

SOME ASPECTS OF THE PRODUCTION AND MARKETING OF FRESH
MARKET TOMATOES IN MANITOBA

by

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A Thesis

Submitted to the Faculty of Graduate Studies and Research

in Partial Fulfilment of the Requirements

for the Degree of

MASTER OF SCIENCE

THE UNIVERSITY OF MANITOBA

May 1963



ACKNOWLEDGMENTS

Grateful acknowledgment is made for the helpful criticisms and guidance provided by Dr. A. W. Wood, Department of Agricultural Economics and Farm Management, and by Dr. A. C. Ferguson, Division of Plant Science of the University of Manitoba.

The author wishes also to express his sincere appreciation for the many helpful suggestions tendered him by Dr. G. E. Ackerman, Department of Agricultural Economics and Farm Management, The University of Manitoba.

Special thanks is extended for the wholehearted co-operation received from the many growers and wholesalers contacted in regard to this study.

Grateful acknowledgment is also made to Mr. R. Kapy, Manitoba Department of Agriculture, who provided the illustrations.

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ABSTRACT

The fresh market tomato industry in Manitoba in recent years has advanced considerably, but further developments are being hampered by the lack of pertinent information in respect to production and marketing. Those involved at various levels of the industry are finding it exceedingly difficult to make any definite progress because of gaps in the information needed for forward planning, such as the recommended cultural practices, the cost of production, the available marketing channels, the effective market demands, etc. In view of this the central theme of the study was the compiling as well as the analysis of the available information pertaining to the physical and economic aspects of production and marketing in order to make a critical appraisal of the economic use of resources.

In order to obtain sufficient information it was necessary to visit 33 growers involved in the production of tomatoes and 10 wholesalers engaged in the distribution of the product. Accordingly a questionnaire was developed for the purpose of obtaining two major types of information: factual data based on the records of production or marketing and intuitive information in the form of personal opinions shaped by many years of experience.

The findings of the study indicated that the production of tomatoes requires a specialized skill on the part of both management and labor. The supply of skilled labor was found to be limited for tomato production and growers indicated that this could be a limiting factor in future

expansion of this enterprise. The scarcity of experienced help has put greater emphasis on mechanization. This in turn, has promoted the need for the shifting of production to areas where soil conditions are better suited to mechanical methods. It was also made quite clear by the growers that urban development was forcing them to consider moving to areas of lower land values.

It was quite evident that greater markets are available to Manitoba producers. However, it was pointed out by the distributing trade that in order for the growers to capture these additional outlets tomato varieties better suited to current methods of merchandising would have to be grown and greater consideration would have to be given to quality ripening of the mature-green fruit.

It was also found that the extent to which markets can be developed will depend on the ability of the growers to reduce production costs. The total inputs were found to be extremely high with labor accounting for approximately 57 percent. On analysing labor inputs it was determined that 34 percent of the labor costs were incurred on the operations involving staking, pruning and tying of the indeterminant type plants. It was concluded from this information that if economic production could be obtained with determinant type plants growers could greatly reduce their labor costs and thus be in a much more favorable position to compete for outside markets.

In analysing the data it was observed that the price of tomatoes on the local market during August and September were determined mainly by the supply of locally grown tomatoes available. Import tomatoes only affected prices to the extent that they depressed prices by causing an over-supply situation to occur. The prices at which growers continued to sell differed between individuals. Those employing family help continued to sell as long as there was some return to labor.

Through the determination of the marketing channels by which the product reached the consumer from the primary producer it was found that the wholesaler occupied a very important position in the distribution system. It was also found that the growers organization (Gardeners' Sales Ltd) through handling 63 percent of the growers' volume was playing a major role as a first receiver. Roadside stands and the "Farmers' Market", Nairn Avenue, Winnipeg, were found to be the major outlets for the marketing of second grade fruit.

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CHAPTER I
INTRODUCTION

Historical Review

The commercial production of tomatoes in Manitoba began around the turn of the century. They were grown by market gardeners operating in the immediate vicinity of the populated areas of Winnipeg. The volume of production was very small and most of the sales were made directly to the consumer. The tomatoes grown were from seed sown directly in the field as few growers had greenhouse facilities for transplant production. Due to the fact that tomatoes require a long growing season this type of production did not allow sufficient time for ripening. As a result, a large portion of the crop was sold for green tomato pickles and relishes.

As the growers became better acquainted with alternative production methods transplants were used to shorten the period to maturity in the field thus allowing a greater portion of the crop to ripen before the first fall frost. The growers found a ready market for the ripened product especially for home canning purposes. The marketing season was extended when the growers found that when the tomatoes were picked at a certain stage of maturity and held under favorable storage conditions they could be ripened satisfactorily and marketed at a later date. In many cases the growers used their root storage pits to carry out the ripening process. These pits were empty at that time of the year (mid September) and it was found that the conditions of temperature, humidity and light were adequate to bring on ripening.

The development of the fresh market tomato industry in Manitoba up to recent years has been very slow. For many years it received little

support from the distributing section of the vegetable industry. The wholesale distributors were importing supplies from outside areas twelve months of the year (since 1920) and showed great reluctance to break contact with their foreign suppliers for one month to help move the local crop. Their reluctance to break contacts often stemmed from the fact the local product was inferior in respect to grading and packaging as well as being unreliable from the standpoint of continuous supplies.

It was early in the 1950's that the growers began to take a more serious look at the production and marketing potentials of the Manitoba tomato crop. More emphasis was placed on the selection of suitable varieties to fit the needs of present methods of merchandising. Growers improved their standards of grading and packing to meet the competition of imports. At the time of this study a large percentage of the local market has been captured by Manitoba growers and exports of tomatoes in various stages of maturity are made each year in considerable volume.

The acreage survey, included in this study, indicated that there are approximately 100 acres of land devoted annually in Manitoba to the growing of tomatoes with the volume of sales estimated at 75,000 cases. The marketing period now extends from the last week in July until the end of September when the last pickings are removed from the ripening rooms.

Importance of the Problem

In order to plan future developments in any industry it is essential that complete details in regards to every aspect of the industry be available for full examination. Without full knowledge of all phases concerned few decisions can be made with any degree of confidence; thus the chances for success in future developments are reduced.

The Manitoba tomato industry today finds itself seriously lacking in detailed information from all sections. There has been little if any effort put forth by those concerned to collect and analyse, fully, data which would bring into full focus the major forces governing the expansion of this industry.

One piece of evidence that indicates the opportunities of greater production have not been fully explored is that there are significant volumes of tomatoes from other production areas competing successfully with the locally grown product at the height of its marketing season. Wholesalers have also stressed many times that Manitoba grown tomatoes have only scratched the surface in respect to invading the markets available in Saskatchewan and Alberta. These markets are now supplied by imports originating mainly in California and Mexico (25). There is every reason to believe that if all the economic implications were studied, ways and means of expanding markets both at home and abroad would be identified and general expansion of the tomato industry in Manitoba would be possible.

Objectives of the Study

It is an apt saying that, "your judgment is only as good as your information" - W.C.Hopper.

