39.7	32.0	39.5	–
75	28.8	–	41.9	39.4	30.4	42.7	–
76	28.7	–	40.1	37.3	28.1	37.4	–
77	26.4	–	32.7	34.1	23.9	32.3	–
78	23.7	–	32.1	30.1	26.3	32.1	–
79	25.6	–	33.8	31.1	23.5	36.3	–
80	27.9	–	38.3	37.3	23.2	40.2	–
81	17.2	–	27.0	20.8	15.5	28.7	–
82	23.0	–	35.9	32.9	18.0	40.5	–
83	22.4	29.1	43.3	36.0	22.6	41.6	68.1
84	22.3	27.5	40.9	33.9	22.3	38.3	67.5
85	22.3	30.7	47.2	36.0	21.9	46.1	62.7
86	22.2	31.0	43.6	35.4	22.1	43.3	67.1
87	22.5	33.7	51.8	40.0	22.7	51.2	73.8
88	21.9	27.9	46.1	35.7	21.9	43.8	68.0
89	21.7	30.7	47.5	38.2	23.4	46.5	66.4
90	22.0	31.0	41.4	35.1	23.5	42.5	67.1
91	22.6	31.2	43.3	37.9	23.0	43.3	65.5
92	22.2	31.1	46.3	39.7	24.2	44.5	69.2

TABLE B.13 (continued)

Producing Region	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Bushels)			
93	21.5	31.8	44.5	34.2	22.1	44.8	65.4
94	21.5	32.9	42.0	35.6	23.5	41.5	68.8
95	22.3	32.5	48.3	39.1	22.8	46.8	67.5
96	21.8	32.8	45.2	38.5	23.8	45.5	66.0
97	21.9	32.5	48.7	39.5	23.9	47.4	68.3
98	21.7	31.8	41.9	35.1	23.0	39.7	63.3
99	23.2	36.9	53.9	42.4	25.5	54.3	72.6
100	21.9	34.1	50.9	42.1	23.3	50.2	66.7
101	22.1	31.8	46.1	36.8	22.0	44.7	63.3
102	22.5	35.4	54.5	44.3	23.4	51.7	73.0
103	22.6	37.6	54.2	42.6	25.2	52.4	74.3
104	24.9	35.0	50.5	41.6	24.2	51.0	69.9
105	23.6	33.7	54.6	40.9	23.8	55.1	75.3
106	24.9	36.2	57.9	43.6	24.9	55.0	71.7
107	24.4	35.9	56.4	45.9	24.8	56.3	66.7
108	25.6	34.8	54.3	44.0	24.5	51.9	66.4
109	24.6	37.2	56.8	44.5	25.0	55.9	71.7
110	25.5	38.0	56.6	46.4	26.8	56.8	76.5
111	25.2	38.4	60.5	47.1	24.7	60.2	73.3
112	24.8	39.3	59.3	45.1	24.3	58.6	74.5
113	22.3	36.2	50.9	43.4	24.1	50.5	72.7
114	24.2	32.7	53.7	44.3	23.5	51.5	75.0
115	24.9	38.0	57.0	47.1	26.1	57.2	79.8
116	24.2	32.7	53.4	44.2	22.5	51.9	73.8
117	24.8	30.5	51.8	41.4	22.5	51.2	69.5
118	24.1	27.7	48.7	42.2	21.6	48.3	71.5
119	23.8	33.4	52.6	40.8	21.9	53.9	71.0
120	23.9	34.8	59.6	45.1	21.6	59.5	80.3
121	24.6	32.8	55.0	44.5	23.2	54.5	79.0
122	23.5	35.6	55.5	46.1	24.0	55.1	73.3
123	24.6	36.6	56.8	45.5	24.2	55.6	79.5
124	24.2	35.5	57.1	42.7	22.2	53.6	78.3
125	24.2	39.4	60.5	46.9	25.8	56.1	81.3
126	24.2	41.1	67.6	49.7	24.4	59.1	84.0
127	22.4	27.3	43.3	34.1	19.7	41.9	54.9
128	20.8	30.8	45.1	33.9	22.9	44.3	65.0
129	22.0	30.8	41.5	32.2	19.7	42.9	58.6
130	22.0	30.6	43.5	32.2	20.6	41.8	60.2
131	22.1	31.9	41.2	32.4	20.6	39.4	51.2
132	21.2	24.7	35.7	28.4	19.2	33.6	49.1
133	21.2	27.0	42.6	31.9	20.4	38.0	53.8
134	21.8	26.6	48.5	34.8	20.8	45.4	50.2
135	19.2	26.4	40.0	25.8	17.8	37.4	58.8
136	19.3	27.4	36.9	26.9	18.5	32.8	46.8

*The figures in this Table represent long-term yields for 1966 and not the actual yields for this year. Net yields were determined by subtracting estimated seed requirements per seeded acre. The estimation procedures are discussed in Appendix A.

TABLE B.14

ESTIMATED NET YIELDS PER ACRE FOR CEREAL GRAINS BY PRODUCING REGION IN WESTERN CANADA, 1966*

Producing Region	Summerfallow Crop				Stubble Crop			
	Wheat	Oats	Barley	Rye	Wheat	Oats	Barley	Rye
	(Bushels)							
137	18.2	34.8	21.7	15.0	15.4	31.0	17.8	12.3
138	20.4	36.9	25.8	16.1	16.2	31.9	21.4	13.4
139	21.3	46.0	28.6	19.8	16.9	37.7	22.4	15.5
140	20.5	38.7	27.6	20.9	16.3	34.0	21.3	16.1
141	21.5	40.4	28.1	19.3	15.3	30.5	21.6	14.9
142	22.7	50.7	32.4	22.3	17.0	36.9	23.7	16.4
143	23.3	47.5	31.1	19.6	18.0	35.9	24.3	15.3
144	22.1	45.3	28.8	18.0	17.0	34.9	22.4	14.1
145	25.5	57.7	34.1	21.7	18.6	41.5	24.4	15.5
146	21.3	44.8	32.5	19.3	16.0	34.4	23.8	14.1
147	20.8	45.0	29.9	22.6	15.7	33.9	23.5	17.8
148	22.1	43.8	29.5	18.7	16.3	35.4	23.0	14.5
149	25.6	48.6	34.3	27.6	19.4	40.1	26.5	21.3
150	19.5	34.5	26.3	15.6	15.1	28.8	19.2	11.4
151	22.2	44.9	33.8	21.9	16.3	34.3	24.4	15.8
152	24.1	46.8	36.4	18.9	17.6	35.8	26.4	13.7
153	23.9	46.7	35.1	19.3	17.5	35.8	25.7	14.1
154	22.6	45.6	37.4	17.4	16.4	35.3	27.0	12.6
155	18.7	40.1	31.5	19.0	13.8	30.2	22.9	13.8
156	20.6	46.8	32.1	23.0	14.3	35.3	23.2	16.6
157	21.7	48.9	32.8	23.1	15.7	37.0	24.7	17.4
158	19.7	43.1	33.5	21.5	14.1	31.3	24.6	15.8
159	23.3	49.5	36.8	20.0	16.7	37.1	27.3	14.9
160	17.5	38.8	31.3	13.4	12.0	27.5	22.2	9.5
161	16.1	36.8	33.7	14.0	10.9	25.8	23.2	9.6
162	15.3	35.1	27.2	13.6	10.2	25.7	19.3	9.6
163	17.2	37.2	32.3	13.7	12.1	26.7	22.6	9.6
164	13.5	32.7	24.0	10.4	8.9	23.0	16.0	6.9
165	17.1	37.2	32.5	13.7	11.1	27.0	21.7	9.2
166	16.0	36.0	29.1	12.7	11.3	26.9	21.7	9.5
167	19.0	38.5	28.7	14.3	12.9	27.8	20.7	10.3
168	21.6	46.0	34.6	16.0	14.7	32.3	23.5	10.9
169	17.5	36.6	32.9	15.5	12.4	28.1	24.8	11.7
170	20.2	40.3	34.9	15.6	14.5	30.5	23.8	10.7
171	15.6	36.2	27.3	15.9	10.5	25.0	20.3	11.9
172	24.4	53.7	43.5	15.9	17.4	41.2	33.2	12.2
173	13.5	31.3	23.0	15.9	9.1	21.5	17.2	11.9
174	26.1	52.0	43.2	15.9	18.7	39.9	33.0	12.2
175	21.7	45.9	41.5	16.5	16.1	35.0	30.8	12.2
176	26.9	56.1	42.2	16.5	19.9	42.8	31.3	12.2
177	23.2	50.1	39.3	18.8	14.9	34.9	26.2	12.6
178	25.5	56.8	37.6	19.1	17.1	38.6	24.2	12.3
179	20.1	42.6	27.5	18.6	13.6	29.2	19.5	13.2
180	29.4	59.3	39.0	18.8	20.1	41.2	26.6	12.9
181	26.8	60.5	42.5	18.8	18.4	42.1	29.1	12.9
182	23.9	50.8	33.1	18.6	16.2	34.9	23.5	13.2
183	21.3	44.0	31.6	23.4	15.7	33.9	21.1	15.6
184	25.4	50.2	37.9	27.4	18.7	38.7	25.3	18.3
185	–	–	–	–	25.2	47.2	34.9	28.2
186	–	–	–	–	31.8	53.3	39.0	13.6
187	–	–	–	–	29.6	49.6	40.5	28.9
188	–	–	–	–	35.1	63.7	46.2	33.1

*The figures in this Table represent long-term yields for 1966 and not the actual yields for this year. Net yields were determined by subtracting estimated seed requirements per seeded acre. The estimation procedures are discussed in Appendix A.

TABLE B.15

ESTIMATED COST OF PRODUCTION PER ACRE FOR CEREAL GRAINS IN EASTERN CANADA BY PRODUCING REGION AND FARM SIZE, 1966*

Producing Region	Farm Size	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Dollars per acre)				
1	Small	26.20	–	29.30	27.03	–	28.10	–
	Large	21.01	–	22.52	21.35	–	21.82	–
2	Small	24.89	–	27.26	25.29	–	27.12	–
	Large	18.60	–	19.48	18.69	–	20.75	–
3	Small	19.87	–	21.96	20.82	–	22.43	–
	Large	15.48	–	16.53	15.90	–	16.75	–
4	Small	19.44	–	21.21	20.23	–	21.10	–
	Large	16.15	–	17.45	16.65	–	17.36	–
5	Small	21.14	–	23.62	22.33	–	23.49	–
	Large	18.27	–	20.56	19.36	–	20.58	–
6	Small	18.51	–	19.92	18.15	–	19.94	–
	Large	14.63	–	15.43	14.99	–	15.39	–
7	Small	23.50	–	26.38	25.30	–	23.86	–
	Large	19.45	–	21.20	19.67	–	18.70	–
8	Small	16.45	–	18.70	17.98	–	18.88	–
	Large	12.86	–	14.00	13.38	–	14.00	–
9	Small	25.19	–	27.10	26.38	–	26.90	–
	Large	21.26	–	22.25	21.79	–	22.18	–
10	Small	17.73	–	19.87	18.78	–	20.21	–
	Large	13.03	–	14.23	13.47	–	14.09	–
11	Small	20.85	–	23.44	22.48	–	23.84	–
	Large	14.11	–	15.18	15.26	–	15.29	–
12	Small	17.52	–	19.67	18.19	–	19.59	–
	Large	14.16	–	15.60	14.60	–	15.50	–
13	Small	25.40	–	26.36	26.78	25.81	26.70	–
14	Small	17.32	–	18.02	18.07	17.09	20.03	–
15	Small	15.02	–	16.31	16.49	14.81	16.52	–
16	Small	18.51	–	19.84	20.02	18.05	20.05	–
17	Small	15.85	–	17.57	17.28	15.66	18.14	–
18	Small	14.79	–	16.11	15.81	14.52	16.24	–
19	Small	18.69	–	18.98	19.71	18.66	19.21	–
20	Small	17.69	–	18.43	18.24	17.35	18.50	–
21	Small	15.28	–	16.85	16.34	14.95	16.71	–
22	Small	13.93	–	15.53	15.14	13.70	15.59	–
23	Small	19.28	–	20.54	20.95	19.27	21.07	–
24	Small	12.76	–	13.72	13.74	12.54	14.03	–
25	Small	16.52	–	17.26	17.61	16.14	17.99	–
26	Small	24.17	–	26.18	25.74	24.04	26.76	–
27	Small	16.60	–	18.76	18.62	17.09	19.23	–
28	Small	17.04	–	17.54	17.44	16.82	18.15	–
29	Small	21.58	–	22.07	22.33	21.42	22.76	–
30	Small	17.34	–	17.83	18.09	17.06	18.42	–
31	Small	22.78	–	24.03	23.88	22.50	24.75	–

TABLE B.15 (continued)

Producing Region	Farm Size	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Dollars per acre)				
32	Small	18.65	–	19.04	19.50	18.33	19.09	–
33	Small	18.05	–	19.53	19.31	17.96	20.00	–
34	Small	17.31	–	19.44	18.90	17.39	20.05	–
35	Small	19.89	–	20.36	20.31	19.68	20.53	–
36	Small	22.12	–	22.65	23.00	22.08	23.38	–
37	Small	16.68	–	18.51	17.78	16.58	18.79	–
38	Small	20.77	–	22.04	21.94	20.35	22.51	–
39	Small	18.03	–	19.07	18.95	17.60	19.33	–
40	Small	17.19	–	17.77	17.75	17.04	18.08	–
41	Small	17.82	–	18.59	18.06	17.53	19.48	–
42	Small	18.73	–	19.77	19.65	18.95	19.66	–
43	Small	15.65	–	16.21	16.54	15.84	16.58	–
44	Small	21.10	–	21.69	21.54	20.91	22.23	–
45	Small	17.41	–	17.91	17.95	17.28	18.31	–
46	Small	17.03	–	18.72	17.93	16.55	18.83	–
47	Small	17.01	–	18.17	18.71	17.48	17.77	–
48	Small	19.32	–	19.90	20.12	19.03	20.44	–
49	Small	19.04	–	20.12	20.15	18.77	20.18	–
50	Small	18.54	–	19.26	19.42	16.69	19.82	–
51	Small	14.76	–	15.97	16.16	14.64	16.05	–
52	Small	12.60	–	13.98	13.60	12.80	14.06	–
53	Small	16.30	–	17.97	17.74	16.50	18.11	–
54	Small	22.70	–	22.77	23.66	22.19	24.09	–
55	Small	22.29	–	22.46	23.38	22.22	23.08	–
56	Small	21.89	–	22.78	23.38	21.59	22.73	–
57	Small	19.01	–	19.74	20.25	18.85	19.97	–
58	Small	18.22	–	18.98	18.97	17.79	19.45	–
59	Small	18.06	–	19.09	18.89	17.66	19.29	–
60	Small	20.43	–	20.83	21.66	20.20	21.83	–
61	Small	17.20	–	17.84	17.93	17.11	18.58	–
62	Small	18.11	–	18.24	18.46	17.91	18.69	–
63	Small	17.01	–	17.27	17.59	16.96	17.80	–
64	Small	16.75	–	17.93	17.52	16.43	17.80	–
65	Small	21.42	–	22.01	22.10	21.43	21.74	–
66	Small	17.75	–	19.10	18.82	18.17	19.13	–
67	Small	18.57	–	19.97	19.96	18.99	20.10	–
68	Small	16.97	–	17.47	17.48	16.65	17.71	–
69	Small	15.73	–	16.54	16.60	15.69	16.94	–
70	Small	20.73	–	22.14	22.55	20.43	22.60	–
71	Small	18.70	–	19.63	19.64	18.49	20.08	–
72	Small	16.19	–	18.12	17.79	16.27	18.66	–
73	Small	19.03	–	20.00	20.33	18.96	20.14	–
74	Small	18.94	–	19.78	19.94	19.16	19.96	–
75	Small	21.22	–	21.91	22.41	21.38	22.52	–
76	Small	18.07	–	19.05	18.79	18.04	19.08	–
77	Small	15.22	–	15.98	15.78	14.96	15.91	–
78	Small	16.77	–	17.63	17.47	16.93	17.78	–

TABLE B.15 (continued)

Production Region	Farm Size	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Dollars per acre)				
79	Small	17.43	–	18.92	18.32	17.09	19.35	–
80	Small	13.36	–	14.61	14.12	13.09	14.72	–
81	Small	14.15	–	16.16	14.82	13.81	16.31	–
82	Small	13.44	–	14.93	14.63	13.04	15.35	–
83	Small	19.67	19.51	21.88	20.84	19.71	21.62	38.57
	Large	17.88	18.11	18.99	18.44	17.89	18.86	30.13
84	Small	25.39	25.77	27.39	26.35	25.39	27.04	46.57
	Large	20.63	20.85	21.82	21.16	20.62	21.64	37.98
85	Small	19.50	20.35	22.59	21.01	19.48	22.39	37.55
	Large	18.15	19.04	20.22	20.08	18.13	21.02	33.41
86	Small	24.16	24.81	26.42	25.23	24.15	26.29	43.51
	Large	19.48	19.85	20.80	20.08	19.46	20.73	34.62
87	Small	19.15	19.82	21.76	19.98	19.17	21.67	35.81
	Large	15.50	15.79	16.66	15.99	15.51	16.66	34.33
88	Small	23.79	24.17	26.15	24.81	23.79	25.83	42.59
	Large	20.08	20.27	21.35	20.61	20.08	21.20	38.17
89	Small	18.83	19.34	20.99	19.89	18.91	20.84	–
	Large	16.83	17.10	18.02	17.38	16.86	17.94	–
90	Small	17.42	18.24	19.67	18.70	17.57	20.60	–
	Large	13.96	14.22	14.86	14.50	13.99	14.87	–
91	Small	18.39	19.14	20.40	19.89	18.44	20.01	34.69
	Large	17.05	17.31	16.25	17.62	17.06	17.66	33.47
92	Small	15.98	16.59	18.11	17.22	16.13	17.89	–
	Large	15.16	15.49	16.32	15.60	15.24	16.22	–
93	Small	15.70	15.39	17.92	16.69	15.75	15.97	–
	Large	16.83	14.80	19.72	18.24	16.90	16.73	–
94	Small	19.12	19.31	20.83	20.09	19.28	20.72	–
	Large	17.45	17.35	18.73	21.25	19.97	18.66	–
95	Small	17.63	17.85	19.79	18.68	17.67	19.49	36.96
	Large	14.98	14.31	16.17	15.56	15.00	15.99	31.86
96	Small	17.51	22.68	19.09	18.41	17.61	19.06	–
	Large	16.76	18.51	17.64	17.25	16.83	17.63	–
97	Small	20.28	26.18	21.91	21.08	20.35	21.72	–
	Large	18.59	20.83	19.61	19.10	18.64	19.50	–
98	Small	22.81	23.93	25.53	24.37	22.97	25.15	–
	Large	18.65	19.22	20.13	19.45	18.72	19.93	–
99	Small	17.93	18.10	20.75	19.15	18.07	20.71	31.44
	Large	17.44	15.33	19.17	18.22	17.54	19.14	26.47
100	Small	19.83	21.33	22.43	21.24	19.92	22.28	–
	Large	17.05	17.59	18.16	17.59	17.08	18.08	–
101	Small	18.80	20.07	22.47	20.79	18.81	22.17	–
	Large	14.85	15.42	16.66	15.76	14.85	16.50	–
102	Small	19.37	20.63	22.33	20.83	19.42	21.73	30.18
	Large	16.77	18.57	18.27	17.43	16.78	17.88	26.96
103	Small	17.88	19.79	21.30	19.40	18.03	20.82	34.63
	Large	14.24	16.20	15.86	14.95	14.31	15.63	29.99

TABLE B.15 (continued)

Producing Region	Farm Size	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Dollars per acre)				
104	Small	18.87	18.17	21.55	20.02	18.64	21.66	35.40
	Large	15.66	16.47	16.82	16.39	15.42	16.92	30.34
105	Small	20.21	20.92	23.60	21.60	20.24	23.59	–
	Large	17.34	18.49	18.73	17.95	17.35	18.70	–
106	Small	19.64	21.88	22.29	20.70	19.65	21.89	–
	Large	16.69	19.17	17.98	17.26	16.69	17.84	–
107	Small	17.22	18.67	19.64	18.55	17.24	19.54	–
	Large	15.79	16.61	17.17	16.50	15.79	17.11	–
108	Small	22.18	23.09	25.76	24.12	22.09	25.35	–
	Large	20.87	21.87	24.49	22.94	20.77	24.13	–
109	Small	20.43	21.36	24.02	22.07	20.46	23.78	29.56
	Large	16.56	17.08	18.45	17.44	16.58	18.34	26.66
110	Small	21.38	22.56	25.31	23.52	21.51	25.23	–
	Large	17.74	18.14	19.26	18.48	17.77	19.22	–
111	Small	22.03	22.78	25.51	23.47	22.01	25.27	38.58
	Large	19.14	18.92	20.83	19.87	19.13	20.68	37.35
112	Small	18.24	18.90	21.66	19.70	18.20	21.57	35.73
	Large	16.41	16.52	18.22	17.21	16.36	18.14	31.72
113	Small	18.17	21.28	20.37	19.42	18.26	20.25	42.04
	Large	16.10	17.96	17.23	16.73	16.15	17.16	33.10
114	Small	16.23	17.55	18.43	17.33	16.22	18.18	37.24
	Large	15.27	15.89	16.57	15.91	15.26	16.46	28.72
115	Small	20.64	20.67	23.74	22.25	20.73	23.10	37.36
	Large	18.05	17.92	20.45	19.37	18.15	20.43	31.04
116	Small	13.79	14.08	15.46	14.65	13.74	15.28	30.85
	Large	12.75	12.96	13.79	13.31	12.71	13.69	25.61
117	Small	15.55	15.75	17.27	16.31	15.47	17.12	31.27
	Large	14.93	14.50	16.10	15.48	14.86	15.99	28.66
118	Small	16.66	18.33	18.88	17.89	16.56	18.67	31.78
	Large	14.50	17.39	15.89	15.25	14.43	15.73	27.51
119	Small	18.60	19.24	21.72	19.90	18.50	21.81	39.94
	Large	16.07	16.38	17.54	16.67	16.01	17.54	36.00
120	Small	19.77	20.32	22.36	20.03	19.66	22.54	35.61
	Large	16.84	17.09	18.14	17.08	16.78	18.48	31.73
121	Small	18.04	17.88	20.86	19.29	17.97	20.65	39.14
	Large	15.32	15.39	16.73	15.93	15.29	16.61	30.87
122	Small	22.01	19.91	24.85	23.36	22.02	24.46	42.50
	Large	19.18	17.92	21.47	19.87	19.18	20.43	37.49
123	Small	18.19	19.34	21.03	19.54	18.17	20.77	39.65
	Large	16.15	16.80	17.48	16.82	16.13	17.37	33.11
124	Small	19.08	19.20	22.72	20.54	18.97	22.11	37.38
	Large	16.97	14.33	18.77	17.71	16.90	18.53	28.42
125	Small	20.27	19.89	23.67	21.66	20.35	22.88	49.33
	Large	18.43	17.46	20.05	19.10	18.46	19.71	43.08
126	Small	22.72	23.22	28.67	24.92	22.75	26.52	44.98
	Large	19.38	20.35	21.26	20.23	19.38	20.76	40.24

TABLE B.15 (continued)

Producing Region	Farm Size	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Dollars per acre)				
127	Small	13.34	–	15.05	14.18	13.19	14.87	–
	Large	10.96	–	11.65	11.27	10.91	11.57	–
128	Small	19.73	–	22.98	21.35	20.00	22.79	–
	Large	19.29	–	23.11	21.23	19.63	22.88	–
129	Small	16.88	–	19.71	18.20	16.62	19.79	–
	Large	16.27	–	19.63	17.89	15.96	19.73	–
130	Small	18.92	19.63	21.27	19.82	18.80	21.00	–
	Large	15.30	15.56	16.26	15.63	15.25	16.15	–
131	Small	15.83	16.57	17.72	16.64	15.74	17.47	–
	Large	15.83	16.57	17.72	16.64	15.74	17.47	–
132	Small	18.30	18.59	19.85	18.93	18.16	19.59	–
	Large	14.29	14.37	14.86	14.46	14.25	14.76	–
133	Small	14.57	14.93	17.77	18.04	15.41	17.49	–
	Large	12.32	12.62	13.98	14.11	12.44	14.04	–
134	Small	16.22	–	17.99	16.82	16.18	17.68	–
	Large	13.82	–	14.78	14.14	13.79	14.63	–
135	Small	15.77	16.36	18.00	16.34	15.67	17.66	–
	Large	13.30	13.51	14.22	13.51	13.26	14.08	–
136	Small	18.12	–	19.56	18.58	18.09	19.18	–
	Large	14.89	–	15.67	15.11	14.87	15.49	–

*These cost estimates exclude all land costs, including taxes, buildings, off-farm trucking of grain, and management returns.