Information concerning the various phases of the fresh market tomato industry in Manitoba is very limited. The study, "The Marketing of Fresh Fruits and Vegetables in Greater Winnipeg", published in 1946, draws attention, in a general way, to the various aspects of vegetable marketing, of which tomatoes are a part, but no specific reference is

made to this crop. Literature on production costs in Manitoba is non-existent. In order to measure and plan improvements in the efficient use of resources in the production and marketing of any product it is essential that accurate knowledge of the existing production patterns and performance of that portion of the economic community be available for critical appraisal.

Objectives

1. To compile available information pertaining to the physical and economic aspects of the production and marketing of fresh market tomatoes as they currently exist in Manitoba.
2. To make an analysis of the areas of production and marketing where sufficient data are available.
3. To make a critical appraisal of the economic use of resources (land, labor, capital and management) in the production and marketing of fresh market tomatoes with a view to determining ways in which greater efficiency may be attained at all levels.
4. To point out any weaknesses in the production and marketing patterns that warrant future studies of a more intensive nature.
5. To assemble information for the various government institutions that will aid in the formulation of policies to promote developments beneficial to the tomato industry.

Scope and Procedures followed in Study

Information concerning the production and marketing of fresh market tomatoes was obtained from an interview type survey. Thirty-three growers and ten distributors were interviewed individually during the winter months of 1961 - 62.

The interview with growers involved the filling in of a questionnaire prepared specifically to determine the many aspects of production, the costs involved, and the net returns to capital investment and management. The information received from the growers was obtained from production records when available as well as from personal opinions shaped by many years of experience.

The information obtained from the distributors included the total volume of local tomatoes handled, the form in which they were handled, the amount of processing done, the volume exported to other provinces and prices received at various levels of the trade.

The data for the analysis concerning the physical and economic aspects of production was taken from records of twenty-five growers. This group included only growers who were growing the indeterminate types (staking) of tomatoes, pruned to a single stem and staked. There were three growers producing the determinate type (bush) but due to the limited acreage in this category no attempt will be made in this study to make a duplicate analysis for this type of tomato production. Subsequent discussions will refer to tomatoes of the indeterminate type only.

The average figures resulting from the analysis are weighted averages. They are averages in respect to total production rather than means of individual growers' averages.

CHAPTER II

PRODUCTION TRENDS AND TECHNIQUES

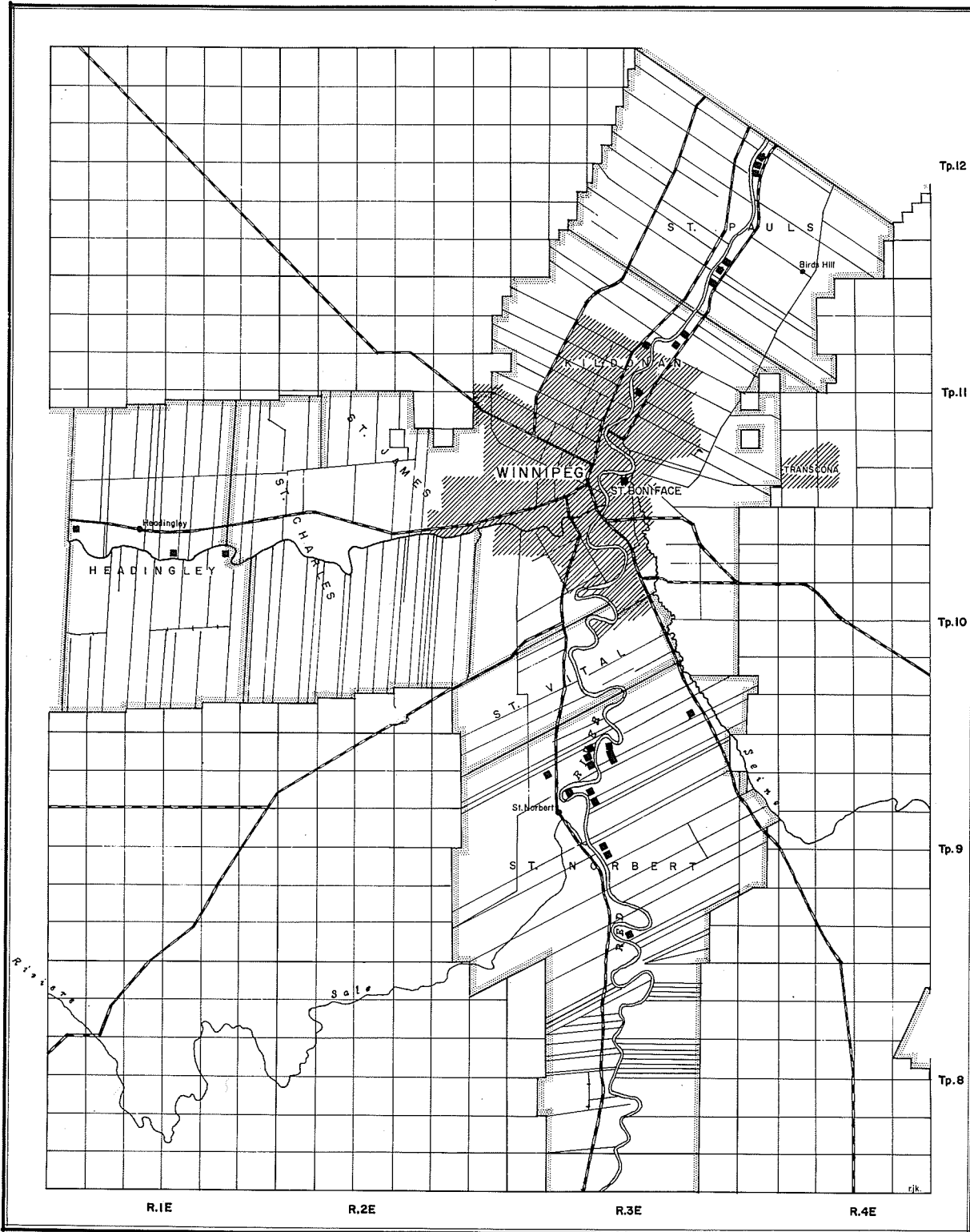
Production Areas

Commercial tomato production for the fresh market trade, like that of other vegetable crops grown in Manitoba, developed in response to a demand created by consumers in the heavily populated urban areas. The greatest interest in production developed among growers situated in the immediate vicinity of Winnipeg. Tomatoes are a highly perishable crop and close proximity to market was essential to ensure the consumer a quality product. In the early period of production, storage and transportation facilities were of an inferior nature.

Early history of tomato growing in the Winnipeg area indicates growers were located in the suburban areas on all sides of the city. As the residential areas moved farther out, real estate values in the growing areas forced growers to relocate or withdraw from production. Many growers did relocate on land of a type best suited to tomato production or vegetable growing in general.

The main acreage of tomatoes is presently located in four areas, listed according to importance in respect to acreage; St. Vital, East St. Paul, Charleswood and Fort Garry. There are also small acreages located in the Headingly, St. Adolphe and Brandon areas. The map in figure 1 shows the distribution of acreage. It is interesting to note, from the map, that with the exception of two, growers are all situated on land bordering either the Red or Assiniboine rivers. Growers have found that to ensure a quality crop supplementary water is an essential resource in the production of tomatoes.

Figure 1 - Distribution of Major Tomato Growers in Manitoba, 1961



■ Indicates a single grower

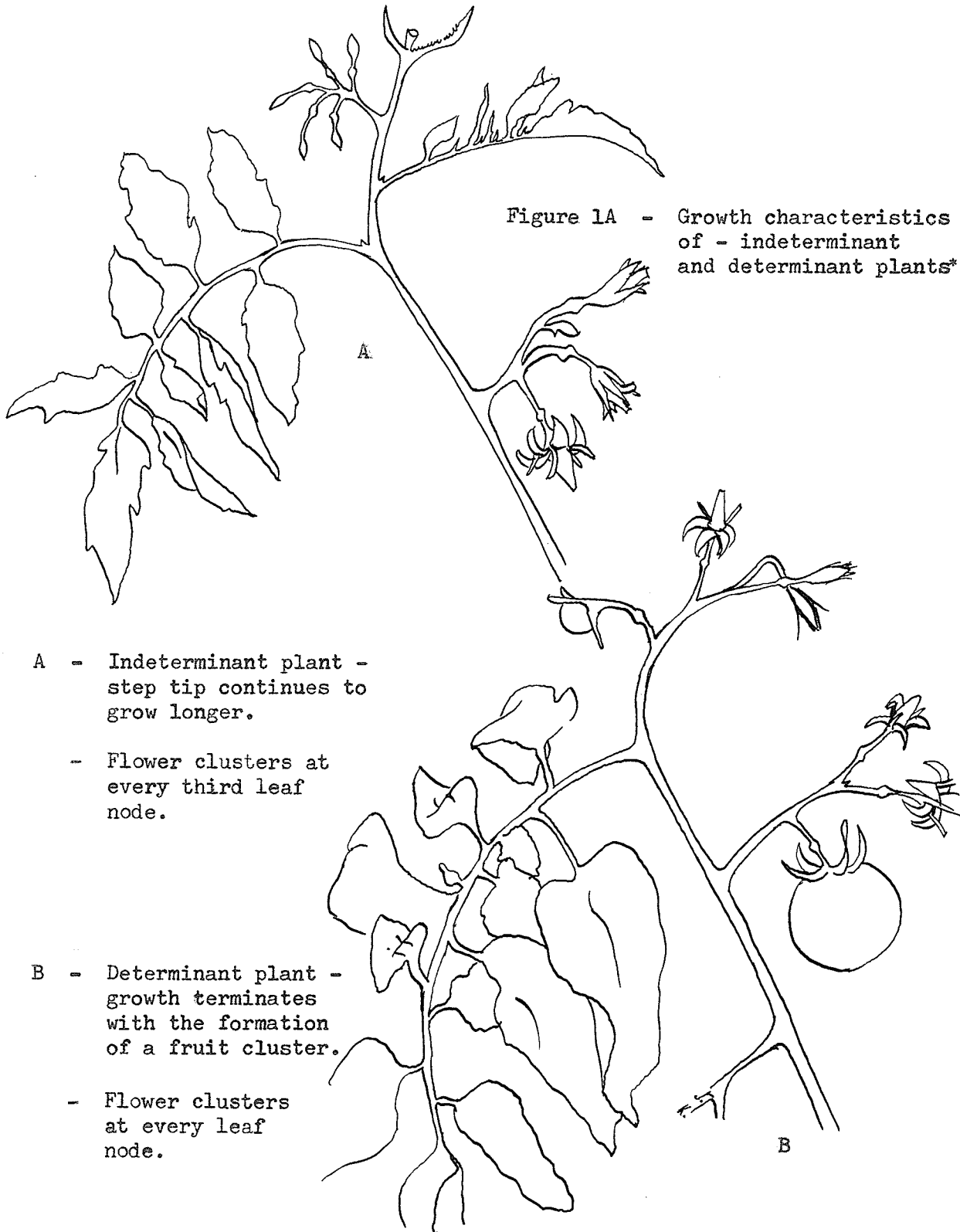


Figure 1A - Growth characteristics of - indeterminate and determinant plants*

A - Indeterminate plant -
- stem tip continues to
grow longer.

- Flower clusters at
every third leaf
node.

B - Determinant plant -
- growth terminates
with the formation
of a fruit cluster.

- Flower clusters
at every leaf
node.

* Source (1)

The future production of tomatoes or vegetables of all types, in the areas mentioned above, is somewhat uncertain at the present time, especially for the acreage situated in the East St. Paul district. Real estate values for residential and industrial purposes have increased to levels of one to three thousand dollars. It is difficult to justify production on land valued in this range when suitable production areas, with lower land values, are available. Proximity to market has been a deterrent to the relocation of production, but with recent improvements in production methods and transportation this aspect is not as important a limiting factor as it was in the past. One of the larger growers, now located in the East St. Paul area, recently purchased additional land in the Portage la Prairie district. His future plans include the transfer of his tomato acreage to the new location. If this venture is successful it will no doubt have considerable influence on the future distribution of tomato acreage in Manitoba.

Soil Types

Through the many years of production Manitoba growers have found that alluvial soils of the Red and Assiniboine rivers are superior to that of other types for growing tomatoes. Ninety-five percent of the growers interviewed during the study had their acreage located on soil types of the Riverdale Association. The alluvial types have excellent internal drainage and are highly fertile. The deep profiles normally found in alluvial soils are well suited to the deep and extensive root system produced by the tomato plant. They are however, somewhat lacking in organic matter (16).

The balance of the acreage is confined mainly to soils classed as Red

river clay. This type of soil is very productive but lacks internal drainage and tends to bake and crack, destroying portions of the root system in the process. The acreage confined to lighter soil types is negligible and its productivity for commercial tomato production in Manitoba has not been fully investigated.

Tomato Types and Varieties

The commercially grown tomato belong to the nightshade, or Solanaceae family and to the genus and species Lycopersicon esculentum, with practically all the types in the variety commune (1).

The commercial types grown in Manitoba may be broadly classified as indeterminant (staking) or determinant (bush), Figure 1 A. The study indicates that eighty-nine percent of the commercial acreage is of the indeterminant type. The varieties of both indeterminant and determinant types and the acreages of each are listed in Table I.

TABLE I
VARIETIES AND ACREAGE OF TOMATOES
GROWN COMMERCIALY IN MANITOBA 1961*

<u>Indeterminant</u>		<u>Determinant</u>	
Variety	Acreage	Variety	Acreage
Moreton Hybrid	28.0	Firesteel	6.0
Queens	23.5	Manitoba	1.0
Valiant	12.5	Meteor	.6
Stokesdale	2.0	Bounty	.4
Cardinal	2.0	Bush Beefsteak	1.0
CRT	1.5	Fireball	.4
Glamor	.5		
Others	2.0		
Total	72.0		9.4

* Compiled from data obtained by questionnaire survey of 33 commercial growers in Manitoba.

The large acreage of indeterminate type tomatoes in comparison to that of the determinant is reported by the growers to be due to the fact that they produce fruits that are freer of blemishes, have a finer finish and remain firmer on ripening. Less injury from disease of both the plant and fruit also has been indicated. This is a very important factor as the tomatoes when harvested in the mature-green stage (seed cavities showing a jelly-like consistency) must remain in storage up to 14 days before they are sufficiently ripe for marketing (14). During this time conditions of temperature and humidity are highly favorable to the development of fruit rotting organisms.