TABLE B. 16

ESTIMATED COST OF PRODUCTION PER ACRE
FOR CEREAL GRAINS IN WESTERN CANADA
BY PRODUCING REGION AND FARM SIZE, 1966*

Producing Region	Farm Size	Summerfallow Crop				Summer-fallow	Stubble Crop			
		Wheat	Oats	Barley	Rye		Wheat	Oats	Barley	Rye
		(Dollars per acre)								
137	Small	12.83	13.75	13.25	11.76	4.44	14.87	15.65	15.66	13.93
	Large	10.17	10.85	10.54	9.13	5.30	11.73	12.31	12.49	10.81
138	Small	12.22	13.35	12.70	11.25	6.00	14.53	15.80	15.13	13.62
	Large	8.81	9.74	9.20	7.88	4.23	10.23	11.30	10.77	9.35
139	Small	11.92	13.07	12.34	11.75	6.29	14.23	16.02	15.35	14.79
	Large	9.49	10.35	9.83	9.33	4.80	11.01	12.77	11.96	11.65
140	Small	12.81	13.53	13.19	13.06	7.02	14.58	16.08	15.39	15.53
	Large	9.35	9.90	9.61	9.59	5.03	11.26	12.50	12.00	12.21
141	Small	12.08	13.04	12.58	11.82	6.60	16.04	17.61	17.15	16.52
	Large	8.91	9.30	9.18	8.69	4.38	11.87	12.97	12.83	12.38
142	Small	9.91	10.87	10.27	9.43	5.41	11.23	13.07	11.91	11.07
	Large	8.54	9.32	9.31	8.05	4.35	9.66	11.38	10.39	9.59
143	Small	10.34	11.33	10.45	10.02	4.83	11.61	13.22	12.00	11.80
	Large	8.34	9.14	8.37	8.03	4.03	9.68	10.86	10.16	9.88
144	Small	7.97	8.51	8.12	7.87	3.37	9.17	10.17	9.59	9.43
	Large	7.90	8.56	8.07	7.78	4.66	8.71	9.85	9.17	8.95
145	Small	9.14	10.09	9.58	9.16	6.69	10.67	11.64	11.02	11.10
	Large	7.68	8.46	7.80	7.71	4.99	9.10	9.99	9.53	9.54
146	Small	7.87	7.79	7.73	7.51	5.52	8.96	9.79	9.35	9.22
	Large	7.16	7.23	7.09	6.79	3.84	8.71	9.64	9.14	8.97
147	Small	9.28	9.88	9.53	9.30	4.17	10.80	11.35	11.20	11.06
	Large	8.15	8.63	8.36	8.17	3.58	9.15	9.34	9.52	9.41
148	Small	9.62	10.40	10.00	9.76	4.69	11.44	12.67	11.89	11.81
	Large	7.93	8.50	8.19	7.93	4.12	10.00	10.12	10.05	10.36
149	Small	10.14	11.21	10.54	10.21	7.98	10.60	12.22	11.29	11.10
	Large	8.02	8.76	8.31	8.07	6.36	8.68	10.14	9.33	9.17
150	Small	8.71	9.26	9.00	8.01	5.28	10.97	12.08	11.45	10.27
	Large	7.22	7.73	7.50	6.53	4.47	9.08	10.21	9.54	8.38
151	Small	7.54	8.39	7.85	7.59	3.80	7.66	8.35	8.07	7.93
	Large	6.51	6.99	6.46	6.49	3.36	6.54	7.01	6.79	6.69
152	Small	8.06	9.04	8.21	7.84	5.21	9.80	10.52	10.78	9.97
	Large	6.92	7.68	7.18	6.73	3.74	7.62	9.29	8.56	7.82
153	Small	9.39	10.64	9.91	9.21	4.94	9.67	10.59	10.21	9.70
	Large	8.08	9.01	8.44	7.93	3.77	8.62	9.41	9.09	8.67
154	Small	9.06	10.54	9.87	9.26	4.18	9.95	10.93	10.72	10.26
	Large	7.56	8.54	8.03	7.39	3.16	9.17	10.09	9.20	9.49
155	Small	6.96	7.60	7.25	6.94	4.19	6.96	7.58	7.30	7.10
	Large	5.88	6.47	6.14	5.87	3.55	6.26	6.85	6.59	6.41
156	Small	6.15	6.72	6.35	6.19	3.73	6.84	7.23	7.06	6.95
	Large	5.62	6.39	5.85	5.66	2.76	6.75	7.16	7.00	6.86
157	Small	7.12	8.18	7.55	7.29	4.70	8.25	9.21	8.68	8.51
	Large	6.74	7.66	7.13	6.90	4.01	7.48	8.30	7.89	7.75

TABLE B. 16 (continued)

Producing Region	Farm Size	Summerfallow Crop				Summer-fallow	Stubble Crop			
		Wheat	Oats	Barley	Rye		Wheat	Oats	Barley	Rye
		(Dollars per acre)								
158	Small	6.22	7.23	6.78	6.48	3.81	6.45	7.01	6.71	6.51
	Large	5.40	6.16	5.73	5.45	3.06	5.70	6.23	5.94	5.76
159	Small	7.11	8.07	7.50	7.03	3.74	7.44	8.17	7.79	7.50
	Large	5.72	6.56	6.05	5.65	3.12	5.94	6.57	6.25	6.00
160	Small	6.17	7.10	6.62	6.04	3.05	6.44	6.91	6.69	6.29
	Large	4.88	5.70	5.27	4.76	2.79	5.63	6.07	5.86	5.48
161	Small	6.31	7.03	6.73	6.24	3.65	7.10	7.19	7.32	6.97
	Large	5.32	6.00	5.71	5.26	3.36	5.36	5.41	5.54	5.24
162	Small	6.28	7.21	6.64	6.18	4.55	5.74	6.46	6.02	5.68
	Large	4.72	5.56	5.04	4.64	4.32	5.75	6.39	5.99	5.69
163	Small	6.71	7.34	7.12	6.60	2.49	8.08	7.66	8.09	7.71
	Large	5.06	5.68	5.46	4.97	2.51	6.38	5.89	6.33	6.01
164	Small	5.59	6.22	5.86	5.50	3.45	5.99	5.90	6.02	5.75
	Large	4.40	4.94	4.62	4.32	3.26	5.27	5.14	5.28	5.04
165	Small	5.55	6.22	5.95	5.47	3.85	7.56	7.36	7.71	7.35
	Large	4.99	5.65	5.39	4.92	3.01	6.47	6.26	6.60	6.27
166	Small	6.39	7.35	6.76	6.28	3.68	7.50	8.06	7.81	7.48
	Large	5.35	6.05	5.68	5.24	3.00	6.36	6.89	6.65	6.34
167	Small	8.66	9.84	9.22	8.45	4.95	8.65	9.65	9.57	8.69
	Large	6.98	7.80	7.36	6.83	4.11	7.46	8.16	7.99	7.54
168	Small	8.23	9.10	8.71	8.15	3.78	8.56	9.64	9.14	8.76
	Large	6.67	7.37	7.08	6.63	3.25	7.24	8.21	7.75	7.45
169	Small	7.22	7.92	7.64	7.15	4.00	7.91	8.06	8.25	7.92
	Large	5.88	6.45	6.20	5.80	2.85	6.37	6.46	6.65	6.39
170	Small	7.01	7.83	7.45	6.88	3.14	7.31	7.95	7.58	7.29
	Large	5.26	5.93	5.55	5.16	2.53	5.56	6.10	5.70	5.57
171	Small	6.29	7.01	6.65	6.29	4.28	8.14	8.16	8.43	8.17
	Large	5.36	6.00	5.71	5.35	3.13	6.40	6.37	6.65	6.43
172	Small	9.22	10.07	10.54	8.88	3.51	12.15	13.20	13.97	12.55
	Large	7.26	7.88	8.43	6.96	2.77	9.59	10.52	11.35	10.03
173	Small	5.96	6.72	6.20	5.96	5.21	8.46	9.10	8.68	8.51
	Large	4.88	5.61	5.10	4.88	2.53	5.85	6.47	6.07	5.90
174	Small	7.99	8.73	8.46	7.63	5.17	9.07	9.64	10.01	9.21
	Large	6.23	6.77	6.59	5.92	4.02	7.03	7.48	7.93	7.20
175	Small	8.10	9.32	9.81	8.46	4.77	9.83	10.62	11.37	10.30
	Large	6.78	7.85	8.54	7.19	4.43	9.29	9.96	10.14	9.77
176	Small	10.53	10.87	10.90	10.24	3.68	12.07	12.61	13.36	12.85
	Large	10.23	10.46	10.77	9.95	3.42	11.95	12.44	13.22	12.73
177	Small	8.36	9.06	8.75	8.15	5.79	9.89	10.57	10.57	10.22
	Large	6.84	7.33	7.11	6.66	4.97	8.19	8.73	8.79	8.54
178	Small	9.31	9.95	9.80	9.26	5.04	10.66	11.89	12.00	11.73
	Large	7.91	8.39	8.32	7.91	4.50	9.64	9.93	10.14	10.05
179	Small	9.48	10.57	10.33	9.80	5.42	11.85	12.45	12.62	12.46
	Large	7.56	8.74	8.27	7.85	4.13	9.77	10.17	10.46	10.38

TABLE B. 16 (continued)

Producing Region	Farm Size	Summerfallow Crop				Summer-fallow	Stubble Crop			
		Wheat	Oats	Barley	Rye		Wheat	Oats	Barley	Rye
		(Dollars per acre)								
180	Small	10.25	11.11	11.07	10.24	5.60	12.55	13.57	13.61	13.16
	Large	8.58	9.31	9.29	8.59	4.04	10.75	11.36	11.73	11.35
181	Small	12.29	13.43	13.14	12.23	7.10	14.46	15.74	15.73	15.38
	Large	9.98	10.85	11.25	9.97	5.12	11.67	12.75	12.87	12.63
182	Small	10.43	11.33	11.23	10.63	5.80	12.76	13.68	14.15	13.74
	Large	9.07	9.60	9.60	9.33	4.87	10.13	10.78	11.43	11.16
183	Small	9.68	10.39	9.81	9.78	6.09	11.47	12.11	12.01	12.00
	Large	7.42	7.98	7.59	7.51	5.19	9.30	9.78	9.77	9.82
184	Small	11.55	14.70	12.82	11.82	6.59	13.53	14.42	17.80	14.16
	Large	7.71	8.55	8.04	7.84	5.73	10.05	10.60	10.57	10.58
185	Small	–	–	–	–	–	22.45	26.64	23.94	22.93
	Large	–	–	–	–	–	18.87	21.47	20.20	19.33
186	Small	–	–	–	–	–	17.66	22.49	19.12	16.55
	Large	–	–	–	–	–	12.99	14.51	13.22	12.34
187	Small	–	–	–	–	–	21.47	24.19	24.72	21.49
	Large	–	–	–	–	–	16.55	19.39	19.31	16.59
188	Small	–	–	–	–	–	25.31	29.81	26.46	25.20
	Large	–	–	–	–	–	25.31	26.87	26.46	25.20

*These cost estimates exclude all land costs, including taxes, buildings, off-farm trucking of grain, and management returns.

TABLE B.17

ESTIMATED COST OF PRODUCTION PER BUSHEL FOR CEREAL GRAINS IN EASTERN CANADA BY PRODUCING REGION AND FARM SIZE, 1966*

Producing Region	Farm Size	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Dollars per bushel)				
1	Small	.99		.70	.84		.77	
	Large	.79		.54	.66		.60	
2	Small	.72		.60	.67		.59	
	Large	.54		.43	.49		.45	
3	Small	.69		.56	.60		.54	
	Large	.53		.42	.46		.40	
4	Small	.67		.51	.56		.51	
	Large	.55		.42	.46		.42	
5	Small	.72		.57	.62		.57	
	Large	.63		.50	.54		.50	
6	Small	.73		.48	.47		.45	
	Large	.57		.37	.39		.35	
7	Small	.84		.58	.62		.51	
	Large	.70		.47	.48		.40	
8	Small	.50		.37	.39		.36	
	Large	.39		.28	.29		.27	
9	Small	.78		.61	.68		.62	
	Large	.65		.50	.56		.51	
10	Small	.77		.52	.57		.49	
	Large	.57		.37	.41		.34	
11	Small	.91		.62	.68		.57	
	Large	.61		.40	.46		.37	
12	Small	.83		.53	.66		.52	
	Large	.67		.42	.53		.41	
13	Small	1.10		.77	.86	1.00	.82	
14	Small	.90		.74	.77	.96	.56	
15	Small	.71		.56	.56	.75	.55	
16	Small	.77		.62	.62	.86	.62	
17	Small	.76		.57	.59	.81	.53	
18	Small	.64		.46	.50	.70	.46	
19	Small	.90		.73			.77	
20	Small	.75		.61	.67	.82	.58	
21	Small	.66		.50	.53	.73	.50	
22	Small	.63		.51	.52	.66	.50	
23	Small	.84		.57	.60	.84	.57	
24	Small	.54		.41	.41	.58	.39	
25	Small	.71		.48	.54	.83	.49	
26	Small	1.25		.79	.86	1.32	.74	
27	Small	.90		.54	.56	.76	.52	
28	Small	.73		.52	.62	.80	.50	
29	Small	.93		.59	.69	1.00	.57	
30	Small	.70		.56	.58	.77	.53	

TABLE B.17 (continued)

Producing Region	Farm Size	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Dollars per bushel)				
31	Small	1.08		.78	.83	1.19	.71	
32	Small	.72		.57	.59	.81	.62	
33	Small	.86		.57	.62	.87	.55	
34	Small	.87		.53	.61	.85	.51	
35	Small	.71		.55	.61	.72	.58	
36	Small	.87		.58	.66	.88	.59	
37	Small	.78		.52	.58	.80	.51	
38	Small	.84		.56	.59	1.00	.55	
39	Small	.70		.48	.53	.87	.50	
40	Small	.79		.50	.59	.94	.51	
50	Small	.61		.51	.53	.69	.50	
51	Small	.59		.44	.44	.61	.45	
52	Small	.54		.38	.38	.48	.37	
53	Small	.59		.47	.48	.57	.46	
54	Small	.82		.61	.63	.97	.56	
55	Small	.77		.53	.55	.79	.56	
56	Small	.78		.58	.56	.88	.63	
57	Small	.68		.49	.48	.72	.53	
58	Small	.64		.52	.54	.73	.49	
59	Small	.65		.47	.49	.73	.46	
60	Small	.62		.48	.47	.68	.46	
61	Small	.66		.47	.50	.68	.44	
62	Small	.57		.45	.50	.64	.45	
63	Small	.66		.43	.47	.68	.43	
64	Small	.60		.46	.48	.63	.48	
65	Small	.85		.57	.64	.79	.67	
66	Small	.74		.52	.51	.61	.52	
67	Small	.79		.52	.50	.65	.52	
68	Small	.57		.43	.45	.65	.44	
69	Small	.57		.38	.43	.57	.38	
70	Small	.74		.52	.52	.78	.52	
71	Small	.75		.52	.55	.81	.51	
72	Small	.62		.41	.43	.60	.40	
73	Small	.78		.50	.50	.73	.55	
74	Small	.64		.48	.50	.60	.51	
75	Small	.74		.52	.57	.70	.53	
76	Small	.63		.48	.50	.64	.51	
77	Small	.58		.49	.46	.63	.49	
78	Small	.71		.55	.58	.64	.55	
79	Small	.68		.56	.59	.73	.53	
80	Small	.48		.38	.38	.56	.37	
81	Small	.82		.60	.71	.89	.57	
82	Small	.58		.42	.44	.72	.38	
83	Small	.88	.67	.51	.58	.87	.52	.57
	Large	.80	.62	.44	.51	.79	.45	.44

TABLE B.17 (continued)

Producing Region	Farm Size	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Dollars per bushel)				
84.....	Small	1.14	.94	.67	.78	1.14	.71	.69
	Large	.92	.76	.53	.62	.93	.56	.56
85.....	Small	.87	.66	.48	.58	.89	.49	.60
	Large	.81	.62	.43	.56	.83	.46	.53
86.....	Small	1.09	.80	.61	.71	1.09	.61	.65
	Large	.88	.64	.48	.57	.88	.48	.52
87.....	Small	.85	.59	.42	.50	.85	.42	.49
	Large	.69	.47	.32	.40	.68	.33	.46
88.....	Small	1.09	.87	.57	.69	1.08	.59	.63
	Large	.92	.73	.46	.58	.92	.48	.56
89.....	Small	.87	.63	.44	.52	.81	.45	
	Large	.77	.56	.38	.45	.72	.39	
90.....	Small	.79	.59	.48	.53	.75	.48	
	Large	.63	.46	.36	.41	.60	.35	
91.....	Small	.81	.61	.47	.52	.80	.46	.53
	Large	.75	.55	.38	.46	.74	.41	.51
92.....	Small	.72	.53	.39	.43	.67	.40	
	Large	.68	.50	.35	.39	.63	.36	
93.....	Small	.73	.48	.40	.49	.71	.36	
	Large	.78	.47	.44	.53	.77	.37	
94.....	Small	.89	.59	.50	.56	.82	.50	
	Large	.81	.53	.45	.60	.85	.45	
95.....	Small	.79	.55	.41	.48	.77	.42	.55
	Large	.67	.44	.33	.40	.66	.34	.47
96.....	Small	.80	.69	.42	.48	.74	.42	
	Large	.77	.56	.39	.45	.71	.39	
97.....	Small	.93	.80	.45	.53	.85	.46	
	Large	.85	.64	.40	.48	.78	.41	
98.....	Small	1.05	.75	.61	.69	1.00	.63	
	Large	.86	.60	.48	.55	.81	.50	
99.....	Small	.77	.49	.38	.45	.71	.38	.43
	Large	.75	.42	.36	.43	.69	.35	.36
100.....	Small	.90	.63	.44	.50	.85	.44	
	Large	.78	.52	.36	.42	.73	.36	
101.....	Small	.85	.63	.49	.56	.85	.50	
	Large	.67	.48	.36	.43	.67	.37	
102.....	Small	.86	.58	.41	.47	.83	.42	.41
	Large	.74	.52	.34	.39	.72	.35	.37
103.....	Small	.79	.53	.39	.45	.72	.40	.47
	Large	.63	.43	.29	.35	.57	.30	.40
104.....	Small	.76	.52	.43	.48	.77	.43	.51
	Large	.63	.47	.33	.39	.64	.33	.43
105.....	Small	.86	.62	.43	.53	.85	.43	
	Large	.74	.55	.34	.44	.73	.34	
106.....	Small	.79	.60	.39	.48	.79	.40	
	Large	.67	.53	.31	.40	.67	.32	

TABLE B.17 (continued)

Producing Region	Farm Size	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Dollars per bushel)				
107	Small	.71	.52	.35	.40	.70	.35	
	Large	.65	.46	.30	.36	.64	.30	
108	Small	.87	.66	.47	.55	.90	.49	
	Large	.81	.63	.45	.52	.85	.47	
109	Small	.83	.57	.42	.50	.82	.43	.41
	Large	.67	.46	.32	.39	.66	.33	.37
110	Small	.84	.59	.45	.51	.80	.44	
	Large	.70	.48	.34	.40	.66	.34	
111	Small	.87	.59	.42	.50	.89	.42	.53
	Large	.76	.49	.34	.42	.77	.34	.51
112	Small	.73	.48	.37	.44	.75	.37	.48
	Large	.66	.42	.31	.38	.67	.31	.43
113	Small	.82	.59	.40	.45	.76	.40	.58
	Large	.72	.50	.34	.39	.67	.34	.46
114	Small	.67	.54	.34	.39	.69	.35	.50
	Large	.63	.49	.31	.36	.65	.32	.38
115	Small	.83	.54	.42	.47	.79	.40	.47
	Large	.73	.47	.36	.41	.69	.36	.39
116	Small	.57	.43	.29	.33	.61	.29	.42
	Large	.53	.40	.26	.30	.56	.26	.35
117	Small	.63	.52	.33	.39	.69	.33	.45
	Large	.60	.48	.31	.37	.66	.31	.41
118	Small	.69	.66	.39	.42	.77	.39	.44
	Large	.60	.63	.33	.36	.67	.33	.38
119	Small	.78	.58	.41	.49	.84	.40	.56
	Large	.68	.49	.33	.41	.73	.33	.51
120	Small	.83	.58	.37	.44	.91	.38	.44
	Large	.70	.49	.30	.38	.78	.31	.39
121	Small	.73	.54	.38	.43	.77	.38	.50
	Large	.62	.47	.30	.36	.66	.30	.39
122	Small	.94	.56	.45	.51	.92	.44	.58
	Large	.82	.50	.39	.43	.80	.37	.51
123	Small	.74	.53	.37	.43	.75	.37	.50
	Large	.66	.46	.31	.37	.67	.31	.42
124	Small	.79	.54	.40	.48	.85	.41	.48
	Large	.70	.40	.33	.41	.76	.35	.36
125	Small	.84	.50	.39	.46	.79	.41	.61
	Large	.76	.44	.33	.41	.71	.35	.53
126	Small	.94	.56	.42	.50	.93	.45	.54
	Large	.80	.49	.31	.41	.80	.35	.48
127	Small	.60		.35	.42	.67	.36	
	Large	.49	.41	.27	.33	.55	.28	
128	Small	.95		.51	.63	.87	.51	
	Large	.93		.51	.63	.86	.52	
129	Small	.77		.47	.56	.84	.46	
	Large	.74		.47	.55	.81	.46	

TABLE B.17 (continued)

Producing Region	Farm Size	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Dollars per bushel)				
130	Small	.86	.64	.49	.61	.91	.50	
	Large	.69	.51	.37	.48	.74	.39	
131	Small	.72	.52	.43	.51	.76	.44	
	Large	.72	.52	.43	.51	.76	.44	
132	Small	.86	.75	.56	.67	.94	.58	
	Large	.67	.58	.42	.51	.74	.44	
133	Small	.69	.55	.42	.56	.76	.46	
	Large	.58	.47	.33	.44	.61	.37	
134	Small	.74		.37	.48	.78	.39	
	Large	.63		.30	.41	.66	.32	
135	Small	.82	.62	.45	.63	.88	.47	
	Large	.69	.51	.36	.52	.74	.38	
136	Small	.94		.53	.69	.98	.58	
	Large	.77		.43	.56	.80	.47	

*These costs exclude all land costs, including taxes, buildings, off-farm trucking of grain, and management returns.