Other reasons mentioned are the improved harvesting conditions. Less time and effort is required in harvesting as the trusses of fruit are ideally located for the rapid selection of quality fruit. In the bush type varieties considerable time is lost in the selection of marketable fruits as they are intermingled with the vines which are prostrate on the ground. The expense of production is much higher for the staking varieties but the growers feel that, with the present selection available of bush type varieties, the extra costs are offset by the advantages mentioned above.

Due to the fact that there were only three growers included in the study who were producing the bush type varieties no attempt will be made to compare the two methods of production from the standpoint of net returns.

Production Techniques

Plant Growing: The tomato is a warm season plant and requires a relatively long season to produce a profitable crop. In regions having less than three and one-half months frost-free period the tomato is not

likely to be a profitable crop (2). The areas of commercial production as indicated in Figure 1 have a frost-free period on the average of 118 days which, according to Thompson and Kelly (2) is sufficient for economic production.

Of the growers visited all except one have greenhouse facilities for plant growing. The grower lacking facilities contracted for his plant requirements with one of the other growers.

The plants were started in the greenhouse some weeks in advance of planting in the field. The time of seeding varied from March 15th to April 15th. The seeding operation generally consisted of sowing the seed thickly in flats of specially prepared soil. Once the seed had germinated and the young seedlings had the first true leaf showing they were pricked out into other flats. The number of transplantings undertaken before the plants were placed in the field varied from two to four times. On the last transplanting the number of plants placed in a flat (21 x 12 x 3) varied from 40 to 100 with an overall average of 56 plants. Three of the growers produced their plants singly in "jiffy" pots (two to three inches in diameter), which only entailed one transplanting operation in the greenhouse. The plants on the average were grown at a temperature of approximately 70°F. In most cases there was considerable fluctuation in the temperature due to lack of facilities for holding temperatures steady.

It is doubtful whether growers are maintaining optimum temperatures for the production of maximum yields of fruit. Walkof (15) states that from the time the tomato seed germinates until its first true leaf is well developed the small plants should be grown at a temperature of 55°F.

Following this period the plants should be held at a temperature of 60 to 65°F. As a result, plants will have compact, sturdy growth, early maturity and the fruit clusters will develop from 20 to 50 percent more flowers. Information of this nature stresses the need for more emphasis on temperature control during the time the young plants are held under greenhouse conditions.

Estimates of yields received from the growers showed little or no relationship between the early and total yield obtained and the number of times the plants were transplanted before being placed in the field. Literature cited by Thompson and Kelly (2) states that plants seven weeks from seed planted in the field produced significantly higher early and total yields than plants 11 weeks old. They also relate that greater total yields were obtained from plants grown under four by four inch spacings than from those with only two by two inch spacing. From discussions with the growers there is considerable evidence to indicate that growers are seeding their tomatoes too early in the greenhouse and transplanting too often before plants are placed in the field. Growers may well reduce the expense of labor and fuel by taking a more serious look at this aspect of plant production.

Soil Preparation: The growers unanimously agreed that a deep, well prepared seedbed was required for maximum growth of tomato plants. In all cases the land was plowed to a depth of eight to ten inches in the fall and left to be broken down into a friable condition by the freezing and thawing action experienced during the winter months. In the spring the land was either worked over with a spring-toothed cultivator or leveled off with a light harrowing just before planting.

As an observation at this point, no effort was made by the growers to stimulate weed growth early in the year so that one crop could be destroyed before planting occurred. The fact that tomatoes are not planted in the field much before the 1st of June means that ample time is available to significantly reduce weeding expenses at a later date. The cost of controlling weeds, as shown in Chapter III are quite extensive.

Fertilizers: Supplementary nutrients were applied in the form of chemical fertilizers by 96% of the growers contacted. Of the group using chemical fertilizers, 38% produced their tomato crop on land to which manure had been applied two to three years prior to the year of production. Only one grower relied solely on manure for the supplementary nutrient supply. The rates of application of manure were from 100 to 150 tons per acre.

The growers applying manure to their land are attempting to maintain the fibre content of the soil as well as the nutrient level. In the production of crops under irrigation, the alluvial soils, which are naturally low in organic matter (16), become even more deficient. Growers state that baking and cracking is a serious soil problem at all times. In the past liberal amounts of manure have helped alleviate the difficulty. However, with the present scarcity and high cost of this vital product, many of the growers have been forced to abandon this practice. Several operators have used forage crops to maintain the soil fibre content. Others, because of limited acreage, are unable to take land out of production for the necessary two to three years for forage production and are now having greater difficulty in maintaining satisfactory soil conditions.

Chemical fertilizers are applied as a starter solution, as a side-band application, or broadcast in the granular form. Starter solutions of the more soluble forms, 10-52-17 or "Vigoro", were applied by 17 percent of the growers. In all cases it was dissolved in water and applied at planting time by an attachment fitted to a mechanical planter. The solution was placed in direct contact with the plants' root system. Extreme care not to use too strong a concentrate was necessary in this operation in order to avoid root damage from burning. The main purpose of the starter solution was to stimulate root development and to reduce the shock of transplanting.

The main application of chemical fertilizer for plant growth throughout the entire season was made as a side-band application; placed in the vicinity of the root system at planting time or shortly after plants became established; or broadcast over the entire field before planting and worked into the top few inches of soil. The analyses most commonly used were 11-48-0 and 10-30-10 at rates varying from 100 to 750 lbs per acre. The rate most generally used was 320 lbs. per acre. Applications of nitrogen through the irrigation system have been made but on a limited scale.

The marketed yields of fruit reported by the growers (Table 2) do not indicate any consistent trend in response to applications of varying rates of chemical fertilizer and varying plant populations. These results are in agreement with those reported by Ferguson (18). He indicated that fertilizer did not increase yields of bush type tomatoes in 1960 or 1961. There was, however, some indication that fruit size was increased in 1961. Growers are quite convinced that

TABLE 2

EFFECT OF FERTILIZER APPLICATION RATES AND
PLANT POPULATION ON TOMATO YIELDS

(Cases marketed per acre).

Population Plants per acre	Pounds of fertilizer per acre)				
	Under 200	201-300	301-400	401-500	Over 500
6000 to 7500	900	1020	788	730	510
7501 to 8500	830	800	1000		960
8501 to 9600	1304		1000		1008

fertilizer increases yield and fruit size of pruned tomatoes. Further testing will be necessary to prove or disprove these hypotheses.

Planting: Since the tomato plant is very tender and is chilled easily by low temperatures which results in severe stunting, most growers refrained from planting in the field until the last week in May or early in June. In a few instances a portion of the planting was made about the 20th of May but the growers concerned admitted that they were running a high risk of severe losses from frost. "Hot-caps" were used in only one case as a protection against adverse spring temperatures.

The planting operation was accomplished by the use of hand labor or with the aid of tractor drawn planters. Forty-five percent of the acreage was planted by the latter method. The use of mechanical planters reduced the hours of labor required to plant an acre of tomatoes by forty-seven percent. Twenty-six hours per acre were needed rather than forty-nine hours when hand labor was employed. The task of securing experienced help for the planting operation is becoming more difficult each year and it is expected that more growers will be mechanizing their planting operations where soil conditions permit the use of machines.

The plants were set in the field at spacings of one to two feet within the row and three to four feet between rows. With these spacings the number of plants per acre varied from 6,000 to 12,400 with an average of 7,860 plants. Table 3 indicates the distribution of acreage according to plant population.

TABLE 3
THE DISTRIBUTION OF ACREAGE AND GROWERS
ACCORDING TO PLANT POPULATION

Plants/acre	Acres	No. of Growers
6000 to 7000	23.2	7
7001 to 8000	17.5	8
8001 to 9000	15.0	5
9001 to 10000	6.9	4
10001 and over	1.3	1
Total	63.9	25

Growers using the four foot spacing between rows, did so because they found it more convenient for harvesting. They found that they could move through the rows with less damage to the plants and bruising to the unharvested fruit. With the wider spacing plant populations were maintained by closer spacings within the rows.

Although the total yield was affected by plant population, data in Table 4 indicates that the spacings used by the growers had no appreciable effect on average yield of marketed fruit per plant grown. The minimum yields suggest that other factors of production had a greater influence on the performance of the tomato plant than that of spacing.

TABLE 4

MINIMUM, AVERAGE AND MAXIMUM YIELDS OF FRUIT
PER PLANT STRATIFIED ACCORDING TO PLANT POPULATION

Plants/acre	No. of Growers	Min. lbs of fruit per Plant	Aver.lb of fruit per Plant	Max. lbs of fruit per Plant
6000 to 7000	7	2.10	3.02	5.57
7001 to 8000	8	1.60	3.28	4.70
8001 to 9000	5	1.40	2.45	3.00
9001 to 10000	4	3.60	4.06	5.00
10001 and over	1	3.60	3.60	3.60

The wide variation in plant populations employed by the growers would indicate a considerable lack of knowledge concerning this aspect of production. Research which would determine the relationship of total yield to plant population (production function curve) would greatly assist growers in obtaining optimum production from their limited acreage.

Irrigation: Supplementary water was applied to ninety-seven percent of the tomato acreage during the growing season of 1961. The number of applications varied considerably between growers ranging from four to eleven settings. The volume of moisture applied at each setting varied from one to three inches.

The value of irrigation is quite evident from Table 6. In 1961, a year of below normal rainfall, Zwarich (24) obtained a six ton increase with irrigation over that of the check. In both plots the soil moisture was brought to approximately field capacity prior to planting. The rainfall in Manitoba during the entire growing season is usually nine inches

TABLE 5

RAINFALL IN INCHES FOR WINNIPEG AREA (1957 - 1961)*

Month	1961	1960	1959	1958	1957
April	1.38	1.06	.33	.77	1.37
May	.39	1.34	4.57	.42	1.73
June	.13	2.18	2.33	2.70	5.00
July	3.29	.67	3.57	5.65	1.68
August	.16	3.09	3.94	.96	3.50
September	2.30	.93	3.83	.80	2.40

* Source (19)

TABLE 6

YIELD AND EVAPOTRANSPIRATION DATA - 1961*

Comparison	Cover	Covered & Irrigated	Non-Covered	Non-covered & Irrigated
Total Yield (tons/ac)	18.3	28.7	18.8	28.1
Marketable Yield (tons/ac)	11.9	16.9	11.0	17.1
Total H ₂ O used (inches)	5.2	6.4	9.4	9.4
Evaporation %			35	32

Covered - growing area covered with black polyethelene to prevent evaporation or the addition of moisture through rain.

Total H₂O - moisture used by plants plus that removed by used evaporation - determined periodically through soil moisture tests.

Evaporation - difference in total water used between covered and non-covered plots.

* Source (19)

or more (illustrated in Table 5) but because of its uneven distribution, even in years of high rainfall, it cannot be relied on for the production of optimum yields.

Zwarich (24) demonstrated that the need for moisture by the plant varies according to the stage of development (Appendix II). He found that the greatest need for moisture is during the period from approximately July 13th to August 15th. The amount of moisture used following this period is very small.

The volume of water and the time of application in the production of tomatoes has been of considerable concern to the growers. The first irrigation in the 1961 operations in most cases followed directly after planting. Any additional irrigation was undertaken as the grower saw the need for it. General moisture conditions of the top two to three inches of soil and the outward appearance of the plants were the only criteria employed in determining moisture needs. No effort by the growers was made to check the subsoil moisture at the two to four foot levels. The tomato plant has an extensive root system, reaching depths of three to four feet within six weeks (20), and the soil moisture supplies at these depths have a considerable influence on growth. The yields received by the growers (Table 7) would bear out this statement as equal or greater average yields were obtained with four or five applications of water than with greater or lesser numbers.

TABLE 7

EFFECTS OF NUMBER OF IRRIGATIONS ON
MARKETED YIELDS OF TOMATOES, 1961

Number of Irrigations	3	4	5	6	7	8	and over
Number of Growers	1	6	5	4	4	3	
Average Cases/acre	600	1040	1083	840	857	840	

Many of the growers indicated that by keeping a uniform supply of moisture present for the plants during the latter part of July and early August little or no cracking occurs in the developing fruit. It is also felt that by regulating the moisture supply in this manner blossom-end rot is reduced to a minimum. The efforts put forth by the growers to maintain optimum moisture conditions no doubt is the reason that blossom-end rot was not mentioned as one of the more serious production problems.

Staking and Pruning: In the production of the indeterminate type tomato, growers prune the plant to one single stem and support it by a stake approximately four feet in height. The need for pruning arises from the fact that secondary branches emerge from all leaf axils. To maintain a single stemmed plant these shoots must be removed as they arise, after the development of a new leaf. On the average the plants are pruned four times during the growing season. The pruning operation is generally combined with the tying of the plants as they grow, to the supporting stakes. The plants are tied three times by the majority of growers throughout the growing season.

By the time the plant reaches the top of the supporting stake it contains four to five trusses of fruit. In some cases the growing tip is removed to prevent any further growth. It is thought by those concerned that this operation hastens ripening of the fruit already set. Many of the growers have experienced greater cracking from this procedure in some seasons and as a result have discarded it as part of their operations.

The placing of the stakes is a very laborious operation and entails a

large number of man hours of labor. In years when the soil is extremely dry irrigation may be necessary to make soil conditions satisfactory for staking. On the average approximately sixty man hours were needed by growers to set an acre of stakes. The amount of time varied with the plant population, type of labor, and soil conditions.

The number of man hours required for the pruning and tying operations as reported by the growers varied considerably. The majority required in the vicinity of 200 hours to complete four pruning and three tying operations. In cases where family labor was available much less time was required on this phase of production because of greater labor efficiency.