TABLE B.18

ESTIMATED COST OF PRODUCTION PER BUSHEL FOR CEREAL GRAINS IN WESTERN CANADA BY PRODUCING REGION AND FARM SIZE, 1966*

Producing Region	Farm Size	Summerfallow Crop				Stubble Crop			
		Wheat	Oats	Barley	Rye	Wheat	Oats	Barley	Rye
		(Dollars per bushel)							
137	Small	.90	.50	.78	1.02	1.03	.53	.93	1.20
	Large	.79	.43	.68	.89	.83	.43	.76	.96
138	Small	.83	.49	.68	1.00	.97	.53	.76	1.11
	Large	.60	.36	.49	.70	.68	.38	.54	.76
139	Small	.79	.39	.61	.85	.92	.46	.74	1.04
	Large	.62	.31	.48	.67	.71	.36	.58	.81
140	Small	.90	.49	.68	.90	.98	.51	.79	1.05
	Large	.65	.36	.49	.65	.75	.40	.61	.82
141	Small	.81	.45	.64	.88	1.13	.62	.86	1.20
	Large	.58	.32	.45	.63	.83	.45	.63	.89
142	Small	.63	.30	.45	.62	.72	.38	.55	.74
	Large	.53	.25	.40	.52	.62	.33	.47	.64
143	Small	.61	.32	.46	.71	.70	.39	.53	.83
	Large	.50	.26	.37	.57	.58	.32	.45	.70
144	Small	.48	.25	.38	.59	.58	.31	.46	.72
	Large	.52	.27	.41	.64	.57	.31	.45	.70
145	Small	.57	.27	.44	.67	.64	.31	.51	.80
	Large	.46	.22	.35	.54	.54	.26	.43	.68
146	Small	.58	.27	.37	.62	.63	.32	.44	.73
	Large	.48	.23	.31	.51	.59	.30	.42	.69
147	Small	.61	.29	.43	.56	.74	.36	.51	.67
	Large	.53	.26	.38	.49	.63	.30	.44	.57
148	Small	.61	.32	.47	.72	.76	.38	.56	.88
	Large	.51	.27	.39	.60	.66	.31	.47	.77
149	Small	.64	.36	.49	.60	.63	.34	.49	.60
	Large	.51	.28	.39	.48	.51	.28	.40	.49
150	Small	.66	.39	.50	.78	.80	.46	.65	.99
	Large	.55	.33	.42	.65	.66	.39	.54	.81
151	Small	.48	.25	.32	.49	.52	.27	.36	.55
	Large	.41	.22	.27	.42	.44	.22	.31	.46
152	Small	.51	.28	.34	.64	.61	.32	.45	.80
	Large	.41	.23	.28	.51	.47	.28	.35	.62
153	Small	.56	.31	.40	.68	.61	.32	.44	.76
	Large	.46	.26	.33	.57	.53	.28	.38	.67
154	Small	.55	.30	.35	.73	.66	.33	.43	.88
	Large	.45	.24	.28	.57	.60	.30	.36	.81
155	Small	.55	.27	.34	.54	.57	.28	.36	.57
	Large	.47	.23	.28	.46	.51	.25	.32	.52
156	Small	.44	.21	.29	.40	.53	.23	.34	.46
	Large	.38	.18	.25	.34	.51	.22	.33	.45
157	Small	.50	.24	.35	.48	.58	.27	.39	.54
	Large	.46	.22	.32	.44	.53	.25	.35	.49

TABLE B.18 (continued)

Producing Region	Farm Size	Summerfallow Crop				Stubble Crop			
		Wheat	Oats	Barley	Rye	Wheat	Oats	Barley	Rye
		(Dollars per bushel)							
158	Small	.47	.24	.29	.44	.51	.25	.30	.46
	Large	.40	.20	.24	.37	.45	.22	.27	.40
159	Small	.43	.22	.29	.50	.49	.24	.31	.56
	Large	.35	.18	.23	.41	.39	.19	.25	.45
160	Small	.49	.25	.29	.63	.59	.27	.33	.72
	Large	.41	.20	.24	.52	.51	.24	.29	.63
161	Small	.57	.27	.29	.66	.72	.31	.35	.80
	Large	.50	.24	.25	.57	.56	.24	.27	.61
162	Small	.65	.31	.38	.72	.65	.29	.36	.68
	Large	.53	.26	.31	.60	.65	.28	.35	.68
163	Small	.51	.25	.28	.63	.71	.31	.38	.86
	Large	.41	.21	.23	.51	.57	.24	.30	.68
164	Small	.62	.27	.36	.79	.75	.29	.42	.93
	Large	.52	.23	.30	.66	.66	.25	.37	.82
165	Small	.50	.25	.28	.62	.75	.30	.39	.89
	Large	.43	.22	.24	.54	.64	.25	.33	.75
166	Small	.58	.29	.33	.73	.73	.33	.39	.87
	Large	.48	.24	.28	.60	.61	.28	.33	.73
167	Small	.66	.36	.46	.87	.75	.38	.51	.94
	Large	.54	.29	.37	.71	.64	.32	.43	.81
168	Small	.52	.26	.34	.70	.64	.32	.42	.87
	Large	.43	.22	.28	.58	.54	.27	.36	.74
169	Small	.60	.30	.33	.67	.70	.32	.37	.75
	Large	.47	.24	.26	.52	.56	.25	.29	.60
170	Small	.47	.26	.29	.60	.55	.28	.34	.74
	Large	.36	.20	.22	.46	.42	.22	.26	.57
171	Small	.62	.29	.37	.61	.85	.36	.46	.76
	Large	.50	.23	.30	.49	.67	.28	.36	.59
172	Small	.49	.24	.31	.73	.74	.34	.44	1.09
	Large	.39	.19	.24	.58	.58	.27	.36	.87
173	Small	.75	.35	.45	.64	1.04	.47	.57	.81
	Large	.51	.24	.31	.43	.70	.32	.38	.54
174	Small	.46	.25	.29	.74	.54	.27	.34	.84
	Large	.36	.19	.23	.57	.42	.21	.26	.66
175	Small	.55	.29	.33	.75	.67	.33	.40	.92
	Large	.48	.25	.29	.65	.63	.31	.36	.87
176	Small	.50	.25	.33	.80	.64	.31	.45	1.11
	Large	.48	.24	.32	.77	.64	.31	.44	1.10
177	Small	.56	.27	.34	.68	.74	.34	.45	.90
	Large	.47	.23	.28	.56	.62	.28	.37	.76
178	Small	.52	.25	.37	.70	.68	.33	.54	1.04
	Large	.45	.21	.32	.60	.62	.28	.46	.89
179	Small	.69	.35	.53	.76	.95	.46	.70	1.02
	Large	.54	.28	.42	.60	.78	.38	.58	.85
180	Small	.50	.26	.40	.78	.68	.36	.55	1.11
	Large	.40	.21	.32	.63	.58	.30	.47	.94

TABLE B.18 (continued)

Producing Region	Farm Size	Summerfallow Crop				Stubble Crop			
		Wheat	Oats	Barley	Rye	Wheat	Oats	Barley	Rye
		(Dollars per bushel)							
181	Small	.67	.32	.44	.95	.87	.41	.59	1.30
	Large	.52	.25	.36	.75	.69	.33	.48	1.06
182	Small	.63	.31	.48	.82	.86	.43	.65	1.13
	Large	.54	.27	.41	.71	.69	.34	.53	.92
183	Small	.68	.35	.47	.63	.81	.39	.63	.85
	Large	.54	.28	.37	.50	.66	.32	.51	.70
184	Small	.66	.40	.48	.62	.79	.41	.76	.85
	Large	.48	.26	.33	.45	.60	.30	.46	.64
185	Small					.89	.56	.69	.81
	Large					.75	.45	.58	.68
186	Small					.55	.42	.49	1.21
	Large					.41	.27	.34	.91
187	Small					.72	.49	.61	.74
	Large					.56	.39	.48	.57
188	Small					.72	.47	.57	.76
	Large					.72	.42	.57	.76

*These costs exclude all land costs, including taxes, buildings, off-farm trucking of grain, and management returns.

TABLE B.19

MINIMUM SUMMERFALLOW REQUIREMENT
PER PRODUCTIVE ACRE, BY PRODUCING REGION

Producing Region	Minimum Summerfallow Requirement	Producing Region	Minimum Summerfallow Requirement	Producing Region	Minimum Summerfallow Requirement
	(Per cent)		(Per cent)		(Per cent)
137	26.4	153	39.8	169	42.5
138	27.2	154	35.9	170	45.3
139	26.4	155	44.4	171	45.2
140	28.5	156	43.2	172	44.4
141	32.2	157	43.4	173	44.9
142	32.5	158	45.0	174	44.6
143	33.2	159	42.6	175	39.0
144	33.8	160	45.2	176	35.1
145	39.1	161	45.9	177	37.6
146	37.8	162	46.3	178	32.9
147	35.1	163	45.8	179	30.9
148	34.2	164	45.4	180	22.6
149	30.3	165	45.9	181	20.9
150	33.0	166	42.7	182	27.1
151	42.5	167	38.2	183	28.4
152	39.0	168	39.7	184	29.4

TABLE B.20

NUMBER OF FARMS, BY PROVINCE AND FARM SIZE CLASS, 1966

Province	Improved Acres												Total All Classes	Total ≥10 Acres
	1-2	3-9	10-69	70-129	130-179	180-239	240-399	400-559	560-759	760-1,119	1,120-1,599	1,600		
	(Number of farms)													
Nova Scotia	559	1,092	5,567	1,548	383	188	113	19	15	6	2	0	9,492	7,841
Prince Edward Island	78	167	2,599	2,310	693	291	172	24	5	6	1	2	6,348	6,103
New Brunswick	242	478	4,566	2,123	613	316	213	47	10	10	1	4	8,623	7,903
Quebec	646	1,925	28,215	32,383	10,291	4,308	1,993	208	47	20	7	7	80,050	77,479
Ontario	2,612	5,167	29,695	38,735	16,085	9,059	6,123	971	301	131	39	16	108,934	101,155
Manitoba	485	1,256	3,848	4,224	4,381	3,842	10,244	5,642	3,151	1,695	460	193	39,421	37,680
Saskatchewan	275	480	1,908	4,160	6,464	5,214	20,151	15,625	13,154	11,117	4,658	2,082	85,288	84,533
Alberta*	553	1,173	5,072	7,110	8,849	6,756	17,110	9,529	6,257	4,666	2,074	1,396	70,545	68,819
British Columbia*	1,472	3,810	6,787	1,567	581	334	342	142	80	46	26	39	15,226	9,944
Total	6,922	15,548	88,257	94,160	48,340	30,308	56,461	32,207	23,020	17,697	7,268	3,739	423,927	401,457

*The figures for Alberta include data for the Peace River area of British Columbia.

TABLE B.21

LAND AVAILABLE FOR CEREAL PRODUCTION
AND SUMMERFALLOW IN CANADA
BY PROVINCE AND FARM SIZE, 1966*

Province	Small	Large	Total
		(Acres)	
Nova Scotia	26,262	14,452	40,714
Prince Edward Island	83,252	64,499	147,751
New Brunswick	50,181	41,481	91,662
Quebec**	1,151,189	–	1,151,189
Ontario	2,178,150	1,345,078	3,523,228
Manitoba	3,434,741	5,144,038	8,578,779
Saskatchewan	13,953,491	26,466,445	40,419,936
Alberta***	9,429,057	11,033,382	20,462,439
British Columbia***	21,206	42,008	63,214
Total	30,327,529	44,151,383	74,478,912

*Acreage by farm size estimated from unpublished 1966 Census data obtained from the Dominion Bureau of Statistics.

**Only one representative farm size was used in Quebec.

***Data for the Peace River area in British Columbia are included in the Alberta figures.

TABLE B.22

LAND AVAILABLE FOR CEREAL PRODUCTION AND SUMMERFALLOW IN CANADA, BY PRODUCING REGION*

Producing Region	Farm Size		Total	Producing Region	Farm Size		Total
	Small	Large			Small	Large	
		(Acres)				(Acres)	
1	1,159	127	1,286	48	6,553	–	6,553
2	9,245	7,307	16,552	49	1,606	–	1,606
3	14,189	6,254	20,443	50	22,284	–	22,284
4	754	682	1,436	51	21,989	–	21,989
5	915	82	997	52	15,582	–	15,582
6	16,472	8,568	25,040	53	12,254	–	12,254
7	27,301	28,293	55,594	54	13,068	–	13,068
8	39,479	27,638	67,117	55	18,550	–	18,550
9	26,351	26,304	52,655	56	17,844	–	17,844
10	6,036	3,934	9,970	57	9,807	–	9,807
11	9,756	6,540	16,296	58	8,504	–	8,504
12	8,038	4,703	12,741	59	20,498	–	20,498
13	142	–	142	60	22,359	–	22,359
14	3,327	–	3,327	61	14,320	–	14,320
15	11,003	–	11,003	62	22,643	–	22,643
16	15,598	–	15,598	63	24,346	–	24,346
17	20,190	–	20,190	64	5,819	–	5,819
18	34,139	–	34,139	65	4,297	–	4,297
19	2,482	–	2,482	66	11,250	–	11,250
20	18,308	–	18,308	67	12,673	–	12,673
21	21,093	–	21,093	68	12,165	–	12,165
22	37,584	–	37,584	69	12,096	–	12,096
23	39,062	–	39,062	70	18,065	–	18,065
24	14,817	–	14,817	71	14,968	–	14,968
25	22,332	–	22,332	72	14,589	–	14,589
26	14,524	–	14,524	73	14,857	–	14,857
27	8,151	–	8,151	74	14,311	–	14,311
28	18,206	–	18,206	75	19,223	–	19,223
29	8,366	–	8,366	76	12,647	–	12,647
30	22,482	–	22,482	77	17,591	–	17,591
31	28,243	–	28,243	78	19,310	–	19,310
32	20,630	–	20,630	79	15,012	–	15,012
33	13,700	–	13,700	80	21,520	–	21,520
34	13,291	–	13,291	81	23,138	–	23,138
35	34,505	–	34,505	82	23,758	–	23,758
36	26,824	–	26,824	83	25,376	19,741	45,117
37	7,850	–	7,850	84	17,987	9,980	27,967
38	15,489	–	15,489	85	20,121	14,559	34,680
39	10,926	–	10,926	86	16,526	7,726	24,252
40	3,570	–	3,570	87	26,358	22,636	48,994
41	9,530	–	9,530	88	23,702	12,486	36,188
42	24,605	–	24,605	89	12,002	6,750	18,752
43	29,488	–	29,488	90	15,928	7,153	23,081
44	29,043	–	29,043	91	32,344	21,218	53,562
45	16,022	–	16,022	92	19,362	9,306	28,668
46	3,666	–	3,666	93	11,755	9,239	20,994
47	12,505	–	12,505	94	18,634	10,360	28,994

TABLE B.22 (continued)

Producing Region	Farm Size		Total	Producing Region	Farm Size		Total
	Small	Large			Small	Large	
		(Acres)				(Acres)	
95	21,971	13,947	35,918	142	311,853	561,917	873,770
96	36,646	13,081	49,727	143	222,319	438,345	660,664
97	20,579	8,551	29,130	144	233,212	355,101	588,313
98	917	122	1,039	145	419,193	622,216	1,041,409
99	35,484	18,504	53,988	146	184,954	496,346	681,300
100	28,953	16,310	45,263	147	119,867	635,178	755,045
101	2,498	500	2,998	148	354,816	342,582	697,398
102	42,702	26,350	69,052	149	164,863	160,161	325,024
103	45,330	37,496	82,826	150	157,519	111,415	268,934
104	88,233	47,297	135,530	151	1,397,438	1,228,416	2,625,854
105	19,622	13,988	33,610	152	1,663,772	942,300	2,606,072
106	20,131	27,473	47,604	153	749,288	534,752	1,284,040
107	39,702	25,550	65,252	154	1,043,954	807,095	1,851,049
108	95,671	39,455	135,126	155	816,865	2,623,965	3,440,830
109	66,168	59,343	125,511	156	601,761	1,212,671	1,814,432
110	96,823	57,063	153,886	157	876,355	531,370	1,407,725
111	119,163	54,356	173,519	158	430,134	1,276,315	1,706,449
112	112,767	89,090	201,857	159	838,317	1,563,958	2,402,275
113	37,724	21,947	59,671	160	499,633	1,879,977	2,379,610
114	36,226	12,481	48,707	161	294,951	1,083,289	1,378,240
115	68,424	26,985	95,409	162	363,145	1,468,308	1,831,453
116	15,253	4,718	19,971	163	470,860	2,045,205	2,516,065
117	19,211	8,085	27,296	164	173,557	816,597	990,154
118	40,848	28,448	69,296	165	240,010	1,210,873	1,450,883
119	78,358	19,413	97,771	166	674,850	2,058,552	2,733,402
120	103,343	46,437	149,780	167	1,283,323	995,835	2,279,158
121	45,393	26,634	72,027	168	668,680	700,703	1,369,383
122	99,831	84,506	184,337	169	394,905	1,586,352	1,981,257
123	107,731	90,967	198,698	170	471,693	1,899,912	2,371,605
124	75,292	55,568	130,860	171	304,977	930,225	1,235,202
125	105,202	53,361	158,563	172	542,180	1,370,647	1,912,827
126	155,727	124,862	280,589	173	218,431	974,757	1,193,188
127	7,252	3,811	11,063	174	468,741	2,118,089	2,586,830
128	5,924	2,159	8,083	175	252,095	647,866	899,961
129	6,951	2,365	9,316	176	564,305	774,729	1,339,034
130	7,043	4,090	11,133	177	742,588	1,352,430	2,095,018
131	12,956	15,203	28,159	178	1,726,452	979,128	2,705,580
132	2,238	2,362	4,600	179	579,486	99,024	678,510
133	5,303	3,379	8,682	180	971,554	268,617	1,240,171
134	4,070	3,079	7,149	181	759,071	384,040	1,143,111
135	2,660	2,123	4,783	182	942,776	212,550	1,155,326
136	1,735	2,465	4,200	183	1,137,933	745,856	1,883,789
137	51,481	14,910	66,391	184	218,468	175,424	393,892
138	420,269	338,467	758,736	185	7,617	15,606	23,223
139	474,506	845,243	1,319,749	186	2,192	12,187	14,379
140	130,223	163,486	293,709	187	8,003	11,083	19,086
141	189,666	58,491	248,157	188	3,394	3,132	6,526

*Acreage by farm size estimated from unpublished Census data obtained from the Dominion Bureau of Statistics.

TABLE B.23

DISTRIBUTION OF CEREAL GRAIN EXPORTS, BY PORTS*

Port	Wheat	Oats	Barley	Rye
		(Per cent)		
Vancouver**	33.5	49.6	54.1	41.7
Prince Rupert	2.5			
Churchill	4.7			
Thunder Bay	1.4	43.6	33.5	45.8
Kingston	0.2			1.4
Montreal	20.4	4.8	6.2	6.6
Sorel	6.8	0.8		1.2
Trois-Rivières	4.9	0.4	0.1	0.6
Quebec	4.4		3.1	2.2
Baie Comeau	12.9		3.0	0.3
Saint John***	4.9	0.8		0.2
Halifax	3.4			
Total	100.0	100.0	100.0	100.0

*Flour, rolled oats, and malt were converted to bushels and were assumed shipped through Vancouver, Thunder Bay, Montreal, Sorel, Trois-Rivières, and Quebec according to the proportion of grain exported from these ports.

**Includes grain shipped through Victoria.

***Includes grain shipped through West Saint John.

TABLE B.24

DOMESTIC INDUSTRIAL AND MILLING DEMANDS
FOR CEREAL GRAINS, 1966

Consuming Region	Wheat	Winter Wheat	Oats	Barley	Rye	Corn
			(Bushels)			
1	1,964,094		207,529	498,693	44,559	
2	275,223		29,792	0	0	
3	1,610,981		169,305	332,462	44,559	
4	1,809,316		195,855	0	0	
5	2,064,823		223,513	0	0	
6	1,942,773		202,671	1,092,881	66,928	
7	8,177,836		853,971	3,278,642	274,208	
8	1,164,589		110,803	0	133,857	
9	2,617,565		272,178	521,683	97,957	
10	9,047,871		895,952	3,114,178	732,063	
11	5,266,198		543,605	1,557,974	231,994	
12	1,745,229		188,917	1,557,974	0	
13	202,385		21,908	1,038,060	0	
14	1,770,485		191,651	871,829	0	
15	387,627		41,960	0	0	
16	284,030		30,746	0	0	
17	1,015,897		109,969	288,252	0	
18	606,819		65,687	288,252	0	
19	201,814		21,846	0	0	
20	598,046		64,737	143,242	0	
21	435,620		47,155	162,694	0	
22	1,104,173		114,444	325,388	44,559	
23	1,829,945		198,088	652,545	0	
24	163,559		17,705	0	0	
25	329,015		35,615	0	0	
26	468,989		50,767	208,673	0	
27	558,667		60,475	208,673	0	
28	3,578,301		372,144	1,043,365	133,316	
29	180,724		19,563	0	0	
30	1,251,154		135,435	498,693	0	
Total . .	52,653,747	8,262,768*	5,493,985	17,684,155	1,804,000	10,900,000*

*The domestic industrial and milling demands for corn and winter wheat were not identified by region. It was assumed that these demands could only be met from Ontario production. Each of supplying regions 9, 10, and 11 in Southern Ontario was given equal access to this market.

TABLE B.25

ASSUMED LIVESTOCK CONSUMPTION OF DOMESTICALLY PRODUCED CEREAL GRAINS BY CONSUMING REGION, 1966

Consuming Region	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Barley Equivalent	Regional Barley Equivalent as % of Total
				(Bushels)					(Per cent)
1	1,815,447	0	2,635,528	1,554,818	0	547,245	0	5,937,730	.98
2	281,968	0	5,232,165	1,078,380	0	2,991,320	0	7,103,390	1.17
3	617,705	0	4,197,940	936,272	0	449,350	0	4,687,453	.77
4	1,132,421	0	7,432,317	2,212,222	81,174	523,277	275,264	9,107,893	1.50
5	4,246,305	0	27,869,403	8,295,302	304,382	1,962,162	1,032,174	34,152,412	5.64
6	876,015	0	5,749,472	1,711,325	62,794	404,795	212,938	7,045,660	1.16
7	2,300,319	0	15,097,479	4,493,751	164,891	1,062,947	559,152	18,501,126	3.06
8	495,615	0	3,252,827	968,201	35,527	229,017	120,472	3,986,159	.66
9	587,908	802,412	10,568,170	3,375,654	262,786	5,745,334	7,762,128	26,038,960	4.30
10	1,877,057	2,561,602	33,741,800	10,777,708	839,015	18,343,565	24,782,734	83,136,566	13.72
11	1,417,481	1,934,422	25,480,493	8,138,906	633,592	13,852,346	18,714,956	62,781,497	10.36
12	102,257	139,549	1,838,161	587,140	45,707	999,307	1,350,096	4,529,053	.75
13	14,397	19,647	258,795	82,663	6,435	140,692	190,080	637,645	.11
14	2,879,850	0	21,822,755	13,100,817	396,717	3,080,291	0	33,235,625	5.49
15	2,258,848	0	17,116,969	10,275,800	311,170	2,416,068	0	26,068,806	4.30
16	827,306	0	6,269,109	3,763,523	113,966	884,887	0	9,547,729	1.58
17	2,965,419	0	22,471,179	13,490,084	408,505	3,171,817	0	34,223,162	5.65
18	2,100,129	0	15,914,232	9,553,763	289,306	2,246,301	0	24,237,060	4.00
19	1,148,242	0	8,701,084	5,223,506	158,178	1,228,162	0	13,251,578	2.19
20	2,301,168	0	17,437,652	10,468,315	317,000	2,461,332	0	26,557,200	4.38
21	2,841,357	0	21,531,065	12,925,707	391,414	3,039,119	0	32,791,386	5.41
22	2,249,029	0	17,042,560	10,231,131	309,818	2,405,565	0	25,955,483	4.28
23	6,730,982	0	51,005,638	30,620,126	927,234	7,199,468	0	77,680,578	12.83
24	1,333,947	0	10,108,308	6,068,303	183,759	1,426,792	0	15,394,753	2.54
25	732,734	0	5,552,465	3,333,302	100,939	783,733	0	8,456,294	1.40
26	674,320	0	784,690	919,404	10,976	31,050	0	2,299,960	.38
27	360,951	0	420,030	492,140	5,875	16,620	0	1,231,127	.20
28	1,857,849	0	2,161,935	2,533,092	30,240	85,547	0	6,336,726	1.05
29	22,479	0	26,159	30,649	366	1,035	0	76,672	.01
30	282,000	0	260,000	244,000	3,000	0	0	766,760	.13
Total . . .	47,331,505	5,457,531	361,980,379	177,486,008	6,394,767	77,729,145	54,999,993*	605,756,447*	100.00

*Corn imports of 13,500,000 bushels, or 16,335,000 bushels of barley equivalent, from the United States were not included in these figures. The feed value was subtracted from the regional requirements prior to estimation of the above figures.