The staking, pruning and tying operations exert heavy demands on labor. The possibilities of mechanizing these phases of production look very remote for the near future. The only prospect of overcoming the heavy requirements for labor would seem to lie in the field of determinate type plants. Present varieties have not proven satisfactory in respect to specific characteristics such as freedom from soil induced blemishes, proper size, and storage, ripening and shipping qualities. Bush type tomatoes are used in the production of fresh market tomatoes in other areas of North America. It is no doubt only a matter of time until plant breeders will produce a determinate (non-staking) type tomato plant that will produce satisfactorily under Manitoba soil and climatic conditions. Competition from outside areas is increasing and growers will be forced in the near future to reduce costs wherever possible. The elimination of pruning and staking through the use of determinate type plants could do much to improve the competitive position of the Manitoba grower.

Insect and Disease Control Program: Insects have not been a major consideration in the production of tomatoes. Most growers protect their plants from cutworm damage with a granular application of heptachlor applied at planting time. D.D.T. was employed periodically during the 1961 growing season by a few growers to keep leaf-hoppers and flea beetles in check. Others applied no insecticide and reported no appreciable damage.

Growers were not as fortunate in escaping damage caused by disease during 1961. Several reported heavy damage to the lower portions of the plant even though the summer was generally hot and dry. The disease causing the most serious damage was early blight (Alternaria solani). In the most severe cases one-third of the leaf area of the plant was destroyed. There was no damage reported from late blight (Phytophthora infestans), one of the more serious diseases.

The spray (or dusting) program for the control of diseases employed by the growers in 1961 leaves much to be desired. Only sixty percent of the growers applied a fungicide and there were only three producers that used more than three applications throughout the entire season. This would indicate that there is little or no attempt being made by the growers in most years to carry out a complete protective spray program. The general attitude of the grower is to spray only if infection is apparent on the plants. Thus, they use control rather than preventative measures. Beach (22) found that in Pennsylvania the yield of tomatoes could be increased by 3.4 to 4.4 tons per acre with the incorporation of a complete spray program. These results were obtained over a three year period when late blight infection did not occur.

The protection of the plant from diseases would appear to be an area of production where extension programs could play an important role in emphasizing to the growers the importance of a complete disease prevention program. The problem lies not only in providing protection to the plants in the field but also in providing protection to the fruit during the period between harvest and final consumption. This period may extend up to 21 days if the fruit is picked in the mature-green stage and ripened at 60°F (14). Any inoculum on the fruit when harvested would have an ample opportunity to develop infection and cause considerable damage before the product reached its final destination. The fact that these fruits must be held under conditions of high humidity to prevent loss through shrinkage makes the need for a disease free product even more important.

Harvesting: The harvesting operation is done entirely by hand. Female help is used by the majority of producers where family help is not available. The fruit when picked is placed in 28 pound cases and piled in the ripening rooms. The number of hours required for harvesting varied considerably between growers but in the average operation 20 hours were used per hundred cases placed in the storage for ripening.

The distributing trade, under the present system of marketing, demands fresh market tomatoes in all stages of maturity from mature-green to firm ripe. In order to meet this demand the growers harvest the greatest volume of their crop in the mature-green stage and carry out the necessary ripening under artificial conditions.

The mature-green stage is defined as that stage of maturity when a tomato is fully developed, well filled out, yields to pressure giving a feeling of springiness, has well developed seeds and seed cavities showing

a jelly-like consistency (21). The fruit at this stage has not as yet begun to turn color.

The growers have found that by picking the tomatoes at this stage there is much less loss from cracking and blemishes. The experience has been that the longer the fruits are left on the vines the greater are the possibilities that blemishes and growth cracks will develop. The blemishes in most cases are due to sun scalding. When the plants are pruned to one stem and tied to an upright support there is little or no protection left against the strong rays from the sun.

Obtaining experienced help for the harvesting operation is becoming more difficult. Both skill and experience is required of the picker in the selection of fruit from the vines after it has reached the mature-green stage.

Some growers have been able to retain their same pickers from year to year but others are finding it increasingly difficult to obtain competent people for this job. The result has been that many tomatoes have been picked in the immature stage. Immature tomatoes have also been picked by growers who are anxious to obtain the high prices of the early market. Trossman (14) cites literature which states that tomatoes harvested when immature, ripen only one day earlier than tomatoes which were allowed to remain on the vines until they had reached the mature-green stage. He also indicated that, when ripe, the immature tomatoes were of inferior quality and had lost 4.6 percent of their weight during the ripening period in comparison to 2.0 percent for the mature-green. In addition, increases of approximately 12 percent in size were found in tomatoes during the four days just before the tomato started to turn. This information clearly emphasizes the need for extreme care in the picking

operation with greater supervision from management when inexperienced help is employed.

The harvest period for tomatoes varies somewhat with the season. In 1961 the first picking of mature-green fruit was made on the 17th of July. Growing conditions during June and July were quite favorable for tomato production and the first picking was a few days earlier than normal. Successive pickings were made as the crop matured. In general, the picking operation on any one area was carried out once a week throughout the harvesting period. The harvest was terminated by a heavy frost on September 15th.

The average yield of marketed tomatoes for the entire 63.9 acres was 828 cases (28 pound) per acre. No data are available on yields obtained in Manitoba in previous years, but this is an above average yield, according to the growers.

Yields per acre varied widely between growers, even for those using a similar plant population (Table 8) and growing their plants on comparable soils. The low yields imply that the use of good husbandry is lacking in many cases and that the employment of new improved technologies of production could greatly improve the gross returns to the operators.

TABLE 8
AVERAGE YIELDS OF MARKETED TOMATOES BY
DENSITY OF PLANT POPULATIONS
(Cases per acre)

Plant Populations	Number of Growers	Yields		
		Low	High	Average
6000 to 7500	9	389	1240	650
7501 to 8500	8	600	1210	930
8501 to 9600	7	414	1600	945
Over 9601	1			1500
Over-all average				828

Ripening: The degree of maturity will depend on the market destination and whether or not the first receiver has ripening facilities to bring the semi-ripe product to the stage of maturity satisfactory to the ultimate consumer.

In order to supply the first receiver with tomatoes having the required stage of maturity all growers have installed ripening facilities at the farm level. Buildings used for this purpose vary from those that are specially constructed to meet the necessary requirements of ripening to others that are temporarily converted for the two-month period. The most elaborate types consist of frame buildings fully insulated to maintain optimum conditions of temperature and humidity. Small oil or wood stoves have been installed to supply additional heat. Open pails of water, placed on the stoves, maintain conditions of high humidity through evaporation. Only two growers have buildings constructed strictly for the tomato ripening process.

The majority of growers convert their garages and implement sheds for the ripening process. Some of them are well constructed buildings with insulated walls and ceilings but the majority are of single ply lumber and lack the necessary facilities for proper maintenance of temperature and humidity. In extreme cases growers have utilized open-sided sheds and vacant greenhouse space for this all important premarketing process.

Temperatures and humidities used by the growers in the ripening of mature-green tomatoes varied considerably. In the early part of the season temperatures in the vicinity of 80°F and a relative humidity of 85 percent were used to hasten ripening in an attempt to capture the high price of the early market. Additional heat in many cases was used to maintain these high temperatures. Later on in the season when

ample supplies were available to meet market demands growers reduced the temperatures of their ripening rooms to approximately 70°F. They found at this temperature that if markets were slow the tomatoes could be held for a longer period of time and still maintain their quality. These results agree with conclusions of work carried out by Trossman (14). Data in Appendix III indicate that as the temperature is increased from 50°F to 70°F the number of days needed for the ripening process decreased.