TABLE B.26

ACREAGES OF PRINCIPAL FIELD CROPS IN PRAIRIES, 1958-69*

Year	Wheat	Oats	Barley	Rye	Mixed Grain	Flax-seed	Rape-seed	Summer-fallow	Total
					(Thousand acres)				
1958 . . .	21,480	5,810	9,104	432	411	2,526	626	26,399	66,788
1959 . . .	23,970	5,626	7,700	458	493	2,026	213	26,594	67,080
1960 . . .	23,900	6,344	6,680	490	520	2,481	763	26,893	68,071
1961 . . .	24,629	5,122	5,361	493	667	2,051	710	27,860	66,893
1962 . . .	26,237	7,152	5,097	556	616	1,396	371	27,495	68,920
1963 . . .	26,996	6,260	5,922	582	535	1,629	478	27,211	69,613
1964 . . .	29,080	5,054	5,217	620	548	1,916	791	26,375	69,601
1965 . . .	27,790	5,645	5,741	691	606	2,265	1,435	26,580	70,753
1966 . . .	29,166	5,450	7,010	671	747	1,883	1,525	25,224	71,676
1967 . . .	29,570	5,090	7,600	628	667	998	1,620	25,950	72,123
1968 . . .	28,860	5,340	8,330	619	676	1,502	1,052	26,660	73,039
1969 . . .	24,400	5,630	9,000	859	705	2,420	2,012	28,800	73,826

*In this Table, the Prairies do not include the Peace River area of British Columbia.

Source: Dominion Bureau of Statistics, *Handbook of Agricultural Statistics, Part I – Field Crops,* Catalogue No. 21-507, 1908-63; Dominion Bureau of Statistics, *Quarterly Bulletin of Agricultural Statistics,* Catalogue No. 21-003, January–March 1964 to 1967; Dominion Bureau of Statistics, *Field Crop Reporting Series – No. 20,* November 21, 1969.

APPENDIX C

SOLUTION DATA

TABLE C.1

REGIONAL ACREAGE ADJUSTMENTS REQUIRED
FOR PRODUCTION-DEMAND SPATIAL EQUILIBRIUM
IN THE CANADIAN CEREAL GRAIN ECONOMY, MODEL 1

Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage
	(Acres)	(Per cent)		(Acres)	(Per cent)		(Acres)	(Per cent)
1	1,270	98.8	36	21,608	80.6	74	2,976	20.8
2	8,063	48.7	38	1,366	8.8	75	9,945	51.7
3	4,273	20.9	42	15,307	62.2	76	7,018	55.5
5	401	40.2	47	2,223	17.8	81	19,724	85.3
7	27,301	49.1	48	4,918	75.1	84	15,354	54.9
9	31,284	59.4	49	1,111	69.2	98	382	36.8
10	3,288	33.0	50	16,476	73.9	135	937	19.6
11	9,756	59.9	53	5,090	41.5	136	1,735	41.3
12	8,038	63.1	54	12,173	93.2	137	51,481	77.5
13	142	100.0	55	13,444	72.5	138	256,331	33.8
16	11,869	76.1	56	12,879	72.2	140	130,223	44.3
19	1,273	51.3	57	4,574	46.6	141	189,666	76.4
20	8,078	44.1	58	5,235	61.6	173	199,415	16.7
23	17,015	43.6	59	710	3.5	179	554,721	81.8
26	14,524	100.0	61	3,989	27.9	183	348,925	18.5
29	7,436	88.9	65	1,952	45.4	185	7,617	32.8
30	7,597	33.8	66	5,623	50.0	187	8,003	41.9
31	28,243	100.0	67	6,301	49.7	188	550	8.4
32	16,870	81.8	70	13,990	77.4			
35	27,641	80.1	73	8,881	59.8			

TABLE C.2

REGIONAL ACREAGE ADJUSTMENTS REQUIRED
FOR PRODUCTION-DEMAND SPATIAL EQUILIBRIUM
IN THE CANADIAN CEREAL GRAIN ECONOMY, MODEL 2

Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage
	(Acres)	(Per cent)		(Acres)	(Per cent)		(Acres)	(Per cent)
1	1,286	100.0	38	12,137	78.4	78	17,520	90.7
2	9,245	55.9	39	7,385	67.6	79	13,908	92.7
3	12,601	61.6	40	2,614	73.2	81	23,138	100.0
4	662	46.1	41	4,431	46.5	84	17,122	61.2
5	949	95.2	42	15,307	62.2	86	13,924	57.4
6	5,307	21.2	44	19,254	66.3	88	8,254	22.8
7	27,301	49.1	47	11,082	88.6	98	382	36.8
9	47,805	90.8	48	6,553	100.0	128	26	0.3
10	6,036	60.5	49	1,606	100.0	132	1,203	26.2
11	9,756	59.9	50	21,549	96.7	135	1,718	35.9
12	8,038	63.1	51	18,036	82.0	136	4,200	100.0
13	142	100.0	53	8,501	69.4	137	66,391	100.0
14	3,327	100.0	54	13,068	100.0	138	420,269	55.4
15	4,381	39.8	55	18,550	100.0	139	474,506	35.9
16	11,869	76.1	56	17,844	100.0	140	130,223	44.3
17	15,505	76.8	57	4,574	46.6	141	189,666	76.4
19	2,482	100.0	58	8,042	94.6	150	157,519	58.6
20	17,293	94.5	59	13,367	65.2	162	300,858	16.4
23	34,102	87.3	60	14,223	63.6	164	69,827	7.1
25	5,876	26.3	61	10,512	73.4	167	1,283,323	56.3
26	14,524	100.0	62	16,374	72.3	171	174,700	14.1
27	3,372	41.4	63	10,301	42.3	173	218,431	18.3
28	16,084	88.3	65	4,297	100.0	179	579,486	85.4
29	8,366	100.0	66	6,383	56.7	181	759,071	66.4
30	16,243	72.3	67	8,102	63.9	182	348,054	30.1
31	28,243	100.0	68	1,846	15.2	183	1,137,933	60.4
32	17,355	84.1	70	14,824	82.1	184	218,468	55.5
33	13,700	100.0	71	14,968	100.0	185	16,183	69.7
34	8,483	63.8	73	10,818	72.8	187	8,003	41.9
35	27,641	80.1	74	2,976	20.8	188	2,603	39.9
36	26,824	100.0	75	19,223	100.0			
37	5,840	74.4	76	7,018	55.5			

TABLE C.3

REGIONAL ACREAGE ADJUSTMENTS REQUIRED
FOR PRODUCTION-DEMAND SPATIAL EQUILIBRIUM
IN THE CANADIAN CEREAL GRAIN ECONOMY, MODEL 3

Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage
	(Acres)	(Per cent)		(Acres)	(Per cent)		(Acres)	(Per cent)
1	1,286	100.0	27	3,372	41.4	52	4,901	31.5
2	14,094	85.1	28	18,206	100.0	53	8,784	71.7
3	14,189	69.4	29	8,366	100.0	54	13,068	100.0
4	754	52.5	30	16,311	72.6	55	18,550	100.0
5	949	95.2	31	28,243	100.0	56	17,844	100.0
6	5,307	21.2	32	20,021	97.1	57	5,431	55.4
7	49,990	89.9	33	13,700	100.0	58	8,042	94.6
9	52,655	100.0	34	13,291	100.0	59	19,640	95.8
10	7,995	80.2	35	31,440	91.1	60	14,223	63.6
11	9,756	59.9	36	26,824	100.0	61	13,677	95.5
12	10,470	82.2	37	7,850	100.0	62	20,653	91.2
13	142	100.0	38	15,489	100.0	63	16,191	66.5
14	3,327	100.0	39	7,385	67.6	65	4,297	100.0
15	4,434	40.3	40	3,570	100.0	66	11,085	98.5
16	11,869	76.1	41	5,444	57.1	67	12,673	100.0
17	15,505	76.8	42	22,974	93.4	68	2,172	17.9
19	2,482	100.0	44	19,254	66.3	70	18,065	100.0
20	17,293	94.5	45	4,163	26.0	71	14,968	100.0
21	18,172	86.2	47	12,505	100.0	73	14,857	100.0
22	30,959	82.4	48	6,553	100.0	74	12,046	84.2
23	34,102	87.3	49	1,606	100.0	75	19,223	100.0
25	8,844	39.6	50	21,549	96.7	76	11,055	87.4
26	14,524	100.0	51	18,036	82.0	78	18,950	98.1

TABLE C.3 (continued)

REGIONAL ACREAGE ADJUSTMENTS REQUIRED
FOR PRODUCTION-DEMAND SPATIAL EQUILIBRIUM
IN THE CANADIAN CEREAL GRAIN ECONOMY, MODEL 3

Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage
	(Acres)	(Per cent)		(Acres)	(Per cent)		(Acres)	(Per cent)
79	13,908	92.7	137	66,391	100.0	167	1,283,323	56.3
81	23,138	100.0	138	420,269	55.4	169	228,428	11.5
84	21,873	78.2	139	474,506	36.0	171	304,977	24.7
86	13,924	57.4	140	130,223	44.3	173	218,431	18.3
88	21,835	60.3	141	189,666	76.4	177	252,226	12.0
98	382	36.8	142	311,853	35.7	179	672,563	99.1
101	1,810	60.4	143	222,319	33.7	180	922,069	74.4
108	50,859	37.6	147	89,698	11.9	181	759,071	66.4
128	8,083	100.0	148	354,816	50.9	182	348,054	30.1
130	3,086	27.7	149	164,863	50.7	183	1,137,933	60.4
132	1,203	26.2	150	157,519	58.6	184	218,468	55.5
134	578	8.1	162	363,145	19.8	185	23,223	100.0
135	1,718	35.9	164	104,286	10.5	187	8,003	41.9
136	4,200	100.0	166	429,522	15.7	188	2,603	39.9

TABLE C.4

REGIONAL ACREAGE ADJUSTMENTS REQUIRED
FOR PRODUCTION-DEMAND SPATIAL EQUILIBRIUM
IN THE CANADIAN CEREAL GRAIN ECONOMY, MODEL 4

Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage
	(Acres)	(Per cent)		(Acres)	(Per cent)		(Acres)	(Per cent)
1	1,270	98.8	35	27,641	80.0	73	8,881	59.8
2	8,063	48.7	36	26,110	97.3	74	2,976	20.8
3	12,601	61.6	38	11,097	71.6	75	18,413	95.8
4	662	46.1	41	4,431	46.5	76	7,018	55.5
5	401	40.2	42	15,307	62.2	79	10,560	70.4
6	5,307	21.2	44	9,684	33.3	81	22,153	95.7
7	27,301	49.1	47	2,223	17.8	84	17,122	61.2
9	45,400	86.2	48	5,770	88.0	86	7,517	31.0
10	5,683	57.0	49	1,111	69.2	98	382	36.8
11	9,756	59.9	50	16,476	73.9	135	1,718	35.9
12	8,038	63.1	51	4,655	21.2	136	4,200	100.0
13	142	100.0	53	8,501	69.4	137	51,481	77.5
14	1,798	54.0	54	12,173	93.2	138	420,269	55.4
15	3,071	27.9	55	17,627	95.0	139	379,948	28.8
16	11,869	76.1	56	17,053	95.6	140	130,223	44.3
19	1,273	51.3	57	4,574	46.6	141	189,666	76.4
20	13,771	75.2	58	5,235	61.6	167	1,283,323	56.3
23	32,766	83.9	59	13,367	65.2	173	218,431	18.3
26	14,524	100.0	60	14,223	63.6	179	579,486	85.4
27	1,827	22.4	61	4,472	31.2	181	728,729	63.8
28	6,548	36.0	62	16,374	72.3	182	343,999	29.8
29	8,366	100.0	63	433	1.8	183	1,137,933	60.4
30	16,243	72.2	65	4,297	100.0	184	218,468	55.5
31	28,243	100.0	66	5,623	50.0	185	14,524	62.5
32	16,870	81.8	67	6,301	49.7	187	8,003	41.9
33	7,539	55.0	70	13,990	77.4	188	2,147	32.9

TABLE C.5

REGIONAL ACREAGE ADJUSTMENTS REQUIRED
FOR PRODUCTION-DEMAND SPATIAL EQUILIBRIUM
IN THE CANADIAN CEREAL GRAIN ECONOMY, MODEL 7

Producing Region	Surplus Acreage	% of 1966 Cereal Acreage	Producing Region	Surplus Acreage	% of 1966 Cereal Acreage
	(Acres)	(Per cent)		(Acres)	(Per cent)
137	66,391	100.0	166	409,365	15.0
138	420,269	55.4	167	1,283,323	56.3
139	474,506	36.0	169	180,081	9.1
140	130,223	44.3	171	304,977	24.7
141	189,666	76.4	173	218,431	18.3
142	311,853	35.7	179	672,563	99.1
148	354,816	50.9	181	759,071	66.4
150	157,519	58.6	182	348,054	30.1
162	363,145	19.8	183	1,137,933	60.4
164	69,827	7.0	184	218,468	55.5

TABLE C. 6

REGIONAL ACREAGE ADJUSTMENTS, BY FARM SIZE, FOR PRODUCTION-DEMAND SPATIAL EQUILIBRIUM IN THE CANADIAN CEREAL GRAIN ECONOMY, MODEL 1

Producing Region	Surplus Acreage by Farm Size		% of 1966 Cereal Acreage by Farm Size		Producing Region	Surplus Acreage by Farm Size		% of 1966 Cereal Acreage by Farm Size	
	Small	Large	Small	Large		Small	Large	Small	Large
	(Acres)		(Per cent)			(Acres)		(Per cent)	
1	1,159	111	100.0	87.4	55	13,444		72.5	
2	8,063	0	87.2	0	56	12,879		72.2	
3	4,273	0	30.1	0	57	4,574		46.6	
5	401	0	43.8	0	58	5,235		61.6	
7	27,301	0	100.0	0	59	710		3.5	
9	23,556	7,728	89.4	29.4	61	3,989		27.9	
10	3,288	0	54.5	0	65	1,952		45.4	
11	9,756	0	100.0	0	66	5,623		50.0	
12	8,038	0	100.0	0	67	6,301		49.7	
13	142		100.0		70	13,990		77.4	
16	11,869		76.1		73	8,881		59.8	
19	1,273		51.3		74	2,976		20.8	
20	8,078		44.1		75	9,945		51.7	
23	17,015		43.6		76	7,018		55.5	
26	14,524		100.0		81	19,724		85.3	
29	7,436		88.9		84	15,354	0	85.4	0
30	7,597		33.8		98	382	0	41.7	0
31	28,243		100.0		135	937	0	35.2	0
32	16,870		81.8		136	1,735	0	100.0	0
35	27,641		80.1		137	51,481	0	100.0	0
36	21,608		80.6		138	256,331	0	61.0	0
38	1,366		8.8		140	130,223	0	100.0	0
42	15,307		62.2		141	189,666	0	100.0	0
47	2,223		17.8		173	199,415	0	91.3	0
48	4,918		75.1		179	554,721	0	95.7	0
49	1,111		69.2		183	348,925	0	30.7	0
50	16,476		73.9		185	7,617	0	100.0	0
53	5,090		41.5		187	8,003	0	100.0	0
54	12,173		93.2		188	550	0	16.2	0

TABLE C. 7

REGIONAL ACREAGE ADJUSTMENTS, BY FARM SIZE, FOR PRODUCTION-DEMAND SPATIAL EQUILIBRIUM IN THE CANADIAN CEREAL GRAIN ECONOMY, MODEL 2

Producing Region	Surplus Acreage by Farm Size		% of 1966 Cereal Acreage by Farm Size		Producing Region	Surplus Acreage by Farm Size		% of 1966 Cereal Acreage by Farm Size	
	Small	Large	Small	Large		Small	Large	Small	Large
	(Acres)		(Per cent)			(Acres)		(Per cent)	
1	1,159	127	100.0	100.0	57	4,574		46.6	
2	9,245	0	100.0	0	58	8,042		94.6	
3	12,601	0	88.8	0	59	13,367		65.2	
4	662	0	87.8	0	60	14,223		63.6	
5	915	0	100.0	41.5	61	10,512		73.4	
6	5,307	0	32.2	0	62	16,374		72.3	
7	27,301	0	100.0	0	63	10,301		42.3	
9	26,351	21,454	100.0	81.6	65	4,297		100.0	
10	6,036	0	100.0	0	66	6,383		56.7	
11	9,756	0	100.0	0	67	8,102		63.9	
12	8,038	0	100.0	0	68	1,846		15.2	
13	142		100.0		70	14,824		82.1	
14	3,327		100.0		71	14,968		100.0	
15	4,381		39.8		73	10,818		72.8	
16	11,869		76.1		74	2,976		20.8	
17	15,505		76.8		75	19,223		100.0	
19	2,482		100.0		76	7,018		55.5	
20	17,293		94.5		78	17,520		90.7	
23	34,102		87.3		79	13,908		92.6	
25	5,876		26.3		81	23,138		100.0	
26	14,524		100.0		84	17,122	0	95.2	0
27	3,372		41.4		86	13,924	0	84.3	0
28	16,084		88.3		88	8,254	0	34.8	0
29	8,366		100.0		98	382	0	41.7	0
30	16,243		72.2		128	26	0	0.4	0
31	28,243		100.0		132	1,203	0	53.7	0
32	17,355		84.1		135	1,718	0	64.6	0
33	13,700		100.0		136	1,735	2,465	100.0	100.0
34	8,483		63.8		137	51,481	14,910	100.0	100.0
35	27,641		80.1		138	420,269	0	100.0	0
36	26,824		100.0		139	474,506	0	100.0	0
37	5,840		74.4		140	130,223	0	100.0	0
38	12,137		78.4		141	189,666	0	100.0	0
39	7,385		67.6		150	157,519	0	100.0	0
40	2,614		73.2		162	300,858	0	82.8	0
41	4,431		46.5		164	69,827	0	40.2	0
42	15,307		62.2		167	1,283,323	0	100.0	0
44	19,254		66.3		171	174,700	0	57.3	0
47	11,082		88.6		173	218,431	0	100.0	0
48	6,553		100.0		179	579,486	0	100.0	0
49	1,606		100.0		181	759,071	0	100.0	0
50	21,549		96.7		182	348,054	0	36.9	0
51	18,036		82.0		183	1,137,933	0	100.0	0
53	8,501		69.4		184	218,468	0	100.0	0
54	13,068		100.0		185	7,617	8,566	100.0	54.9
55	18,550		100.0		187	8,003	0	100.0	0
56	17,844		100.0		188	1,917	686	56.5	21.9

TABLE C.8

REGIONAL ACREAGE ADJUSTMENTS, BY FARM SIZE, FOR PRODUCTION-DEMAND SPATIAL EQUILIBRIUM IN THE CANADIAN CEREAL GRAIN ECONOMY, MODEL 3

Producing Region	Surplus Acreage by Farm Size		% of 1966 Cereal Acreage by Farm Size		Producing Region	Surplus Acreage by Farm Size		% of 1966 Cereal Acreage by Farm Size	
	Small	Large	Small	Large		Small	Large	Small	Large
	(Acres)		(Per cent)			(Acres)		(Per cent)	
1 . . .	1,159	127	100.0	100.0	60 . . .	14,223		63.6	
2 . . .	9,245	4,849	100.0	66.4	61 . . .	13,677		85.5	
3 . . .	14,189	0	100.0	0	62 . . .	20,653		91.2	
4 . . .	754	0	100.0	0	63 . . .	16,191		66.5	
5 . . .	915	34	100.0	41.5	65 . . .	4,297		100.0	
6 . . .	5,307	0	32.2	0	66 . . .	11,085		98.5	
7 . . .	27,301	22,689	100.0	80.2	67 . . .	12,673		100.0	
9 . . .	26,351	26,304	100.0	100.0	68 . . .	2,172		17.9	
10 . . .	6,036	1,959	100.0	49.8	70 . . .	18,065		100.0	
11 . . .	9,756	0	100.0	0	71 . . .	14,968		100.0	
12 . . .	8,038	2,432	100.0	51.7	73 . . .	14,857		100.0	
13 . . .	142	0	100.0		74 . . .	12,046		84.2	
14 . . .	3,327	0	100.0		75 . . .	19,223		100.0	
15 . . .	4,434		40.3		76 . . .	11,055		87.4	
16 . . .	11,869		76.1		78 . . .	18,950		98.1	
17 . . .	15,505		76.8		79 . . .	13,908		92.7	
19 . . .	2,482		100.0		81 . . .	23,138		100.0	
20 . . .	17,293		94.5		84 . . .	17,122	4,751	95.2	47.6
21 . . .	18,172		86.2		86 . . .	13,924	0	84.3	0
22 . . .	30,959		82.4		88 . . .	21,835	0	92.1	0
23 . . .	34,102		87.3		98 . . .	382	0	41.7	0
25 . . .	8,844		39.6		101 . . .	1,810	0	72.5	0
26 . . .	14,524		100.0		108 . . .	50,859	0	53.2	0
27 . . .	3,372		41.4		128 . . .	5,924	2,159	100.0	100.0
28 . . .	18,206		100.0		130 . . .	3,086	0	43.8	0
29 . . .	8,366		100.0		132 . . .	1,203	0	53.8	0
30 . . .	16,311		72.6		134 . . .	578	0	14.2	0
31 . . .	28,242		100.0		135 . . .	1,718	0	64.6	0
32 . . .	20,021		97.1		136 . . .	1,735	2,465	100.0	100.0
33 . . .	13,700		100.0		137 . . .	51,481	14,910	100.0	100.0
34 . . .	13,291		100.0		138 . . .	420,269	0	100.0	0
35 . . .	31,440		91.1		139 . . .	474,506	0	100.0	0
36 . . .	26,824		100.0		140 . . .	130,223	0	100.0	0
37 . . .	7,850		100.0		141 . . .	189,666	0	100.0	0
38 . . .	15,489		100.0		142 . . .	311,853	0	100.0	0
39 . . .	7,385		67.6		143 . . .	222,319	0	100.0	0
40 . . .	3,570		100.0		147 . . .	89,698	0	74.8	0
41 . . .	5,444		57.1		148 . . .	354,816	0	100.0	0
42 . . .	22,974		93.4		149 . . .	164,863	0	100.0	0
44 . . .	19,254		66.3		150 . . .	157,519	0	100.0	0
45 . . .	4,163		26.0		162 . . .	363,145	0	100.0	0
47 . . .	12,505		100.0		164 . . .	104,286	0	60.1	0
48 . . .	6,553		100.0		166 . . .	429,522	0	63.7	0
49 . . .	1,606		100.0		167 . . .	1,283,323	0	100.0	0
50 . . .	21,549		96.7		169 . . .	228,428	0	57.8	0
51 . . .	18,036		82.0		171 . . .	304,977	0	100.0	0
52 . . .	4,901		31.5		173 . . .	218,431	0	100.0	0
53 . . .	8,784		71.7		177 . . .	252,226	0	34.0	0
54 . . .	13,068		100.0		179 . . .	579,486	93,077	100.0	94.0
55 . . .	18,550		100.0		180 . . .	922,069	0	94.9	0
56 . . .	17,844		100.0		181 . . .	759,071	0	100.0	0
57 . . .	5,431		55.4		182 . . .	348,054	0	36.9	0
58 . . .	8,042		94.6		183 . . .	1,137,933	0	100.0	0
59 . . .	19,640		95.8						

TABLE C.9

LAND USE, BY PROVINCE, IN PRAIRIES, MODELS 1 TO 4

Province	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage	Acreage by Crop					
	Wheat	Oats	Barley	Rye	Summer-fallow	Total		Wheat	Oats	Barley	Rye	Summer-fallow	Total
	(Per cent)							(Acres)					
MODEL 1													
Manitoba	35.3	7.9	17.9	1.1	30.5	92.7	56.8	3,032,209	679,430	1,534,091	92,773	2,612,576	7,951,079
Saskatchewan	38.6	5.8	12.1	0.6	42.9	100.0	67.5	15,588,654	2,361,862	4,876,875	253,234	17,339,311	40,419,936
Alberta*	29.7	8.0	22.1	0.9	33.9	94.6	49.0	6,085,496	1,628,664	4,531,259	184,904	6,929,055	19,359,378
Prairies*	35.6	6.7	15.8	0.8	38.7	97.6	60.5	24,706,359	4,669,956	10,942,225	530,911	26,880,942	67,730,393
MODEL 2													
Manitoba	31.5	10.6	12.0	1.3	27.8	83.2	56.9	2,705,979	907,158	1,025,593	114,616	2,386,858	7,140,204
Saskatchewan	34.6	6.1	13.3	0.6	41.3	95.9	63.3	13,978,999	2,470,612	5,385,314	252,270	16,678,732	38,765,927
Alberta*	21.8	7.7	21.8	1.1	30.7	83.1	41.6	4,463,909	1,584,691	4,469,497	216,283	6,291,916	17,026,296
Prairies*	30.4	7.1	15.7	0.8	36.5	90.5	56.3	21,148,887	4,962,461	10,880,404	583,169	25,357,506	62,932,427
MODEL 3													
Manitoba	24.3	9.5	11.4	1.3	23.4	69.9	52.3	2,087,063	811,411	978,350	110,885	2,008,947	5,996,656
Saskatchewan	32.7	6.5	13.7	0.6	40.5	94.0	61.1	13,232,817	2,648,035	5,522,725	253,696	16,353,959	38,011,232
Alberta*	17.2	7.7	21.5	1.0	28.8	76.2	36.3	3,528,481	1,577,859	4,409,151	211,738	5,901,418	15,628,647
Prairies*	27.1	7.2	15.7	0.8	34.9	85.7	53.3	18,848,361	5,037,305	10,910,226	576,319	24,264,324	59,636,535
MODEL 4													
Manitoba	33.2	11.0	12.3	1.1	28.8	86.4	57.7	2,849,182	941,997	1,056,755	91,498	2,467,759	7,407,191
Saskatchewan	34.3	6.6	13.5	0.6	41.7	96.7	62.3	13,886,774	2,675,208	5,467,511	257,396	16,849,724	39,136,613
Alberta*	22.4	7.7	21.7	1.2	31.2	84.2	42.3	4,591,010	1,578,718	4,449,170	238,122	6,378,372	17,235,392
Prairies*	30.7	7.5	15.8	0.8	37.0	91.8	56.0	21,326,966	5,195,923	10,973,436	587,016	25,695,855	63,779,196

*The Peace River area of British Columbia is included in the data for Alberta.

TABLE C. 10

REGIONAL LAND USE, BY CROP, IN PRAIRIES, MODEL 1

Producing Region	Wheat	Oats	Barley	Rye	Summer-fallow	Total	% of Land Utilized
			(Acres)				(Per cent)
137	10,972	0	0	0	3,938	66,391	22.5
138	211,445	0	154,206	0	136,755	758,736	66.2
139	329,085	294,713	348,065	0	348,065	1,319,929	100.0
140	70,430	0	46,528	0	46,528	293,709	55.7
141	0	0	39,663	0	18,828	248,157	23.6
Supplying Region 14	621,932	294,713	588,462	0	554,114	2,686,922	76.6
142	590,057	0	0	0	283,713	873,770	100.0
143	441,191	0	0	0	219,473	660,664	100.0
144	389,287	0	0	0	199,026	588,313	100.0
145	338,399	295,298	0	0	407,712	1,041,409	100.0
146	89,410	0	334,222	0	257,668	681,300	100.0
147	56,473	0	342,845	90,707	265,021	755,045	100.0
Supplying Region 15	1,904,817	295,298	677,067	90,707	1,632,613	4,600,501	100.0
148	238,440	89,419	131,098	0	238,440	697,398	100.0
149	175,743	0	48,635	2,066	98,580	325,024	100.0
150	91,276	0	88,829	0	88,829	268,934	100.0
Supplying Region 16	505,459	89,419	268,562	2,066	425,849	1,291,356	100.0
MANITOBA	3,032,208	679,430	1,534,091	92,773	2,612,576	8,578,779	92.7
151	1,510,129	0	0	0	1,115,725	2,625,854	100.0
152	1,589,704	0	0	0	1,016,368	2,606,072	100.0
153	773,377	0	0	0	510,663	1,284,040	100.0
154	964,203	0	222,319	0	664,527	1,851,049	100.0
155	914,298	375,927	613,514	10,739	1,526,352	3,440,830	100.0
Supplying Region 17	5,751,711	375,927	835,833	10,739	4,833,635	11,807,845	100.0

TABLE C. 10 (continued)

Producing Region	Wheat	Oats	Barley	Rye	Summer-fallow	Total	% of Land Utilized
	(Acres)						(Per cent)
156	475,231	345,745	0	209,440	784,016	1,814,432	100.0
157	611,656	184,412	0	0	611,657	1,407,725	100.0
158	631,820	0	293,847	12,709	768,073	1,706,449	100.0
159	1,377,705	0	0	0	1,024,570	2,402,275	100.0
160	728,660	181,230	394,612	0	1,075,108	2,379,610	100.0
161	274,955	114,118	357,106	0	632,061	1,378,240	100.0
Supplying Region 18	4,100,027	825,505	1,045,565	222,149	4,895,485	11,088,731	100.0
162	643,369	132,204	201,125	6,792	847,963	1,831,453	100.0
163	749,549	212,859	402,054	0	1,151,603	2,516,065	100.0
164	199,569	144,269	196,885	0	449,431	990,154	100.0
165	544,911	84,872	154,854	0	666,246	1,450,883	100.0
Supplying Region 19	2,137,398	574,204	954,918	6,792	3,115,243	6,788,555	100.0
166	653,202	302,195	611,935	0	1,166,069	2,733,402	100.0
167	1,409,659	0	0	0	869,499	2,279,158	100.0
168	825,464	0	0	0	543,919	1,369,383	100.0
169	277,335	284,030	564,501	13,554	841,836	1,981,257	100.0
170	433,856	0	864,123	0	1,073,626	2,371,605	100.0
Supplying Region 20	3,599,516	586,225	2,040,559	13,554	4,494,949	10,734,805	100.0
SASKATCHEWAN	15,588,652	2,361,861	4,876,875	253,234	17,339,312	40,419,936	100.0
171	312,100	90,324	274,220	0	558,558	1,235,202	100.0
172	381,228	172,084	510,029	0	849,487	1,912,827	100.0
173	302,220	14,401	154,114	76,436	446,601	1,193,188	83.3
174	850,264	0	582,581	0	1,153,985	2,586,830	100.0
Supplying Region 21	1,845,812	276,809	1,520,944	76,436	3,008,631	6,928,047	97.0

TABLE C. 10 (continued)

Producing Region	Wheat	Oats	Barley	Rye	Summer-fallow	Total	% of Land Utilized
			(Acres)				(Per cent)
175	65,765	0	483,031	0	351,165	899,961	100.0
176	649,319	201,929	17,785	0	470,001	1,339,034	100.0
Supplying Region 22	715,084	201,929	500,816	0	821,166	2,238,995	100.0
177	274,509	520,821	512,589	0	787,098	2,095,018	100.0
178	983,479	335,645	497,402	0	889,054	2,705,580	100.0
179	64,363	0	0	21,237	38,189	678,510	18.2
180	960,264	0	0	0	279,907	1,240,171	100.0
181	0	0	903,629	0	239,482	1,143,111	100.0
Supplying Region 23	2,282,615	856,466	1,913,620	21,237	2,233,730	7,862,390	92.9
182 or Supplying Region 24	343,725	145,482	352,679	0	313,440	1,155,326	100.0
183	620,094	147,978	243,199	87,231	436,362	1,883,789	81.5
184	278,160	0	0	0	115,726	393,892	100.0
Supplying Region 25	898,260	147,978	243,199	87,231	552,088	2,277,681	84.7
ALBERTA	6,085,496	1,628,664	4,531,258	184,904	6,929,055	20,462,439	94.6
PRAIRIES	24,706,356	4,669,955	10,942,224	530,911	26,880,943	69,461,154	97.5

TABLE C. 11

REGIONAL LAND USE, BY CROP, IN PRAIRIE PROVINCES (AS PERCENTAGE), MODEL 1

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
137	16.5	0	0	0	5.9	22.4	100.0
138	27.9	0	20.3	0	18.0	66.2	57.8
139	24.9	22.3	26.4	0	26.4	100.0	33.9
140	24.0	0	15.8	0	15.8	55.6	60.2
141	0	0	16.0	0	7.6	23.6	0
Supplying Region 14	23.1	11.0	21.9	0	20.6	76.6	41.3
142	67.5	0	0	0	32.5	100.0	100.0
143	66.8	0	0	0	33.2	100.0	100.0
144	66.2	0	0	0	33.8	100.0	100.0
145	32.5	28.4	0	0	39.1	100.0	53.4
146	13.1	0	49.1	0	37.8	100.0	21.1
147	7.5	0	45.4	12.0	35.1	100.0	11.5
Supplying Region 15	41.4	6.4	14.7	2.0	35.5	100.0	64.2
148	34.2	12.8	18.8	0	34.2	100.0	52.0
149	54.1	0	15.0	0.6	30.3	100.0	77.6
150	34.0	0	33.0	0	33.0	100.0	50.7
Supplying Region 16	39.1	6.9	20.8	0.2	33.0	100.0	58.4
MANITOBA	35.3	7.9	17.9	1.1	30.5	92.7	56.8
151	57.5	0	0	0	42.5	100.0	100.0
152	61.0	0	0	0	39.0	100.0	100.0
153	60.2	0	0	0	39.8	100.0	100.0
154	52.1	0	12.0	0	35.9	100.0	81.3
155	26.6	10.9	17.8	0.3	44.4	100.0	47.8
Supplying Region 17	48.7	3.2	7.1	0.1	40.9	100.0	82.5

TABLE C. 11 (continued)

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
156	26.2	19.1	0	11.5	43.2	100.0	46.1
157	43.4	13.1	0	0	43.5	100.0	76.8
158	37.1	0	17.2	0.7	45.0	100.0	67.3
159	57.3	0	0	0	42.7	100.0	100.0
160	30.6	7.6	16.6	0	45.2	100.0	55.9
161	19.9	8.3	25.9	0	45.9	100.0	36.9
Supplying Region 18	37.0	7.4	9.4	2.0	44.2	100.0	66.2
162	35.1	7.2	11.0	0.4	46.3	100.0	65.4
163	29.8	8.4	16.0	0	45.8	100.0	54.9
164	20.1	14.6	19.9	0	45.4	100.0	36.9
165	37.6	5.8	10.7	0	45.9	100.0	69.5
Supplying Region 19	31.5	8.5	14.0	0.1	45.9	100.0	58.2
166	23.9	11.1	22.4	0	42.6	100.0	41.7
167	61.9	0	0	0	38.1	100.0	100.0
168	60.3	0	0	0	39.7	100.0	100.0
169	14.0	14.3	28.5	0.7	42.5	100.0	24.3
170	18.3	0	36.4	0	45.3	100.0	33.4
Supplying Region 20	33.5	5.5	19.0	0.1	41.9	100.0	57.7
SASKATCHEWAN	38.6	5.8	12.1	0.6	42.9	100.0	67.5
171	25.3	7.3	22.2	0	45.2	100.0	46.1
172	19.9	9.0	26.7	0	44.4	100.0	35.9
173	25.3	1.2	12.9	6.4	37.4	83.2	55.2
174	32.9	0	22.5	0	44.6	100.0	59.3
Supplying Region 21	26.6	3.9	22.0	1.1	43.4	97.0	49.6

TABLE C. 11 (continued)

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
175	7.3	0	53.7	0	39.0	100.0	12.0
176	48.5	15.1	1.3	0	35.1	100.0	74.7
Supplying Region 22	31.9	9.0	22.4	0	36.7	100.0	50.4
177	13.1	24.9	24.5	0	37.6	100.0	21.0
178	36.4	12.4	18.4	0	32.8	100.0	54.1
179	9.5	0	0	3.1	5.6	18.2	75.2
180	77.4	0	0	0	22.6	100.0	100.0
181	0	0	79.0	0	21.0	100.0	0
Supplying Region 23	29.0	10.9	24.3	0.3	28.4	92.9	45.0
182 or Supplying Region 24	29.8	12.6	30.5	0	27.1	100.0	40.8
183	32.9	7.9	12.9	4.6	23.2	81.5	56.5
184	70.6	0	0	0	29.4	100.0	100.0
Supplying Region 25	39.5	6.5	10.7	3.8	24.2	84.7	65.2
ALBERTA*	29.7	8.0	22.1	0.9	33.9	94.6	49.0
PRAIRIES*	35.5	6.7	15.8	0.8	38.7	97.5	60.5

*Includes Peace River area of British Columbia.

TABLE C.12

REGIONAL LAND USE, BY CROP, IN PRAIRIE PROVINCES (AS PERCENTAGE), MODEL 2

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
137	0	0	0	0	0	0	0
138	32.5	0	0	0	12.1	44.6	100.0
139	28.6	18.6	0	0	16.9	64.1	60.6
140	24.0	0	15.8	0	15.8	55.6	60.2
141	0	0	16.0	0	7.6	23.6	0
Supplying Region 14	25.8	9.1	3.2	0	14.2	52.3	67.7
142	35.8	31.7	0	0	32.5	100.0	53.1
143	66.8	0	0	0	33.2	100.0	100.0
144	66.2	0	0	0	33.8	100.0	100.0
145	32.5	28.4	0	0	39.1	100.0	53.4
146	13.1	0	49.1	0	37.8	100.0	21.1
147	4.6	0	45.4	14.9	35.1	100.0	7.1
Supplying Region 15	34.9	12.4	14.7	2.4	35.6	100.0	54.1
148	28.1	12.8	24.9	0	34.2	100.0	42.6
149	53.1	0	15.9	0.7	30.3	100.0	76.2
150	14.0	0	13.7	0	13.7	41.4	50.7
Supplying Region 16	31.4	6.9	20.3	0.2	28.9	87.7	53.4
MANITOBA	31.5	10.6	12.0	1.3	27.8	83.2	56.9
151	57.5	0	0	0	42.5	100.0	100.0
152	61.0	0	0	0	39.0	100.0	100.0
153	60.2	0	0	0	39.8	100.0	100.0
154	43.7	0	20.4	0	35.9	100.0	68.2
155	26.6	10.9	17.8	0.3	44.4	100.0	47.8
Supplying Region 17	47.4	3.2	8.4	0.1	40.9	100.0	80.2

TABLE C.12 (continued)

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
156	25.9	19.4	0	11.5	43.2	100.0	45.5
157	42.2	14.3	0	0	43.5	100.0	74.7
158	37.0	0	17.2	0.8	45.0	100.0	67.3
159	42.6	0	14.7	0	42.7	100.0	74.4
160	28.6	9.6	16.6	0	45.2	100.0	52.2
161	15.5	12.7	25.9	0	45.9	100.0	28.7
Supplying Region 18	32.6	8.6	12.6	2.0	44.2	100.0	58.4
162	27.7	5.9	11.0	0.3	38.7	83.6	61.6
163	29.8	8.4	16.0	0	45.8	100.0	54.9
164	16.3	14.6	19.9	0	42.2	93.0	32.1
165	37.6	5.8	10.7	0	45.9	100.0	69.4
Supplying Region 19	28.9	8.1	14.1	0.1	43.4	94.6	56.5
166	23.9	11.0	22.4	0	42.7	100.0	41.7
167	27.0	0	0	0	16.7	42.7	100.0
168	60.3	0	0	0	39.7	100.0	100.0
169	14.0	14.3	28.5	0.7	42.5	100.0	24.3
170	18.3	0	36.4	0	45.3	100.0	33.4
Supplying Region 20	26.1	5.5	19.0	0.1	37.3	88.0	51.5
SASKATCHEWAN	34.6	6.1	13.3	0.6	41.3	95.9	63.3
171	12.7	5.1	21.9	7.3	38.8	85.8	27.1
172	19.9	9.0	26.7	0	44.4	100.0	35.8
173	22.5	4.0	12.9	5.5	36.7	81.6	50.1
174	29.8	0	25.6	0	44.6	100.0	53.8
Supplying Region 21	22.8	4.1	23.0	2.2	42.2	94.3	43.7

TABLE C.12 (continued)

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
175	7.3	0	53.7	0	39.0	100.0	12.0
176	47.5	15.2	2.2	0	35.1	100.0	73.2
Supplying Region 22	31.4	9.1	22.8	0	36.7	100.0	49.5
177	12.1	24.8	24.5	1.0	37.6	100.0	19.4
178	21.9	12.4	32.8	0	32.9	100.0	32.6
179	3.9	0	5.6	0.6	4.5	14.6	38.6
180	77.4	0	0	0	22.6	100.0	100.0
181	0	0	26.6	0	7.0	33.6	0
Supplying Region 23	23.3	10.9	22.2	0.3	26.3	83.0	41.1
182 or Supplying Region 24	4.4	12.6	33.9	0	19.0	69.9	8.7
183	12.0	5.1	9.3	1.9	11.3	39.6	42.3
184	18.6	0	12.8	0	13.1	44.5	59.3
Supplying Region 25	13.1	4.2	9.9	1.6	11.6	40.4	45.5
ALBERTA*	21.8	7.7	21.8	1.1	30.7	83.1	41.6
PRAIRIES*	30.4	7.1	15.7	0.8	36.5	90.5	56.3

*Includes Peace River area of British Columbia.

TABLE C. 13

REGIONAL LAND USE, BY CROP, IN PRAIRIE PROVINCES (AS PERCENTAGE), MODEL 3

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
137	0	0	0	0	0	0	0
138	32.5	0	0	0	12.1	44.6	100.0
139	28.6	18.6	0	0	16.9	64.1	60.6
140	24.0	0	15.8	0	15.8	55.6	60.2
141	0	0	16.0	0	7.6	23.6	0
Supplying Region 14	25.8	9.1	3.2	0	14.2	52.3	67.6
142	23.3	20.1	0	0	20.9	64.3	53.7
143	44.3	0	0	0	22.0	66.3	100.0
144	66.2	0	0	0	33.8	100.0	100.0
145	32.5	28.4	0	0	39.1	100.0	53.4
146	13.1	0	49.1	0	37.8	100.0	21.1
147	0	0.7	42.1	14.4	30.9	88.1	0
Supplying Region 15	28.6	10.3	14.2	2.4	31.0	86.5	51.5
148	0	12.8	19.5	0	16.8	49.1	0
149	12.9	0	20.8	0.6	15.0	49.3	37.6
150	14.1	0	13.7	0	13.7	41.4	50.7
Supplying Region 16	6.2	6.9	18.6	0.2	15.7	47.6	19.4
MANITOBA	24.3	9.3	11.4	1.3	23.4	69.7	52.3
151	57.5	0	0	0	42.5	100.0	100.0
152	61.0	0	0	0	39.0	100.0	100.0
153	60.2	0	0	0	39.8	100.0	100.0
154	39.3	0	24.8	0	35.9	100.0	61.2
155	27.1	10.4	17.8	0.3	44.4	100.0	48.8
Supplying Region 17	46.9	3.0	9.1	0.1	40.9	100.0	79.3

TABLE C. 13 (continued)

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
156	25.9	19.4	0	11.5	43.2	100.0	45.5
157	31.8	24.8	0	0	43.4	100.0	56.2
158	30.1	6.7	17.2	1.0	45.0	100.0	54.6
159	39.0	0	18.4	0	42.6	100.0	67.9
160	28.6	9.6	16.6	0	45.2	100.0	52.2
161	15.5	12.7	25.9	0	45.9	100.0	28.7
Supplying Region 18	29.4	11.0	13.4	2.0	44.2	100.0	52.6
162	27.7	5.9	9.2	0.3	37.1	80.2	64.2
163	29.8	8.4	16.0	0	45.8	100.0	54.9
164	16.3	12.7	19.9	0	40.6	89.5	33.4
165	37.6	5.8	10.7	0	45.9	100.0	69.4
Supplying Region 19	28.9	7.8	13.6	0.1	42.7	93.1	57.4
166	14.9	11.0	22.4	0	36.0	84.3	30.8
167	27.0	0	0	0	16.7	43.7	100.0
168	60.3	0	0	0	39.7	100.0	100.0
169	9.9	12.0	28.5	0.5	37.6	88.5	19.4
170	18.3	0	36.4	0	45.3	100.0	33.4
Supplying Region 20	23.1	5.0	19.0	0.1	34.7	81.9	48.9
SASKATCHEWAN	32.7	6.5	13.7	0.6	40.5	94.0	61.1
171	12.7	5.1	16.1	7.3	34.1	75.3	30.9
172	19.9	9.0	26.7	0	44.4	100.0	35.8
173	17.8	8.7	12.9	5.5	36.7	81.6	39.7
174	28.0	0	27.4	0	44.6	100.0	50.5
Supplying Region 21	21.3	4.9	22.7	2.2	41.3	92.4	41.6

TABLE C. 13 (continued)

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
175	7.3	0	53.7	0	39.0	100.0	12.0
176	47.5	15.2	2.2	0	35.1	100.0	73.2
Supplying Region 22	31.3	9.1	22.9	0	36.7	100.0	49.5
177	7.6	21.9	24.5	1.0	33.0	88.0	13.8
178	21.9	12.4	32.9	0	32.8	100.0	32.6
179	0	0	0	0.6	0.3	0.9	0
180	19.9	0	0	0	5.8	25.7	100.0
181	0	0	26.6	0	7.0	33.6	0
Supplying Region 23	12.7	10.1	21.7	0.3	22.1	66.9	28.3
182 or.							
Supplying Region 24	4.4	12.6	33.9	0	19.0	69.9	8.7
183	12.0	5.1	9.6	1.6	11.3	39.6	42.3
184	19.7	0	11.7	0	13.1	44.5	62.8
Supplying Region 25	13.3	4.2	10.0	1.3	11.6	40.4	46.1
ALBERTA*	17.2	7.7	21.6	1.0	28.8	76.3	36.3
PRAIRIES*	27.1	7.2	15.7	0.8	34.9	85.7	53.3

*Includes Peace River area of British Columbia.