In several instances growers indicated that at the higher temperatures (80°F or higher) brought on by use of additional heat or by high daily temperatures, difficulties were encountered in maintaining a quality fruit. The fruits ripen to a yellowish-orange color and lack the firmness necessary for marketing. The findings of the growers once again agree with literature cited by Trossman (14). It indicates that temperatures above 80°F cause uneven or blotchy coloring. At temperatures above 86°F the fruits develop little or no red color but only a yellow color. Further statements explain that the red coloring of tomatoes is due to a pigment, lycopene and the yellow coloring to carotene. The factor for red tomatoes is super-imposed upon the factor or factors for that of yellow and it is only after the red factor is inhibited by high temperatures that the yellow color develops.

Information of this nature emphasizes the great need for more serious consideration of temperatures and humidity levels within the ripening rooms if quality is to be maintained in the ripened fruit.

The light factor has received little consideration from the growers. No attempt has been made to add or exclude light from the ripening room to determine its beneficial or nonbeneficial effect, especially on color. Trossman (14) relates work carried out at Cornell University in 1934 which

indicated that there was no significant differences in the rate of ripening as a result of exclusion of light. It was found, however, that the red pigment developed more evenly over the entire fruit in the dark than in the light.

Packing: The packing process is generally divided into two sections, namely: sorting and packing. Several people are engaged in the sorting process, that is separating out the tomatoes into the various size ranges and the stages of maturity, based on the degree of color development. While the sorting operation is going on other personnel are packing the sorted fruits into the stages of maturity that the market demands at that time. Mature-green, and pinks are the two most popular stages of maturity demanded by the distributing firms.

The sorting and packing operation is a continuous process once the first picking has been placed in the ripening room. The tomatoes in the field container, because of mixed maturity, do not ripen at the same time. Therefore, it is necessary to go through the cases periodically to sort out those that have reached the desired stage of maturity. The growers have found that on the average four sortings for each case are necessary when the market demand is for tomatoes in the pink stage of maturity. Because of the number of sortings necessary before the tomatoes are packed for shipment they must have fair resistance to bruising. In the movement of the fruits from cases to case the potential for bruising is very high and if care is not exercised in this process reduced quality and high losses are experienced.

The packing is generally into 28 pound wooden cases known as lugs. A sheet of semi-waxed paper is used as a liner and the fruits are placed

in the case in two layers. They are generally arranged as 6 x 5 or 6 x 7. The arrangement when stated is indicative of the size of the fruit in the specific case. Most sales are made on this basis. If the tomatoes are to be sold locally for ripening and repacking by the wholesalers they are roiled into the lug with no special arrangement.

A fair volume of tomatoes during the 1961 production period was packed in six quart baskets and shipped in master containers each enclosing six baskets. Greater stress was placed on uniformity with this type of container, resulting in more hours of labor employed in the packing process.

At present the sorting and packing operation at the growers' level utilizes practically no mechanical labor-saving devices. The cases are all handled by hand and no moving belts are used in the sorting and packing process. There were no machines employed to help in the sizing operation. The growers indicated that with the average size of operation the investment in mechanized equipment would be too great in proportion to the benefits derived from reduced labor costs. A further discussion on this aspect of packing will be found under costs in Chapter III.

CHAPTER III

PRODUCTION COSTS AND RETURNS

Detailed information on production costs and market returns involved in the growing of staked tomatoes in Manitoba is practically non-existent. To the knowledge of the writer only one grower has kept detailed production records in the past and only for a two year period. The growers are well aware of the individual costs involved and the various prices obtained for their produce from year to year, but little effort has been exerted to determine net farm income from this highly specialized enterprise.

In making a cost of production study under these conditions it is difficult to obtain a high degree of accuracy in the figures representing the expenditures for the various operations. It must be emphasized that the data compiled was derived in many instances from estimates rather than from actual records. This, of course, leaves considerable room for error in the final analysis. It can also be argued, however, that in the majority of cases the growers have been producing tomatoes for a good many years and their estimates no doubt were tempered with past experience making for a fair degree of accuracy in any conclusion that may be drawn.

Another point of clarification needed in regard to this study is that the survey was carried out on an above average crop. Weather conditions in 1961 favored maximum growth and yields were increased accordingly. This in turn affects total production costs as expenses of harvesting, grading and marketing are closely related to crop yields.

The production costs of tomatoes like those of other crops are composed of explicit and implicit expenditures. Generally in cost of production studies the implicit costs include the interest on capital invested in land,

buildings, and machinery, depreciation on buildings and machinery, as well as the operator's own labor, while explicit costs include expenditures on materials, labor, power and machinery operation. In this study the interest and depreciation on investment in machinery were included in the machinery operations and the operator's labor was included in determining the labor requirements of the various tasks. Thus, only the interest on invested funds in land and buildings along with depreciation on buildings comprise the implicit costs which are recorded under the term "overhead".

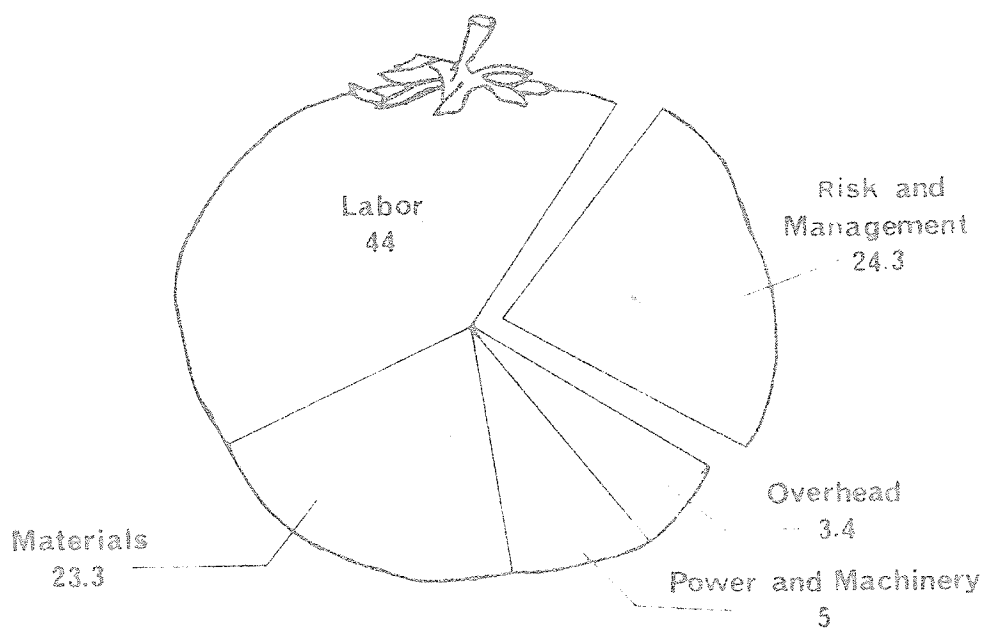
Production Costs and Net Returns

In order to get a general picture of inputs in relation to outputs the gross returns were distributed under five general headings, namely: labor, materials, power and machinery used, overhead, and return for risk and management. Percentage wise, Figure (2) indicates the proportion falling into the various sections.