TABLE C.14

REGIONAL LAND USE, BY CROP, IN PRAIRIE PROVINCES (AS PERCENTAGE), MODEL 4

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
137	16.5	0	0	0	5.9	22.4	100.0
138	32.5	0	0	0	12.1	44.6	100.0
139	31.9	18.6	1.9	0	18.8	71.2	60.9
140	24.0	0	15.8	0	15.8	55.6	60.2
141	0	0	16.0	0	7.6	23.6	0
Supplying Region 14	27.9	9.1	4.1	0	15.2	56.3	67.8
142	35.8	31.7	0	0	32.5	100.0	53.1
143	66.8	0	0	0	33.2	100.0	100.0
144	66.2	0	0	0	33.8	100.0	100.0
145	32.5	28.4	0	0	39.1	100.0	53.4
146	13.1	0	49.1	0	37.8	100.0	21.1
147	3.0	4.6	45.4	11.9	35.1	100.0	4.7
Supplying Region 15	34.7	13.2	14.7	1.9	35.5	100.0	53.7
148	34.2	12.8	18.8	0	34.2	100.0	51.9
149	54.1	0	15.0	0.6	30.3	100.0	77.6
150	34.0	0	33.0	0	33.0	100.0	50.7
Supplying Region 16	39.1	6.9	20.8	0.2	33.0	100.0	58.4
MANITOBA	33.2	11.0	12.3	1.1	28.8	86.4	57.6
151	57.5	0	0	0	42.5	100.0	100.0
152	61.0	0	0	0	39.0	100.0	100.0
153	60.2	0	0	0	39.8	100.0	100.0
154	39.3	0	24.8	0	35.9	100.0	61.2
155	26.6	10.9	17.8	0.3	44.4	100.0	47.8
Supplying Region 17	46.7	3.2	9.1	0.1	40.9	100.0	79.1

TABLE C.14 (continued)

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
				(Per cent)			
156	25.9	19.4	0	11.5	43.2	100.0	45.5
157	36.6	20.0	0	0	43.4	100.0	64.6
158	36.8	0	17.2	1.0	45.0	100.0	66.8
159	42.7	0	14.7	0	42.6	100.0	74.4
160	28.6	9.6	16.6	0	45.2	100.0	52.2
161	15.5	12.7	25.9	0	45.9	100.0	28.7
Supplying Region 18	31.8	9.5	12.6	2.0	44.1	100.0	57.0
162	35.1	7.3	11.0	0.3	46.3	100.0	65.3
163	29.8	8.5	16.0	0	45.7	100.0	54.9
164	20.1	14.6	19.9	0	45.4	100.0	36.9
165	37.6	5.8	10.7	0	45.9	100.0	69.4
Supplying Region 19	31.5	8.5	14.1	0.1	45.8	100.0	58.1
166	20.3	14.7	22.4	0	42.6	100.0	35.4
167	27.0	0	0	0	16.7	43.7	100.0
168	60.3	0	0	0	39.7	100.0	100.0
169	14.0	14.3	28.5	0.7	42.5	100.0	24.3
170	18.3	0	36.4	0	45.3	100.0	33.4
Supplying Region 20	25.2	6.4	19.0	0.1	37.3	88.0	49.7
SASKATCHEWAN	34.4	6.6	13.5	0.6	41.7	96.8	62.3
171	15.7	7.3	22.2	9.6	45.2	100.0	28.6
172	19.9	9.0	26.7	0	44.4	100.0	35.8
173	25.2	1.4	12.9	5.5	36.7	81.7	56.0
174	29.9	0	25.5	0	44.6	100.0	53.9
Supplying Region 21	23.8	4.0	23.1	2.7	43.3	96.9	44.4

TABLE C.14 (continued)

Producing Region	Crops as Percentage of Total Acreage Available for Cereals and Summerfallow						Wheat as Percentage of Cropped Acreage
	Wheat	Oats	Barley	Rye	Summer-fallow	Total	
	(Per cent)						
175	7.3	0	53.7	0	39.0	100.0	12.0
176	48.5	15.1	1.3	0	35.1	100.0	74.7
Supplying Region 22	31.9	9.0	22.4	0	36.7	100.0	50.4
177	12.1	24.8	24.5	1.0	37.6	100.0	19.4
178	21.9	12.4	32.9	0	32.8	100.0	32.6
179	9.5	0	0	0.6	4.5	14.6	94.0
180	77.4	0	0	0	22.6	100.0	100.0
181	0	0	28.7	0	7.6	36.3	0
Supplying Region 23	23.8	10.9	22.0	0.3	26.4	83.4	41.7
182 or Supplying Region 24	4.4	12.6	33.9	0.2	19.1	70.2	8.7
183	12.0	5.1	9.8	1.4	11.3	39.6	42.3
184	20.6	0	10.9	0	13.1	44.6	65.4
Supplying Region 25	13.5	4.2	10.0	1.2	11.6	40.5	46.6
ALBERTA*	22.4	7.7	21.7	1.2	31.2	84.2	42.3
PRAIRIES*	30.7	7.5	15.8	0.8	37.0	91.8	56.0

*Includes Peace River area of British Columbia.

TABLE C.15

REGIONAL LAND USE, BY CROP, IN ONTARIO, MODEL 1

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total	% of Land Utilized
				(Acres)					(Per cent)
83	0	1,153	19,693	7,942	0	14,391	1,938	45,117	100.0
84	0	3,103	4,751	2,797	0	0	1,962	27,967	45.1
85	0	2,015	21,090	4,867	0	5,009	1,699	34,680	100.0
86	0	2,504	0	9,403	0	11,007	1,338	24,252	100.0
87	0	6,259	0	9,375	0	24,766	8,594	48,994	100.0
88	0	3,456	13,235	15,642	0	0	3,855	36,188	100.0
89	0	2,338	0	5,031	0	11,383	0	18,752	100.0
90	0	7,133	0	10,558	523	4,867	0	23,081	100.0
91	0	9,859	17,840	12,050	0	12,974	839	53,562	100.0
92	0	3,689	3,540	7,088	0	14,351	0	28,668	100.0
93	0	8,095	1,266	4,097	0	7,536	0	20,994	100.0
94	0	24,894	0	2,939	0	1,161	0	28,994	100.0
95	0	25,531	0	0	0	0	10,387	35,918	100.0
96	0	20,578	0	18,515	0	10,634	0	49,727	100.0
Supplying Region 9	0	120,607	81,415	110,304	523	118,079	30,612	476,894	96.8
97	0	5,751	13,840	9,539	0	0	0	29,130	100.0
98	0	606	0	51	0	0	0	1,039	63.2
99	0	41,410	0	0	0	0	12,578	53,988	100.0
100	0	28,553	0	16,710	0	0	0	45,263	100.0
101	0	241	2,173	584	0	0	0	2,998	100.0
102	0	45,633	0	11,471	0	0	11,948	69,052	100.0
103	0	66,347	0	0	0	0	16,479	82,826	100.0
104	0	96,683	0	23,194	0	0	15,653	135,530	100.0
105	0	19,622	5,588	0	0	8,400	0	33,610	100.0
106	0	0	47,604	0	0	0	0	47,604	100.0
107	0	10,823	1,447	21,546	0	31,436	0	65,252	100.0
108	0	46,300	61,249	27,577	0	0	0	135,126	100.0
109	0	36,999	66,197	15,248	0	0	7,067	125,511	100.0
110	0	49,576	0	24,825	0	79,485	0	153,886	100.0
111	0	35,709	25,525	13,988	0	74,070	24,227	173,519	100.0
112	0	61,563	72,888	0	0	0	67,406	201,857	100.0
113	0	38,460	0	8,178	0	0	13,033	59,671	100.0
Supplying Region 10	0	584,276	296,511	172,911	0	193,391	168,391	1,415,862	99.9

TABLE C.15 (continued)

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total	% of Land Utilized
				(Acres)					(Per cent)
114	0	0	15,441	12,734	0	0	20,532	48,707	100.0
115	0	45,066	0	6,005	0	15,725	28,613	95,409	100.0
116	0	0	11,350	2,987	0	0	5,634	19,971	100.0
117	0	0	9,244	0	0	5,239	12,813	27,296	100.0
118	0	0	21,803	13,513	0	15,168	18,812	69,296	100.0
119	0	27,622	56,076	657	0	8,362	5,054	97,771	100.0
120	0	0	11,315	0	0	50,155	88,310	149,780	100.0
121	0	0	6,942	4,769	0	16,179	44,137	72,027	100.0
122	0	132,912	0	35,899	0	12,835	2,691	184,337	100.0
123	0	0	23,653	13,704	0	0	161,341	198,698	100.0
124	0	4,257	4,927	0	0	0	121,676	130,860	100.0
125	0	138,791	19,772	0	0	0	0	158,563	100.0
126	0	0	43,398	0	0	0	237,191	280,589	100.0
Supplying Region 11	0	348,648	223,921	90,268	0	123,663	746,804	1,533,304	100.0
127	0	148	0	2,916	0	7,999	0	11,063	100.0
128	0	0	0	1,816	26	6,241	0	8,083	100.0
129	0	0	0	592	0	8,724	0	9,316	100.0
130	0	2,746	0	2,091	0	6,296	0	11,133	100.0
131	0	2,726	0	5,985	0	19,448	0	28,159	100.0
132	0	1,656	0	2,944	0	0	0	4,600	100.0
133	0	1,409	7,273	0	0	0	0	8,682	100.0
134	0	0	578	1,684	0	4,887	0	7,149	100.0
Supplying Region 12	0	8,685	7,851	18,028	26	53,595	0	88,185	100.0
135	0	1,304	550	0	0	1,992	0	4,783	80.4
136	0	0	304	2,012	149	0	0	4,200	58.7
Supplying Region 13	0	1,304	854	2,012	149	1,992	0	8,983	70.3
ONTARIO	0	1,063,520	610,552	393,523	698	490,720	945,807	3,523,228	99.5

TABLE C.16

REGIONAL LAND USE, BY CROP, IN ONTARIO, MODEL 2

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total	% of Land Utilized
				(Acres)					(Per cent)
83	0	1,153	19,693	7,942	0	14,391	1,938	45,117	100.0
84	0	1,335	4,751	2,797	0	0	1,962	27,967	38.8
85	0	2,015	21,090	4,867	0	5,009	1,699	34,680	100.0
86	0	2,504	0	2,996	0	3,490	1,338	24,252	42.6
87	0	6,259	0	9,375	0	24,766	8,594	48,994	100.0
88	0	3,456	4,981	15,642	0	0	3,855	36,188	77.2
89	0	2,338	0	5,031	0	11,383	0	18,752	100.0
90	0	7,133	0	10,558	523	4,867	0	23,081	100.0
91	0	9,859	17,840	12,050	0	12,974	839	53,562	100.0
92	0	3,689	3,540	7,088	0	14,351	0	28,668	100.0
93	0	8,095	1,266	4,097	0	7,536	0	20,994	100.0
94	0	24,894	0	2,939	0	1,161	0	28,994	100.0
95	0	25,531	0	0	0	0	10,387	35,918	100.0
96	0	12,737	0	18,515	0	18,475	0	49,727	100.0
Supplying Region 9	0	110,998	73,161	103,897	523	118,403	30,612	476,894	91.8
97	0	5,751	4,895	9,539	0	8,945	0	29,130	100.0
98	0	606	0	51	0	0	0	1,039	63.2
99	0	41,410	0	0	0	0	12,578	53,988	100.0
100	0	28,553	0	16,710	0	0	0	45,263	100.0
101	0	241	749	584	0	1,424	0	2,998	100.0
102	0	45,633	0	11,471	0	0	11,948	69,052	100.0
103	0	66,347	0	0	0	0	16,479	82,826	100.0
104	0	96,683	0	23,194	0	0	15,653	135,530	100.0
105	0	19,622	5,588	0	0	8,400	0	33,610	100.0
106	0	16,516	27,473	3,615	0	0	0	47,604	100.0
107	0	10,823	0	21,546	0	32,883	0	65,252	100.0
108	0	46,300	61,249	27,577	0	0	0	135,126	100.0
109	0	36,999	0	38,439	0	43,006	7,067	125,511	100.0
110	0	49,576	0	24,825	0	79,485	0	153,886	100.0
111	0	35,709	0	13,988	0	99,595	24,227	173,519	100.0
112	0	61,563	0	24,990	0	47,898	67,406	201,857	100.0
113	0	38,460	0	8,178	0	0	13,033	59,671	100.0
Supplying Region 10	0	600,792	99,954	224,707	0	321,636	168,391	1,415,862	100.0

TABLE C.16 (continued)

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total	% of Land Utilized
				(Acres)					(Per cent)
114	0	0	28,559	12,734	0	0	7,414	48,707	100.0
115	0	45,066	0	5,780	0	15,950	28,613	95,409	100.0
116	0	0	11,350	2,987	0	0	5,634	19,971	100.0
117	0	0	9,244	0	0	5,239	12,813	27,296	100.0
118	0	0	21,803	13,513	0	15,168	18,812	69,296	100.0
119	0	32,417	56,076	916	0	8,362	0	97,771	100.0
120	0	0	5,601	0	0	55,869	88,310	149,780	100.0
121	0	0	6,942	4,769	0	16,179	44,137	72,027	100.0
122	0	143,466	0	35,899	0	4,972	0	184,337	100.0
123	0	0	22,207	13,704	0	1,446	161,341	198,698	100.0
124	0	9,184	0	0	0	0	121,676	130,860	100.0
125	0	138,791	19,772	0	0	0	0	158,563	100.0
126	0	70,201	43,398	0	0	0	166,990	280,589	100.0
Supplying Region 11	0	439,125	224,952	90,302	0	123,185	655,740	1,533,304	100.0
127	0	148	0	2,916	0	7,999	0	11,063	100.0
128	0	0	0	1,816	0	6,241	0	8,083	99.7
129	0	0	0	592	0	8,724	0	9,316	100.0
130	0	2,746	0	2,091	0	6,296	0	11,133	100.0
131	0	2,726	0	5,985	0	19,448	0	28,159	100.0
132	0	1,656	0	1,741	0	0	0	4,600	73.9
133	0	1,409	7,273	0	0	0	0	8,682	100.0
134	0	0	578	1,684	0	4,887	0	7,149	100.0
Supplying Region 12	0	8,685	7,851	16,825	0	53,595	0	88,185	98.6
135	0	1,304	550	0	0	1,211	0	4,783	64.1
136	0	0	0	0	0	0	0	4,200	0
Supplying Region 13	0	1,304	550	0	0	1,211	0	8,983	34.1
ONTARIO	0	1,160,904	406,468	435,731	523	618,030	854,743	3,523,228	98.7

TABLE C.17

REGIONAL LAND USE, BY CROP, IN ONTARIO, MODEL 3

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total	% of Land Utilized
				(Acres)					(Per cent)
83	0	1,153	19,693	7,942	0	14,391	1,938	45,117	100.0
84	0	1,335	0	2,797	0	0	1,962	27,967	21.8
85	0	2,015	21,090	4,867	0	5,009	1,699	34,680	100.0
86	0	2,504	0	2,996	0	3,490	1,338	24,252	42.6
87	0	6,259	0	9,375	0	24,766	8,594	48,994	100.0
88	0	120	4,981	5,397	0	0	3,855	36,188	39.7
89	0	2,338	0	5,031	0	11,383	0	18,752	100.0
90	0	7,133	0	10,558	523	4,867	0	23,081	100.0
91	0	9,859	17,840	12,050	0	12,974	839	53,562	100.0
92	0	3,689	3,540	7,088	0	14,351	0	28,668	100.0
93	0	8,095	1,266	4,097	0	7,536	0	20,994	100.0
94	0	24,894	0	2,939	0	1,161	0	28,994	100.0
95	0	25,531	0	0	0	0	10,387	35,918	100.0
96	0	12,737	0	18,515	0	18,475	0	49,727	100.0
Supplying Region 9	0	107,662	68,410	93,652	523	118,403	30,612	476,894	87.9
97	0	5,751	4,895	9,539	0	8,945	0	29,130	100.0
98	0	606	0	51	0	0	0	1,039	63.2
99	0	41,410	0	0	0	0	12,578	53,988	100.0
100	0	28,553	0	16,710	0	0	0	45,263	100.0
101	0	241	101	584	0	262	0	2,998	39.6
102	0	45,633	0	11,471	0	0	11,948	69,052	100.0
103	0	66,347	0	0	0	0	16,479	82,826	100.0
104	0	96,683	0	23,194	0	0	15,653	135,530	100.0
105	0	25,210	0	0	0	8,400	0	33,610	100.0
106	0	16,516	27,473	3,615	0	0	0	47,604	100.0
107	0	10,823	0	21,546	0	32,883	0	65,252	100.0
108	0	46,300	0	27,577	0	10,390	0	135,126	62.4
109	0	36,999	0	38,439	0	43,006	7,067	125,511	100.0
110	0	49,576	0	24,825	0	79,485	0	153,886	100.0
111	0	35,709	0	13,988	0	99,595	24,227	173,519	100.0
112	0	61,563	0	24,990	0	47,898	67,406	201,857	100.0
113	0	38,460	0	8,178	0	0	13,033	59,671	100.0
Supplying Region 10	0	606,380	32,469	224,707	0	330,864	168,391	1,415,862	96.2

TABLE C.17 (continued)

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total	% of Land Utilized
				(Acres)					(Per cent)
114	0	0	28,559	12,734	0	0	7,414	48,707	100.0
115	0	45,066	0	2,723	0	19,007	28,613	95,409	100.0
116	0	0	11,350	2,987	0	0	5,634	19,971	100.0
117	0	0	9,244	0	0	5,239	12,813	27,296	100.0
118	0	0	21,803	13,513	0	15,168	18,812	69,296	100.0
119	0	28,888	56,076	4,445	0	8,362	0	97,771	100.0
120	0	0	5,601	0	0	55,869	88,310	149,780	100.0
121	0	0	6,942	4,769	0	16,179	44,137	72,027	100.0
122	0	146,642	0	35,899	0	1,796	0	184,337	100.0
123	0	0	22,207	13,704	0	1,446	161,341	198,698	100.0
124	0	9,184	0	0	0	0	121,676	130,860	100.0
125	0	138,791	19,772	0	0	0	0	158,563	100.0
126	0	76,434	43,398	0	0	0	160,756	280,589	100.0
Supplying Region 11	0	445,005	224,952	90,774	0	123,066	649,506	1,533,304	100.0
127	0	148	0	2,916	0	7,999	0	11,063	100.0
128	0	0	0	0	0	0	0	8,083	0.0
129	0	0	0	1,776	0	7,540	0	9,316	100.0
130	0	2,746	0	2,091	0	3,210	0	11,133	72.3
131	0	2,726	0	5,985	0	19,448	0	28,159	100.0
132	0	1,656	0	1,741	0	0	0	4,600	73.9
133	1,286	1,409	5,987	0	0	0	0	8,682	100.0
134	0	0	0	1,684	0	4,887	0	7,149	91.9
Supplying Region 12	1,286	8,685	5,987	16,193	0	43,084	0	88,185	85.3
135	0	1,304	550	0	0	1,211	0	4,783	64.1
136	0	0	0	0	0	0	0	4,200	0.0
Supplying Region 13	0	1,304	550	0	0	1,211	0	8,983	34.1
ONTARIO	1,286	1,169,036	332,368	425,326	523	616,628	848,509	3,523,228	96.3

TABLE C.18

REGIONAL LAND USE, BY CROP, IN ONTARIO, MODEL 4

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total	% of Land Utilized
				(Acres)					(Per cent)
83	0	1,153	19,693	7,942	0	14,391	1,938	45,117	100.0
84	0	1,335	4,751	2,797	0	0	1,962	27,967	38.8
85	0	2,015	21,090	4,867	0	5,009	1,699	34,680	100.0
86	0	2,504	0	9,403	0	3,490	1,338	24,252	69.0
87	0	6,259	0	9,375	0	24,766	8,594	48,994	100.0
88	0	3,456	4,981	15,642	0	8,254	3,855	36,188	100.0
89	0	2,338	0	5,031	0	11,383	0	18,752	100.0
90	0	7,133	0	10,558	523	4,867	0	23,081	100.0
91	0	9,859	17,840	12,050	0	12,974	839	53,562	100.0
92	0	3,689	3,540	7,088	0	14,351	0	28,668	100.0
93	0	8,095	1,266	4,097	0	7,536	0	20,994	100.0
94	0	24,894	0	2,939	0	1,161	0	28,994	100.0
95	0	25,531	0	0	0	0	10,387	35,918	100.0
96	0	12,737	0	18,515	0	18,475	0	49,727	100.0
Supplying Region 9	0	110,998	73,161	110,304	523	126,657	30,612	476,894	94.8
97	0	5,751	4,895	9,539	0	8,945	0	29,130	100.0
98	0	606	0	51	0	0	0	1,039	63.2
99	0	41,410	0	0	0	0	12,578	53,988	100.0
100	0	28,553	0	16,710	0	0	0	45,263	100.0
101	0	241	487	584	0	1,686	0	2,998	100.0
102	0	45,633	0	11,471	0	0	11,948	69,052	100.0
103	0	66,347	0	0	0	0	16,479	82,826	100.0
104	0	96,683	0	23,194	0	0	15,653	135,530	100.0
105	0	25,210	0	0	0	8,400	0	33,610	100.0
106	0	16,516	0	3,615	0	27,473	0	47,604	100.0
107	0	10,823	0	21,546	0	32,883	0	65,252	100.0
108	0	46,300	0	27,577	0	61,249	0	135,126	100.0
109	0	36,999	0	38,439	0	43,006	7,067	125,511	100.0
110	0	49,576	0	24,825	0	79,485	0	153,886	100.0
111	0	35,709	0	13,988	0	99,595	24,227	173,519	100.0
112	0	61,563	0	24,990	0	47,898	67,406	201,857	100.0
113	0	38,460	0	8,178	0	0	13,033	59,671	100.0
Supplying Region 10	0	606,380	5,382	224,707	0	410,620	168,391	1,415,862	100.0

TABLE C.18 (continued)

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total	% of Land Utilized
				(Acres)					(Per cent)
114	0	0	15,441	12,734	0	0	20,532	48,707	100.0
115	0	45,066	0	6,005	0	15,725	28,613	95,409	100.0
116	0	0	11,350	2,987	0	0	5,634	19,971	100.0
117	0	0	7,282	1,962	0	5,239	12,813	27,296	100.0
118	0	0	21,803	13,513	0	15,168	18,812	69,296	100.0
119	0	32,499	47,500	3,699	0	8,362	5,711	97,771	100.0
120	0	0	0	0	0	61,470	88,310	149,780	100.0
121	0	0	6,942	6,553	0	14,395	44,137	72,027	100.0
122	0	87,200	0	17,191	0	1,796	78,150	184,337	100.0
123	0	16,706	5,094	14,979	0	579	161,341	198,698	100.0
124	0	9,184	0	0	0	0	121,676	130,860	100.0
125	0	138,791	8,692	11,080	0	0	0	158,563	100.0
126	0	0	43,398	0	0	0	237,191	280,589	100.0
Supplying Region 11	0	329,446	167,502	90,703	0	122,734	822,920	1,533,304	100.0
127	0	148	0	2,916	0	7,999	0	11,063	100.0
128	0	0	0	1,816	26	6,241	0	8,083	100.0
129	0	0	0	592	0	8,724	0	9,316	100.0
130	0	2,746	0	2,091	0	6,296	0	11,133	100.0
131	0	2,726	0	5,985	0	19,448	0	28,159	100.0
132	0	1,656	0	2,944	0	0	0	4,600	100.0
133	0	1,409	7,273	0	0	0	0	8,682	100.0
134	0	0	578	1,684	0	4,887	0	7,149	100.0
Supplying Region 12	0	8,685	7,851	18,028	26	53,595	0	88,185	100.0
135	0	1,304	550	0	0	1,211	0	4,783	64.1
136	0	0	0	0	0	0	0	4,200	0
Supplying Region 13	0	1,304	550	0	0	1,211	0	8,983	34.1
ONTARIO	0	1,056,813	254,446	443,742	549	714,817	1,021,923	3,523,228	99.1

TABLE C. 19

REGIONAL LAND USE, BY CROP, IN ONTARIO, MODEL 7

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total	% of Land Utilized
				(Acres)					(Per cent)
83	0	1,153	19,693	7,942	0	14,391	1,938	45,117	100.0
84	0	3,103	15,063	7,839	0	0	1,962	27,967	100.0
85	0	2,015	21,090	4,867	0	5,009	1,699	34,680	100.0
86	0	2,504	0	9,403	0	11,007	1,338	24,252	100.0
87	0	6,259	0	9,375	0	24,766	8,594	48,994	100.0
88	0	3,456	13,235	15,642	0	0	3,855	36,188	100.0
89	0	2,338	0	5,031	0	11,383	0	18,752	100.0
90	0	7,133	0	10,558	523	4,867	0	23,081	100.0
91	0	9,859	17,840	12,050	0	12,974	839	53,562	100.0
92	0	3,689	8,987	7,088	0	8,904	0	28,668	100.0
93	0	8,095	1,266	4,097	0	7,536	0	20,994	100.0
94	0	24,894	0	2,939	0	1,161	0	28,994	100.0
95	0	25,531	0	0	0	0	10,387	35,918	100.0
96	0	12,737	0	18,515	0	18,475	0	49,727	100.0
Supplying Region 9	0	112,766	97,174	115,346	523	120,473	30,612	476,894	100.0
97	0	5,751	4,895	9,539	0	8,945	0	29,130	100.0
98	0	606	0	433	0	0	0	1,039	100.0
99	0	41,410	0	0	0	0	12,578	53,988	100.0
100	0	28,553	0	16,710	0	0	0	45,263	100.0
101	0	241	487	584	0	1,686	0	2,998	100.0
102	0	45,633	0	11,471	0	0	11,948	69,052	100.0
103	0	66,347	0	0	0	0	16,479	82,826	100.0
104	0	96,683	0	23,194	0	0	15,653	135,530	100.0
105	0	25,210	0	0	0	8,400	0	33,610	100.0
106	0	16,516	27,473	3,615	0	0	0	47,604	100.0
107	0	10,823	0	21,546	0	32,883	0	65,252	100.0
108	0	46,300	58,866	27,577	0	2,383	0	135,126	100.0
109	0	36,999	0	38,439	0	43,006	7,067	125,511	100.0
110	0	49,576	0	24,825	0	79,485	0	153,886	100.0
111	0	35,709	0	13,988	0	99,595	24,227	173,519	100.0
112	0	61,563	0	24,990	0	47,898	67,406	201,857	100.0
113	0	38,460	0	8,178	0	0	13,033	59,671	100.0
Supplying Region 10	0	606,380	91,721	225,089	0	324,281	168,391	1,415,862	100.0

TABLE C. 19 (continued)

Producing Region	Spring Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total	% of Land Utilized
				(Acres)					(Per cent)
114	0	0	28,559	12,734	0	0	7,414	48,707	100.0
115	0	45,066	0	5,780	0	15,950	28,613	95,409	100.0
116	0	0	11,350	2,987	0	0	5,634	19,971	100.0
117	0	0	9,244	0	0	5,239	12,813	27,296	100.0
118	0	0	21,803	13,513	0	15,168	18,812	69,296	100.0
119	0	32,417	56,076	916	0	8,362	0	97,771	100.0
120	0	0	5,601	0	0	55,869	88,310	149,780	100.0
121	0	0	6,942	4,769	0	16,179	44,137	72,027	100.0
122	0	143,466	0	35,899	0	4,972	0	184,337	100.0
123	0	0	22,207	13,704	0	1,446	161,341	198,698	100.0
124	0	9,184	0	0	0	0	121,676	130,860	100.0
125	0	138,791	19,772	0	0	0	0	158,563	100.0
126	0	73,765	43,398	0	0	0	163,426	280,589	100.0
Supplying Region 11	0	442,689	224,952	90,302	0	123,185	652,176	1,533,304	100.0
127	0	148	0	2,916	0	7,999	0	11,063	100.0
128	0	0	0	1,816	26	6,241	0	8,083	100.0
129	0	0	0	1,776	0	7,540	0	9,316	100.0
130	0	2,746	0	2,091	0	6,296	0	11,133	100.0
131	0	2,726	0	5,985	0	19,448	0	28,159	100.0
132	0	1,656	0	2,944	0	0	0	4,600	100.0
133	1,286	1,409	5,987	0	0	0	0	8,682	100.0
134	0	0	578	1,684	0	4,887	0	7,149	100.0
Supplying Region 12	1,286	8,685	6,565	19,212	26	52,411	0	88,185	100.0
135	0	1,304	1,487	0	0	1,992	0	4,783	100.0
136	0	0	0	3,428	174	598	0	4,200	100.0
Supplying Region 13	0	1,304	1,487	3,428	174	2,590	0	8,983	100.0
ONTARIO	1,286	1,171,824	421,899	453,377	723	622,940	851,179	3,523,228	100.0

TABLE C.20

REGIONAL LAND USE, BY CROP, IN QUEBEC, MODEL 1

Producing Region	Wheat	Oats	Barley	Rye	Mixed Grain	Total	% of Land Utilized
				(Acres)			(Per cent)
13	0	0	0	0	0	142	0
14	1,529	0	0	0	1,798	3,327	100.0
15	2,509	0	4,060	1,363	3,071	11,003	100.0
16	2,011	0	1,718	0	0	15,598	23.9
17	2,510	0	2,175	0	15,505	20,190	100.0
18	6,353	0	3,612	665	23,509	34,139	100.0
19	1,209	0	0	0	0	2,482	48.7
20	1,015	0	3,522	464	5,229	18,308	55.9
21	832	0	2,038	0	18,223	21,093	100.0
22	2,215	0	3,165	1,245	30,959	37,584	100.0
23	1,336	0	4,960	0	15,751	39,062	56.4
24	1,160	0	3,457	0	10,200	14,817	100.0
25	1,891	5,034	6,473	842	8,092	22,332	100.0
Supplying Region 4	24,570	5,034	35,180	4,579	132,337	240,077	84.0
26	0	0	0	0	0	14,524	0
27	339	1,827	4,202	577	1,206	8,151	100.0
28	1,915	6,548	1,372	207	8,164	18,206	100.0
29	0	0	930	0	0	8,366	11.1
30	591	0	5,580	68	8,646	22,482	66.2
31	0	0	0	0	0	28,243	0
32	609	0	2,666	485	0	20,630	18.2
33	1,120	0	5,041	504	7,035	13,700	100.0
34	0	0	4,808	0	8,483	13,291	100.0
35	2,155	0	3,799	910	0	34,505	19.9
36	714	0	4,100	402	0	26,824	19.5
37	2,775	0	1,847	163	3,065	7,850	100.0
38	1,040	0	3,352	0	9,731	15,489	91.2
39	1,173	0	2,368	0	7,385	10,926	100.0
40	473	345	956	0	1,796	3,570	100.0
41	1,013	1,271	2,797	363	4,086	9,530	100.0
42	1,369	0	7,667	262	0	24,605	37.8
43	1,412	15,015	4,168	565	8,328	29,488	100.0
44	607	9,684	8,960	222	9,570	29,043	100.0
45	1,084	4,163	3,310	628	6,837	16,022	100.0
46	578	0	3,088	0	0	3,666	100.0
Supplying Region 5	18,967	38,853	71,011	5,356	84,332	359,111	60.8
47	1,423	0	7,727	1,132	0	12,505	82.2
48	783	0	852	0	0	6,553	25.0
49	495	0	0	0	0	1,606	30.8
50	735	0	5,073	0	0	22,284	26.1
51	692	4,655	2,919	2,136	11,587	21,989	100.0
52	1,072	4,901	4,428	205	4,976	15,582	100.0
53	1,370	0	1,205	1,178	3,411	12,254	58.5
Supplying Region 6	6,570	9,556	22,204	4,651	19,974	92,773	67.9

TABLE C.20 (continued)

Producing Region	Wheat	Oats	Barley	Rye	Mixed Grain	Total	% of Land Utilized
				(Acres)			(Per cent)
54	895	0	0	0	0	13,068	6.9
55	923	0	4,183	0	0	18,550	27.5
56	791	0	4,174	0	0	17,844	27.8
57	857	0	4,376	0	0	9,807	53.4
58	462	0	2,807	0	0	8,504	38.4
59	858	0	6,273	0	12,657	20,498	96.5
60	1,662	0	6,474	0	14,223	22,359	100.0
61	643	0	3,165	483	6,040	14,320	72.1
62	1,505	0	4,279	321	16,538	22,643	100.0
63	1,428	433	6,727	0	15,758	24,346	100.0
64	1,895	0	3,924	0	0	5,819	100.0
65	2,345	0	0	0	0	4,297	54.6
66	760	0	4,702	165	0	11,250	50.0
67	1,305	0	4,559	508	0	12,673	50.3
68	1,860	0	7,601	0	2,704	12,165	100.0
69	980	0	11,116	0	0	12,096	100.0
70	834	0	3,241	0	0	18,065	22.6
71	558	0	14,410	0	0	14,968	100.0
72	1,880	0	6,555	0	6,154	14,589	100.0
73	1,937	0	4,039	0	0	14,857	40.2
74	1,439	0	9,070	826	0	14,311	79.2
75	810	0	8,468	0	0	19,223	48.3
76	1,053	0	4,037	539	0	12,647	44.5
Supplying Region 7	27,680	433	124,180	2,842	74,074	338,899	67.6
77	2,164	0	15,427	0	0	17,591	100.0
78	1,538	0	17,520	252	0	19,310	100.0
79	630	10,560	3,348	474	0	15,012	100.0
80	1,713	16,637	3,170	0	0	21,520	100.0
81	3,414	0	0	0	0	23,138	14.8
82	1,372	0	4,311	0	18,075	23,758	100.0
Supplying Region 8	10,831	27,197	43,776	726	18,075	120,329	83.6
QUEBEC	88,618	81,073	296,351	18,154	328,792	1,151,189	70.6

TABLE C.21

REGIONAL LAND USE, BY CROP, IN MARITIME PROVINCES, MODEL 1

Producing Region	Wheat	Oats	Barley	Mixed Grain	Total	% of Land Utilized
			(Acres)			(Per cent)
1	16	0	0	0	1,286	1.2
2	2,640	0	4,991	858	16,552	51.3
3	2,395	0	8,920	4,855	20,443	79.1
4	158	0	504	774	1,436	100.0
5	562	-	34	0	997	59.8
NOVA SCOTIA Supplying Region 1	5,771	0	14,449	6,487	40,714	65.6
6	0	0	19,010	6,030	25,040	100.0
7	0	0	5,604	22,689	55,594	50.9
8	8,788	0	24,191	34,138	67,117	100.0
PRINCE EDWARD ISLAND Supplying Region 2	8,788	0	48,805	62,857	147,751	81.5
9	7,645	0	13,726	0	52,655	40.6
10	603	1,959	2,867	1,253	9,970	67.0
11	737	0	2,918	2,885	16,296	40.1
12	1,404	0	0	3,299	12,741	36.9
NEW BRUNSWICK Supplying Region 3	10,389	1,959	19,511	7,437	91,662	42.9
MARITIMES	24,948	1,959	82,765	76,781	280,127	66.6

TABLE C.22

REGIONAL LAND USE, BY CROP, IN BRITISH COLUMBIA,* MODEL 1

Producing Region	Wheat	Oats	Barley	Rye	Summer-fallow	Total	% of Land Utilized
				(Acres)			(Per cent)
185 or Supplying Region 26	6,846	0	6,907	1,853	0	23,223	67.2
186	10,835	0	3,544	0	0	14,379	100.0
187	10,981	0	0	102	0	19,086	58.1
Supplying Region 27	21,816	0	3,544	102	0	33,465	76.1
188 or Supplying Region 28	3,923	0	1,597	456	0	6,526	91.6
BRITISH COLUMBIA	32,585	0	12,048	2,411	0	63,214	74.4

*The Peace River area of British Columbia is included in Table C.10 with the Alberta figures.

TABLE C.23

LIVESTOCK CONSUMPTION OF DOMESTICALLY PRODUCED CEREAL GRAINS, BY PROVINCE, MODELS 1 TO 4

Province	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Bushels)			
			MODEL 1				
Newfoundland	141,000	0	130,000	505,380	1,500	0	0
Nova Scotia	181,582	726,141	1,317,764	3,746,274	0	273,622	0
Prince Edward Island	286,752	0	2,616,082	2,585,620	0	3,125,462	0
New Brunswick	308,852	0	2,098,970	2,752,745	0	297,660	0
Quebec	2,209,860	2,315,475	29,700,747	37,048,048	451,760	12,476,302	795,663*
Ontario	0	27,145,494	35,943,704	22,590,839	893,769	25,823,218	62,675,459*
Manitoba	10,670,781	0	22,604,415	40,817,077	410,926	0	0
Saskatchewan	4,257,477	0	32,262,071	72,190,916	586,494	0	0
Alberta**	6,944,024	0	52,620,013	117,744,671	956,582	0	0
British Columbia**	1,947,796	0	1,696,406	6,391,962	23,729	0	0
Total	26,948,124	30,187,110	180,990,172	306,373,532	3,324,760	41,996,264	63,471,122*
			MODEL 2				
Newfoundland	141,000	0	130,000	505,380	1,500	0	0
Nova Scotia	125,511	782,212	1,317,764	3,746,274	0	273,622	0
Prince Edward Island	286,752	0	2,616,082	2,774,460	0	2,892,325	0
New Brunswick	196,822	112,030	2,098,970	2,775,795	0	269,204	0
Quebec	1,642,095	5,746,532	29,700,747	39,848,792	332,577	4,696,975	795,663*
Ontario	0	27,438,135	35,943,704	25,292,329	893,769	33,142,344	55,236,091*
Manitoba	11,681,483	0	22,604,415	39,533,485	410,926	0	0
Saskatchewan	4,257,477	0	32,262,071	72,190,916	586,494	0	0
Alberta**	6,944,024	0	56,420,832	115,388,164	956,582	0	0
British Columbia**	1,947,796	0	1,696,406	6,391,962	23,729	0	0
Total	27,222,960	34,078,909	184,790,991	308,447,557	3,205,577	41,274,470	56,031,754*

TABLE C.23 (continued)

LIVESTOCK CONSUMPTION OF DOMESTICALLY PRODUCED CEREAL GRAINS, BY PROVINCE, MODELS 1 TO 4

Province	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn
				(Bushels)			
			MODEL 3				
Newfoundland	141,000	0	130,000	505,380	1,500	0	0
Nova Scotia	76,838	830,885	1,317,764	3,746,274	0	273,622	0
Prince Edward Island	286,752	0	2,616,082	3,637,863	0	1,826,396	0
New Brunswick	12,627	296,225	2,098,970	2,811,863	0	224,675	0
Quebec	1,431,420	5,765,249	29,700,747	41,454,647	324,383	3,026,942	795,663*
Ontario	27,289	27,533,677	35,943,704	25,745,229	893,769	33,173,144	54,712,254*
Manitoba	11,681,483	0	22,604,415	39,533,485	410,926	0	0
Saskatchewan	4,257,477	0	32,262,071	72,190,916	586,494	0	0
Alberta**	6,944,024	0	55,580,423	115,909,217	956,582	0	0
British Columbia**	1,947,796	0	1,696,406	6,391,962	23,729	0	0
Total	26,806,706	34,426,036	183,950,582	311,926,836	3,197,383	38,524,779	55,507,917*
			MODEL 4				
Newfoundland	141,000	0	130,000	505,380	1,500	0	0
Nova Scotia	181,582	726,141	1,317,764	3,746,274	0	273,622	0
Prince Edward Island	286,752	0	2,616,082	2,774,460	0	2,892,325	0
New Brunswick	308,852	0	2,098,970	2,780,253	0	263,699	0
Quebec	2,887,191	1,638,144	29,700,747	46,496,826	441,978	8,453,405	3,688,983
Ontario	0	27,626,618	35,943,704	26,613,148	893,769	38,203,908	56,058,361
Manitoba	12,616,393	0	22,604,415	38,346,149	410,926	0	0
Saskatchewan	4,257,477	0	32,262,071	72,190,916	586,494	0	0
Alberta**	6,944,024	0	56,351,089	115,431,404	956,582	0	0
British Columbia**	1,947,796	0	1,696,406	6,391,962	23,729	0	0
Total	29,571,067	29,990,903	184,721,248	315,276,772	3,314,978	50,086,959	59,747,344

*Does not include corn imported from the United States.
**The figures for Alberta include the Peace River area of British Columbia.

TABLE C.24

INTERREGIONAL SHIPMENTS OF CEREALS WITHIN THE PRAIRIES AND NORTHWESTERN ONTARIO, ALTERNATIVE MODELS

Supplying Region		Consuming Region		Wheat	Oats	Barley	Rye
Number	Description	Number	Description				
					(Bushels)		
			MODEL 1				
15	Southwestern Manitoba	13	Northwestern Ontario	202,385	90,055		
18	Southeastern Sask.	13	Northwestern Ontario			1,038,060	463
20	Northwestern Sask.	13	Northwestern Ontario			157,186	
15	Southwestern Manitoba.	14	Southeastern Manitoba				198,358
21	Southeastern Alberta	22	Southeastern Alberta				199,468
21	Southeastern Alberta	23	Northeastern Alberta				119,208
21	Southeastern Alberta	24	North Central Alberta				45,021
			MODEL 2				
15	Southwestern Manitoba	13	Northwestern Ontario	202,385	21,908		
18	Southeastern Sask.	13	Northwestern Ontario		79,352	1,273,060	3,218
15	Southwestern Manitoba	14	Southeastern Manitoba			576,182	198,358
21	Southeastern Alberta	22	Southwestern Alberta				199,468
21	Southeastern Alberta	24	North Central Alberta				91,880
			MODEL 3				
15	Southwestern Manitoba	13	Northwestern Ontario	202,385	21,908		
18	Southeastern Sask.	13	Northwestern Ontario			1,038,060	3,218
19	Southwestern Sask.	13	Northwestern Ontario		107,397		
20	Northwestern Sask.	13	Northwestern Ontairo			235,000	
15	Southwestern Manitoba	14	Southeastern Manitoba				198,358
18	Southeastern Sask.	14	Southeastern Manitoba			11,980,055	
21	Southeastern Alberta	22	Southwestern Alberta				199,468
21	Southeastern Alberta	24	North Central Alberta				91,880

TABLE C.25

SHIPMENTS OF GRAIN FOR LIVESTOCK FEED FROM PRAIRIE REGIONS TO CONSUMING REGIONS IN BRITISH COLUMBIA
MODEL 1

Supplying Region		Consuming Region		Wheat	Oats	Barley	Rye
Number	Description	Number	Description				
				(Bushels)			
21	Southeastern Alberta	26	Central B.C.			1,381,340	
25	Peace River	26	Central B.C.	164,641	392,345		
21	Southeastern Alberta	27	Southeastern B.C.			107,986	
25	Peace River	27	Southeastern B.C.		210,015		
21	Southeastern Alberta	28	Southwestern B.C.			4,395,742	
25	Peace River	28	Southwestern B.C.	791,267	1,080,967		
21	Southeastern Alberta	29	West Coast B.C.			54,080	
25	Peace River	29	West Coast B.C.	11,240	13,079		183

TABLE C.26

SHIPMENTS OF GRAIN FOR LIVESTOCK FEED FROM PRAIRIE REGIONS TO CONSUMING REGIONS IN BRITISH COLUMBIA
MODEL 2

Supplying Region		Consuming Region		Wheat	Oats	Barley	Rye
Number	Description	Number	Description				
				(Bushels)			
21	Southeastern Alberta	26	Central B.C.			1,622,257	
23	Northeastern Alberta	26	Central B.C.	164,641	392,345		
21	Southeastern Alberta	27	Southeastern B.C.			107,986	
23	Northeastern Alberta	27	Southeastern B.C.		210,015		
21	Southeastern Alberta	28	Southwestern B.C.		69,743	4,469,555	
23	Northeastern Alberta	28	Southwestern B.C.	791,267	1,011,224		
25	Peace River	28	Southwestern B.C.				15,120
21	Southeastern Alberta	29	West Coast B.C.			54,080	
23	Northeastern Alberta	29	West Coast B.C.	11,240	13,079		
25	Peace River	29	West Coast B.C.				183

TABLE C.27

SHIPMENTS OF GRAIN FOR LIVESTOCK FEED FROM PRAIRIE REGIONS TO CONSUMING REGIONS IN BRITISH COLUMBIA
MODEL 3

Supplying Region		Consuming Region		Wheat	Oats	Barley	Rye
Number	Description	Number	Description				
				(Bushels)			
21	Southeastern Alberta	26	Central B.C.		112,148	1,622,257	
23	Northeastern Alberta	26	Central B.C.	337,160	280,197		
25	Peace River	26	Central B.C.				5,488
21	Southeastern Alberta	27	Southeastern B.C.		210,015	107,986	
21	Southeastern Alberta	28	Southwestern B.C.		1,080,967	4,469,555	
23	Northeastern Alberta	28	Southwestern B.C.	791,267			
25	Peace River	28	Southwestern B.C.				15,120
21	Southeastern Alberta	29	West Coast, B.C.		13,079	54,080	
23	Northeastern Alberta	29	West Coast, B.C.	11,240			
25	Peace River	29	West Coast, B.C.				183

TABLE C.28

SHIPMENTS OF GRAIN FOR HUMAN CONSUMPTION FROM PRAIRIE REGIONS TO CONSUMING REGIONS IN BRITISH COLUMBIA
MODEL 1

Supplying Region		Consuming Region		Wheat	Oats	Barley	Rye
Number	Description	Number	Description				
				(Bushels)			
25	Peace River	26	Central B.C.	468,989	50,767	208,673	
25	Peace River	27	Southeastern B.C.	558,667	60,475	208,673	
25	Peace River	28	Southwestern B.C.	3,578,301	372,144	1,043,365	133,316
25	Peace River	29	West Coast, B.C.	180,724	19,563		

TABLE C.29

SHIPMENTS OF GRAIN FOR HUMAN CONSUMPTION FROM PRAIRIE REGIONS TO CONSUMING REGIONS IN BRITISH COLUMBIA
MODEL 2

Supplying Region		Consuming Region		Wheat	Oats	Barley	Rye
Number	Description	Number	Description				
				(Bushels)			
25	Peace River	26	Central B.C.	468,989	50,767	208,673	
21	Southeastern Alberta	27	Southeastern B.C.	558,667	60,475	208,673	
22	Southwestern Alberta	27	Southeastern B.C.				
25	Peace River	28	Southwestern B.C.	3,578,301	372,144	1,043,365	133,316
25	Peace River	29	West Coast, B.C.	180,724	19,563		

TABLE C.30

SHIPMENTS OF GRAIN FOR HUMAN CONSUMPTION FROM PRAIRIE REGIONS TO CONSUMING REGIONS IN BRITISH COLUMBIA
MODEL 3

Supplying Region		Consuming Region		Wheat	Oats	Barley	Rye
Number	Description	Number	Description				
				(Bushels)			
25	Peace River	26	Central B.C.	468,989	50,767	208,673	
21	Southeastern Alberta	27	Southeastern B.C.	448,625	60,475	208,673	
22	Southwestern Alberta	27	Southeastern B.C.	110,042			
25	Peace River	27	Southeastern B.C.				
25	Peace River	28	Southwestern B.C.	3,578,301	372,144	1,043,365	133,316
25	Peace River	29	West Coast, B.C.	180,724	19,563		

TABLE C.31

SHIPMENTS OF GRAIN FROM PRAIRIE REGIONS TO TERMINAL ELEVATORS
MODEL 1

Supplying Region		Terminal Destination	Wheat	Oats	Barley	Rye
Number	Description					
				(Bushels)		
20	Northwestern Sask.	Vancouver	28,803,657	1,014,668	3,123,078	
21	Southeastern Alberta	Vancouver	38,296,364		23,921,922	648,157
22	Southwestern Alberta	Vancouver	14,886,578			
23	Northeastern Alberta	Vancouver	44,207,486	5,427,482		
24	North Central Alberta	Vancouver	4,729,801			
25	Peace River	Vancouver	9,849,613			1,854,623
Total		Vancouver	140,773,499	6,442,150	27,045,000	2,502,780
23	Northeastern Alberta	Prince Rupert	10,586,100			
Total		Prince Rupert	10,586,100			
20	Northwestern Sask.	Churchill	19,530,000			
Total		Churchill	19,530,000			
15	Southwestern Manitoba	Thunder Bay	36,338,986	8,360,008		1,590,485
16	Northwestern Manitoba	Thunder Bay	9,657,802			
17	Northeastern Sask.	Thunder Bay	116,912,130			
18	Southeastern Sask.	Thunder Bay	80,770,163	20,080,831	13,241,710	4,877,019
19	Southwestern Sask.	Thunder Bay	33,813,727	10,827,934	18,455,706	
20	Northwestern Sask.	Thunder Bay	12,041,244	6,313,386	42,836,929	
Total		Thunder Bay	289,534,052	45,582,159	74,534,345	6,467,504

TABLE C.32

SHIPMENTS OF GRAIN FROM PRAIRIE REGIONS TO TERMINAL ELEVATORS
MODEL 2

Supplying Region		Terminal Destination	Wheat	Oats	Barley	Rye
Number	Description					
				(Bushels)		
20	Northwestern Sask.	Vancouver	37,447,837	6,442,150		
21	Southeastern Alberta	Vancouver	33,370,025		27,045,000	1,860,811
22	Southwestern Alberta	Vancouver	14,246,811			
23	Northeastern Alberta	Vancouver	32,246,577			
25	Peace River	Vancouver				641,969
Total		Vancouver	117,311,250	6,442,150	27,045,000	2,502,780
23	Northeastern Alberta	Prince Rupert	8,821,750			
Total		Prince Rupert	8,821,750			
17	Northeastern Sask.	Churchill	6,555,388			
20	Northwestern Sask.	Churchill	9,719,612			
Total		Churchill	16,275,000			
15	Southwestern Manitoba	Thunder Bay	29,602,558	22,480,246		1,648,883
16	Northwestern Manitoba	Thunder Bay	7,829,401			
17	Northeastern Sask.	Thunder Bay	106,853,059		5,805,304	
18	Southeastern Sask.	Thunder Bay	72,533,400	24,687,656	11,668,775	4,874,264
19	Southwestern Sask.	Thunder Bay	31,197,234	10,285,785	18,419,335	
20	Northwestern Sask.	Thunder Bay		885,904	46,117,193	
Total		Thunder Bay	248,015,652	58,339,591	82,010,607	6,523,147

TABLE C.33

SHIPMENTS OF GRAIN FROM PRAIRIE REGIONS TO TERMINAL ELEVATORS
MODEL 3

Supplying Region		Terminal Destination	Wheat	Oats	Barley	Rye
Number	Description					
				(Bushels)		
20	Northwestern Sask.	Vancouver	41,782,596	6,041,521		
21	Southeastern Sask.	Vancouver	31,360,936	400,629	27,045,000	1,987,828
22	Southwestern Alberta	Vancouver	14,356,853			
23	Northeastern Alberta	Vancouver	13,052,115			
25	Peace River	Vancouver				514,952
Total		Vancouver	100,552,500	6,442,150	27,045,000	2,502,780
23	Northeastern Alberta	Prince Rupert	7,561,500			
Total		Prince Rupert	7,561,500			
17	Northeastern Sask.	Churchill	13,950,000			
Total		Churchill	13,950,000			
15	Southwestern Manitoba	Thunder Bay	23,962,856	17,530,320		1,582,490
16	Northwestern Manitoba	Thunder Bay	687,450			
17	Northeastern Sask.	Thunder Bay	97,581,683	8,877,825		
18	Southeastern Sask.	Thunder Bay	64,930,428	35,543,892	15,641,091	4,949,908
19	Southwestern Sask.	Thunder Bay	31,197,234	9,594,217	17,545,586	
20	Northwestern Sask.	Thunder Bay			46,141,853	
Total		Thunder Bay	218,359,651	71,546,254	79,328,530	6,532,398

TABLE C.34

SHIPMENTS OF GRAIN FOR LIVESTOCK FEED
FROM THUNDER BAY TO REGIONS IN EASTERN CANADA
MODEL 1

Consuming Region		Wheat	Oats	Barley	Rye
Number	Description				
			(Bushels)		
1	Nova Scotia		1,317,764	3,226,051	
2	Prince Edward Island		2,616,082	525,413	
3	New Brunswick		2,024,528	2,030,247	
4	Eastern Quebec		3,716,158	1,706,886	
5	South Central Quebec		12,210,411	16,458,297	
6	North Central Quebec		2,524,038	3,168,304	
7	Western Quebec		7,531,406	4,484,020	
8	Northwestern Quebec		632,174	631,767	
9	Eastern Ontario		1,639,825	4,569,082	119,097
10	South Central Ontario				419,508
11	Southwestern Ontario				316,796
12	North Central Ontario		609,396	1,453,719	22,258
13	Northwestern Ontario		61,250	112,743	2,755
30	Newfoundland	141,000	130,000	505,380	1,500
Total		141,000	35,013,032	38,871,909	881,914

TABLE C.35

SHIPMENTS OF GRAIN FOR LIVESTOCK FEED
FROM THUNDER BAY TO REGIONS IN EASTERN CANADA
MODEL 2

Consuming Region		Wheat	Oats	Barley	Rye
Number	Description				
			(Bushels)		
1	Nova Scotia		1,317,764	3,541,626	
2	Prince Edward Island		2,616,082	714,254	
3	New Brunswick		2,024,528	2,622,251	
4	Eastern Quebec		3,716,158	1,661,103	
5	South Central Quebec		13,151,996	16,650,974	55,047
6	North Central Quebec		2,693,154	4,187,487	
7	Western Quebec		7,548,739	7,941,364	
8	Northwestern Quebec		506,689	1,764,487	
9	Eastern Ontario		2,020,335	5,158,593	119,097
10	South Central Ontario		11,374,375		419,508
11	Southwestern Ontario				316,796
12	North Central Ontario		609,396	1,487,908	22,854
13	Northwestern Ontario		50,045	58,620	
30	Newfoundland	141,000	130,000	505,380	1,500
Total		141,000	47,759,261	46,294,047	934,802

TABLE C.36

SHIPMENTS OF GRAIN FOR LIVESTOCK FEED
FROM THUNDER BAY TO REGIONS IN EASTERN CANADA
MODEL 3

Consuming Region		Wheat	Oats	Barley	Rye
Number	Description				
			(Bushels)		
1	Nova Scotia		1,317,764	3,725,608	
2	Prince Edward Island		2,616,082	1,577,657	
3	New Brunswick		2,098,970	2,658,319	
4	Eastern Quebec		3,716,158	1,804,737	
5	South Central Quebec		13,312,479	18,939,289	64,297
6	North Central Quebec		2,874,736	4,196,828	
7	Western Quebec		7,548,739	9,770,406	
8	Northwestern Quebec		506,689	1,764,487	
9	Eastern Ontario		2,214,888	5,642,375	119,097
10	South Central Ontario		15,037,393		419,508
11	Southwestern Ontario				316,796
12	North Central Ontario		664,154	1,846,090	22,854
13	Northwestern Ontario		22,000	58,620	
30	Newfoundland	141,000	130,000	505,380	1,500
Total		141,000	52,060,052	52,489,796	944,052

TABLE C. 37

SHIPMENTS OF FEED GRAINS FROM ONTARIO SUPPLYING REGIONS
TO CONSUMING REGIONS IN EASTERN CANADA
MODEL 1

Supplying Region		Consuming Region		Winter Wheat	Corn
Number	Description	Number	Description		
				(Bushels)	
11	Southwestern Ontario	1	Nova Scotia	726,141	
11	Southwestern Ontario	4	Eastern Quebec	59,964	
11	Southwestern Ontario	5	South Central Quebec	1,601,242	516,087
11	Southwestern Ontario	6	North Central Quebec	267,931	
11	Southwestern Ontario	7	Western Quebec	386,338	279,576
11	Southwestern Ontario	9	Eastern Ontario		1,767,531
11	Southwestern Ontario	10	South Central Ontario		11,137,536
Total Ontario shipments				3,041,616	13,700,730

TABLE C. 38

SHIPMENTS OF FEED GRAINS FROM ONTARIO SUPPLYING REGIONS
TO CONSUMING REGIONS IN EASTERN CANADA
MODEL 2

Supplying Region		Consuming Region		Winter Wheat	Corn
Number	Description	Number	Description		
				(Bushels)	
11	Southwestern Ontario	1	Nova Scotia	782,212	
11	Southwestern Ontario	3	New Brunswick	112,030	
11	Southwestern Ontario	4	Eastern Quebec	1,204,552	
11	Southwestern Ontario	5	South Central Quebec	3,548,833	516,087
11	Southwestern Ontario	6	North Central Quebec	299,811	
11	Southwestern Ontario	7	Western Quebec	676,379	279,576
11	Southwestern Ontario	8	Northwestern Quebec	16,957	
11	Southwestern Ontario	9	Eastern Ontario		1,767,531
11	Southwestern Ontario	10	South Central Ontario		3,698,169
Total Ontario shipments				6,640,774	6,261,363

TABLE C. 39

SHIPMENTS OF FEED GRAINS FROM ONTARIO SUPPLYING REGIONS
TO CONSUMING REGIONS IN EASTERN CANADA
MODEL 3

Supplying Region		Consuming Region		Winter Wheat	Corn
Number	Description	Number	Description		
				(Bushels)	
11	Southwestern Ontario	1	Nova Scotia	830,885	
11	Southwestern Ontario	3	New Brunswick	296,225	
11	Southwestern Ontario	4	Eastern Quebec	2,086,773	
11	Southwestern Ontario	5	South Central Quebec	2,543,408	516,087
11	Southwestern Ontario	6	North Central Quebec	335,130	
11	Southwestern Ontario	7	Western Quebec	749,142	279,576
11	Southwestern Ontario	8	Northwestern Quebec	50,796	
11	Southwestern Ontario	9	Eastern Ontario		1,767,531
11	Southwestern Ontario	10	South Central Ontario		3,174,332
Total Ontario shipments				6,892,359	5,737,526

TABLE C. 40

HISTORICAL AND DERIVED LAND USE, BY CROP, IN CANADA

	Wheat	Winter Wheat	Oats	Barley	Rye	Mixed Grain	Corn	Total Cereals
				(Acres)				
Model 1	24,852,511	1,063,520	5,363,541	11,726,912	552,174	896,293	945,807	45,400,758
Model 2	21,265,028	1,160,905	5,425,034	11,588,596	594,547	819,240	854,743	41,708,093
Average 1939-40 to 1941-42	25,116,866	693,800	12,455,033	4,666,865	1,021,833	1,291,667	206,733	45,452,797
Average 1949-50 to 1951-52	25,944,534	706,333	11,356,234	6,757,667	1,156,566	1,464,599	275,333	47,661,266
Average 1964-65 to 1966-67	28,844,167	386,000	8,256,965	6,343,268	717,032	1,567,866	725,333	46,840,631
1966-67	29,351,500	341,000	7,923,900	7,461,300	725,800	1,766,600	786,000	48,356,100
1968-69	29,067,500	355,000	7,555,900	8,836,500	678,600	1,667,000	920,000	49,080,500

TABLE C. 41

HISTORICAL AND DERIVED LAND USE, BY CROP, IN MARITIME PROVINCES

	Wheat	Oats	Barley	Mixed Grain	Total
			(Acres)		
NOVA SCOTIA					
Model 1	5,771	0	14,449	6,487	26,707
Model 2	4,059	0	5,441	6,471	15,971
Average 1939-40 to 1941-42	2,433	84,200	11,333	5,667	103,633
Average 1949-50 to 1951-52	1,167	61,367	4,633	6,800	73,967
Average 1964-65 to 1966-67	1,167	30,233	2,667	9,033	43,100
1966-67	1,400	25,700	3,600	10,100	40,800
1968-69	2,000	25,000	5,000	12,700	44,700
PRINCE EDWARD ISLAND					
Model 1	8,788	0	48,805	62,857	120,450
Model 2	8,788	0	48,805	57,550	115,143
Average 1939-40 to 1941-42	10,667	138,700	11,800	37,833	199,000
Average 1949-50 to 1951-52	3,900	102,667	4,767	63,200	174,534
Average 1964-65 to 1966-67	3,300	88,967	11,533	46,700	150,500
1966-67	2,100	85,900	11,600	48,100	147,700
1968-69	2,000	78,000	16,000	53,000	149,000
NEW BRUNSWICK					
Model 1	10,389	1,959	19,511	7,437	39,296
Model 2	6,658	1,959	4,643	6,767	20,027
Average 1939-40 to 1941-42	6,733	205,367	17,200	3,333	232,633
Average 1949-50 to 1951-52	3,067	170,333	12,267	4,833	190,500
Average 1964-65 to 1966-67	4,333	80,200	4,133	8,733	97,399
1966-67	4,000	72,600	5,600	9,500	91,700
1968-69	4,500	67,000	7,500	7,800	86,800
MARITIMES					
Model 1	24,948	1,959	82,765	76,781	186,453
Model 2	19,505	1,959	58,889	70,788	151,141
Average 1939-40 to 1941-42	19,833	428,267	40,333	46,833	535,266
Average 1949-50 to 1951-52	8,134	334,367	21,667	74,833	439,001
Average 1964-65 to 1966-67	8,800	199,400	18,333	64,466	290,999
1966-67	7,500	184,200	20,800	67,700	280,200
1968-69	8,500	170,000	28,500	73,500	280,500

TABLE C. 42

HISTORICAL AND DERIVED LAND USE, BY CROP, IN QUEBEC AND ONTARIO

	Wheat	Winter Wheat*	Oats	Barley	Rye	Mixed Grain	Corn*	Total Cereals
				(Acres)				
				QUEBEC				
Model 1	88,618	–	81,074	296,351	18,154	328,792	–	812,989
Model 2	64,051	–	54,146	210,027	10,559	130,423	–	469,206
Average 1939-40 to 1941-42	28,500	–	1,655,733	148,433	5,333	167,567	–	2,005,566
Average 1949-50 to 1951-52	12,700	–	1,406,333	62,633	4,800	206,333	–	1,692,799
Average 1964-65 to 1966-67	17,367	–	1,117,000	14,567	3,433	95,300	–	1,247,667
1966-67	29,000	–	1,002,000	15,500	4,900	102,000	–	1,153,400
1968-69	30,000	–	984,000	18,000	4,200	87,800	–	1,124,000
				ONTARIO				
Model 1	0	1,063,520	610,552	393,523	698	490,720	945,807	3,504,820
Model 2	0	1,160,905	406,468	435,731	523	618,029	854,743	3,476,399
Average 1939-40 to 1941-42	63,667	693,800	2,177,333	459,000	78,633	995,133	206,733	4,674,299
Average 1949-50 to 1951-52	50,700	706,333	1,785,667	195,000	88,700	1,065,333	275,333	4,167,066
Average 1964-65 to 1966-67	17,667	386,000	1,487,333	172,667	51,033	770,000	725,333	3,610,033
1966-67	22,000	341,000	1,219,000	265,000	47,100	845,000	786,000	3,525,100
1968-69	11,000	355,000	984,000	300,000	52,000	825,000	920,000	3,447,000

*Winter wheat and corn were not considered as a production alternative in Quebec in the mathematical models.

TABLE C. 43

HISTORICAL AND DERIVED LAND USE, BY CROP, IN WESTERN CANADA

	Wheat	Oats	Barley	Rye	Mixed Grain*	Total
			(Acres)			
MANITOBA						
Model 1	3,032,209	679,430	1,534,091	92,773	–	5,338,503
Model 2	2,705,979	907,158	1,025,593	114,616	–	4,753,346
Average 1939-40 to 1941-42	3,059,333	1,330,333	1,380,333	164,933	20,467	5,955,399
Average 1949-50 to 1951-52	2,531,667	1,590,000	1,818,667	60,433	30,867	6,031,634
Average 1964-65 to 1966-67	3,293,333	1,563,333	657,667	133,500	152,000	5,799,833
1966-67	3,255,000	1,530,000	875,000	100,500	184,000	5,944,500
1968-69	3,400,000	1,650,000	1,170,000	120,000	178,000	6,518,000
SASKATCHEWAN						
Model 1	15,588,654	2,361,862	4,876,875	253,234	–	23,080,625
Model 2	13,978,999	2,470,612	5,385,314	252,270	–	22,087,195
Average 1939-40 to 1941-42	13,999,667	4,016,667	1,353,000	593,567	27,033	19,989,934
Average 1949-50 to 1951-52	15,957,333	3,525,667	2,067,667	706,333	23,933	22,280,933
Average 1964-65 to 1966-67	19,035,000	1,742,333	1,801,667	342,437	124,000	23,045,433
1966-67	19,405,000	1,838,000	2,255,000	398,300	153,000	24,049,300
1968-69	19,000,000	1,800,000	2,510,000	385,000	138,000	23,833,000
ALBERTA**						
Model 1	6,085,496	1,628,664	4,531,259	184,904	–	12,430,323
Model 2	4,463,909	1,584,691	4,469,497	216,283	–	10,734,380
Average 1939-40 to 1941-42	7,912,033	2,769,400	1,275,533	175,500	30,767	12,163,233
Average 1949-50 to 1951-52	7,345,667	2,671,233	2,586,233	295,033	61,900	12,960,066
Average 1964-65 to 1966-67	6,458,333	2,118,833	3,666,000	185,933	359,967	12,789,066
1966-67	6,506,000	2,082,000	3,880,000	172,300	410,000	13,050,300
1968-69	6,460,000	1,960,000	4,650,000	114,000	360,000	13,544,000

TABLE C. 43 (continued)

	Wheat	Oats	Barley	Rye	Mixed Grain*	Total
			(Acres)			
BRITISH COLUMBIA**						
Model 1	32,586	0	12,048	2,411	–	47,045
Model 2	32,585	0	3,545	296	–	36,426
Average 1939-40 to 1941-42	33,833	77,300	10,233	3,867	3,867	129,100
Average 1949-50 to 1951-52	38,333	42,967	5,800	1,267	1,400	89,767
Average 1964-65 to 1966-67	13,667	28,733	12,367	700	2,133	57,600
1966-67	127,000	68,700	150,000	2,700	4,900	353,300
1968-69	158,000	77,900	160,000	3,400	4,700	404,000
PRAIRIES**						
Model 1	24,706,359	4,669,956	10,942,225	530,911	–	40,849,451
Model 2	21,148,887	4,962,461	10,880,404	583,169	–	37,574,921
Average 1939-40 to 1941-42	24,971,033	8,116,400	4,008,866	934,000	78,267	38,108,566
Average 1949-50 to 1951-52	25,834,667	7,786,900	6,472,567	1,061,799	116,700	41,272,633
Average 1964-65 to 1966-67	28,786,666	5,424,499	6,125,334	661,866	635,967	41,634,332
1966-67	29,166,000	5,450,000	7,010,000	671,100	747,000	43,044,100
1968-69	28,860,000	5,340,000	8,330,000	619,000	676.000	43,825,000

*Mixed grain was not included as a production alternative in the Prairie Provinces in the mathematical models.

**The Alberta figures include data for the Peace River area of British Columbia.

TABLE C. 44

NUMBER OF FARMS ASSOCIATED WITH UNCOMPETITIVE CEREAL ACREAGE, BY PROVINCE AND FARM SIZE CLASS
MODEL 1

Province	Improved Acres												Total All Classes	Total $\geq$10 Acres
	1–2	3–9	10–69	70–129	130–179	180–239	240–399	400–559	560–759	760–1,119	1,120–1,599	1,600		
	(Number of farms)													
Nova Scotia	446	952	4,105	448	12	10	0	0	0	0	0	0	5,973	4,575
Prince Edward Island	28	84	811	814	0	0	0	0	0	0	0	0	1,737	1,625
New Brunswick	242	478	4,566	1,585	281	0	0	0	0	0	0	0	7,152	6,432
Quebec	355	1,269	14,082	12,792	2,386	412	44	2	0	0	0	0	31,342	29,718
Ontario	21	48	731	670	177	0	0	0	0	0	0	0	1,647	1,578
Manitoba	234	696	2,388	2,206	1,693	1,252	1,140	0	0	0	0	0	9,609	8,679
Saskatchewan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alberta*	83	133	938	1,637	1,728	1,548	1,777	665	0	0	0	0	8,509	8,293
British Columbia*	1,374	3,554	3,615	874	0	0	0	0	0	0	0	0	9,417	4,489
Total	2,783	7,214	31,236	21,026	6,277	3,222	2,961	667	0	0	0	0	75,386	65,389

*The figures for Alberta include data for the Peace River area of British Columbia.

TABLE C. 45

NUMBER OF FARMS ASSOCIATED WITH UNCOMPETITIVE CEREAL ACREAGE, BY PROVINCE AND FARM SIZE CLASS
MODEL 2

Province	Improved Acres												Total All Classes	Total ≥10 Acres
	1–2	3–9	10–69	70–129	130–179	180–239	240–399	400–559	560–759	760–1,119	1,120–1,599	1,600		
	(Number of farms)													
Nova Scotia	559	1,092	5,567	1,349	29	10	2	0	0	0	0	0	8,608	6,957
Prince Edward Island	44	109	1,387	814	0	0	0	0	0	0	0	0	2,354	2,201
New Brunswick	242	478	4,566	2,123	341	166	103	1	0	0	0	0	8,020	7,300
Quebec	523	1,695	23,867	23,853	5,426	1,494	429	31	11	2	0	3	57,334	55,116
Ontario	101	147	1,649	1,672	322	24	26	2	1	0	0	0	3,944	3,696
Manitoba	352	1,014	3,079	2,899	2,598	1,977	4,214	37	17	3	2	3	16,195	14,829
Saskatchewan	52	81	422	720	989	868	2,671	1,631	0	0	0	0	7,434	7,301
Alberta*	193	399	2,549	3,875	4,284	3,534	6,177	3,108	0	0	0	0	24,119	23,527
British Columbia*	1,374	3,554	5,526	874	371	158	195	60	0	0	0	0	12,112	7,184
Total	3,440	8,569	48,612	38,179	14,360	8,231	13,817	4,870	29	5	2	6	140,120	128,111

*The figures for Alberta include data for the Peace River area of British Columbia.

TABLE C. 46

NUMBER OF FARMS ASSOCIATED WITH UNCOMPETITIVE CEREAL ACREAGE, BY PROVINCE AND FARM SIZE CLASS
MODEL 7 – RESTRICTED EQUILIBRIUM*

Province	Improved Acres												Total All Classes	Total ≥10 Acres
	1–2	3–9	10–69	70–129	130–179	180–239	240–399	400–559	560–759	760–1,119	1,120–1,599	1,600		
	(Number of farms)													
Manitoba	386	1,090	3,335	3,327	3,216	2,569	6,231	37	17	3	2	3	20,216	18,740
Saskatchewan	86	149	614	961	1,506	1,115	4,258	1,924	0	0	0	0	10,613	10,378
Alberta**	193	399	2,549	3,875	4,284	3,534	6,177	3,418	142	55	6	0	24,632	24,040
Total	665	1,638	6,498	8,163	9,006	7,218	16,666	5,379	159	58	8	3	55,461	53,158

*This model was designed so that all land and hence all farms in Eastern Canada and British Columbia would be in production, regardless of competitive ability.

**Includes data for the Peace River area of British Columbia.

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