The 25 crops comprising 63.9 acres gave an average gross return per acre of \$1,725.34 and an average net return of \$398.87. Net returns varied from a loss of \$505.76 per acre to profits of \$1,353.79 per acre.

The gross receipts per acre received by the growers showed a great variation. They varied from a low of \$680.00 to a high of \$3,500.00. The wide variation is attributed mainly to differences in management at the production level. The vast differences in yields obtained by growers using the same plant spacings (Table 8) are an indication that many operators could increase gross returns by placing greater emphasis on crop production technology. In other cases, however, growers were unfortunate in having the bulk of their crop mature during the period of low prices. This situation may be attributed to lack of planning on the part of management

FIGURE 2 Chart Showing the Breakdown of
Gross Returns on 25 Crops of Staked Tomatoes.
(percent)



but it is very difficult to predict seasonal price changes. It is, however, generally the case that prices are higher during the first two weeks in August than any time later (Chapter IV).

Total Cost Per Acre

The costs incurred by the twenty five growers in the production of 63.9 acres of tomatoes have been consolidated to determine an average cost per acre and to facilitate a breakdown of these costs.

The production of tomatoes for the fresh market is a highly intensified type of enterprise involving unusually large sums of invested funds. The costs involved are mainly explicit in nature as the investment per acre in land, buildings and machinery are relatively small in comparison to that of materials and labor. Approximately 88 percent of the total costs were incurred for materials and labor and only 12.2 percent for land, buildings, power and machinery (Table 9).

With land use representing such a small portion of the total costs tomatoes can be grown on high priced land with little effect on the total costs per acre. Growers agree that this generally true at the present time while staking tomatoes are the main type grown. But, if in time, a variety of determinate (bush) type tomatoes is developed that will compete, in respect to yield and quality to that of the varieties of staking tomato, land will become a more important factor, as greater acreages will be necessary to produce the same volume. Production may then move to areas of lower land values.

TABLE 9
 PRODUCTION COSTS PER ACRE OF TOMATOES,
 MANITOBA, 1961*

Cost Item	Cost	Percent
Labor	\$759. 41	57.3
Materials	404. 79	30.5
Power and Machinery used	91. 03	6.8
Overhead	71. 65	5.4
Total	\$1,326. 88	100 %

* Average for 25 farms

Detailed Analysis of Production Costs

Labor: It is quite evident from Table 9 that labor plays a very important part in the production of tomatoes. The 57.3% of average total expenses allotted to labor indicates very clearly that labor could be a limiting factor in future expansion of this enterprise. Under the present methods of production many of the operations can only be accomplished by the employment of hand labor.

The degree of efficiency with which the production operations are completed depends on the quality of available labor. Considerable skill and experience of the employed help is essential if maximum yields of a quality product are to be obtained. Growers are finding it increasingly difficult to find competent help for the specialized tasks involved in tomato production. This enterprise is of a seasonal nature supplying employment only from six to eight months of the year. Very seldom are the growers able to maintain their labor force from one year to the next as they tend to drift to other fields in the off season.

Married women who are interested in seasonal work as a means of supplementing the family income have played an important role in tomato operations at the grower level. Some of them have remained employed in this field for a number of years and have become highly skilled in specific jobs such as pruning, tying, harvesting, grading and packing. Women in this category have proven very satisfactory and growers are willing to pay somewhat higher wages for this extra skill and experience.

To bring out more detailed information, average total costs have been broken down in Table 10 into various categories relating to specific operations. This Table indicates that 30% of the labor costs are attributed to the tasks of staking, pruning and tying. If these operations could be eliminated a considerable saving would result. Growers have emphasized to research institutes the need for the development of a tomato variety which will combine the qualities of those varieties presently in production but not require the staking and pruning operations. Walkof (15) reported that considerable advancement in this direction has been made as the breeding program presently underway at the Canadian Research Station at Morden is yielding some promising results.

The planting operation is an area where the need for skilled labor has been minimized to a fair extent by progressive operators. This has been accomplished by the use of an improved mechanical transplanter that takes little skill on the part of the operators to obtain a satisfactory stand of plants. Little training is needed; hence inexperienced labor can be used in the planting operation. Semi-mechanical transplanters have been used for a number of years but they still require considerable skill on the part of the operators to ensure a healthy, uniform stand of plants.

TABLE 10

DETAILED BREAKDOWN OF LOW, HIGH AND
AVERAGE PRODUCTION COSTS PER ACRE

Labor	Low	High	Average	Percent of Total
Land preparation	\$1. 00	\$8. 00	\$3. 71	.4
Planting	20. 00	83. 50	40. 57	5.3
Weeding	6. 00	65. 00	35. 45	4.7
Staking	25. 00	126. 00	61. 57	8.1
Pruning and tying	78. 00	300. 00	165. 29	21.8
Dusting	2. 50	14. 00	5. 45	.7
Irrigation	4. 00	56. 00	14. 41	1.9
Harvesting, grading and packing	126. 40	741. 40	370. 74	48.8
Delivery to market	10. 00	90. 00	30. 85	4.1
Stake Removal	10. 00	50. 00	31. 37	4.2
			<u>759. 41</u>	<u>100 %</u>
<u>Power and Machines</u>				
Seedbed Preparation	1. 80	15. 28	5. 13	5.6
Planting	. 60	10. 00	4. 05	4.4
Cultivation	1. 08	12. 00	3. 20	3.5
Dusting	. 40	11. 89	5. 13	5.6
Irrigation	10. 41	54. 40	30. 19	33.2
Trans. to ripening room	3. 00	40. 00	12. 09	13.3
Delivery to market	10. 60	90. 00	31. 24	34.4
			<u>91. 03</u>	<u>100 %</u>
<u>Materials</u>				
Plants	75. 00	285. 00	140. 49	35.0
Fertilizer	8. 00	144. 00	34. 98	8.7
Insecticide and Fungicide	2. 50	45. 00	16. 45	3.3
Stakes and Twine	10. 00	67. 00	43. 06	10.7
Crates	62. 00	439. 00	169. 81	42.3
			<u>404. 79</u>	<u>100 %</u>
<u>Overhead</u>				
Interest on land or rent	5. 00	100. 00	57. 70	80.5
Taxes per cultivated acre	1. 50	21. 40	8. 09	11.3
Interest and Depreciation on Buildings	3. 00	16. 00	5. 86	8.2
			<u>71. 65</u>	<u>100 %</u>
			<u>Total</u>	<u>71. 65</u>
				<u>100 %</u>

Growers having difficulty in retaining their skilled help from year to year could save a considerable amount of time and expense in the training of new help by the employment of the improved transplanter now on the market. Any saving in man hours by using the newer model is questionable, if experienced help is used in both cases.

The use of figures of average cost per acre as illustrated in Table 10 is somewhat misleading for certain operations as the labor costs vary according to plant population. With the wide variation in populations used a figure of average cost per acre does not permit a complete comparison between growers on actual costs. To present an alternative account of the utilization of labor, costs of specific operations have been calculated on a per plant basis and presented in Table 11.

TABLE 11

LABOR COSTS CALCULATED ON A PER PLANT OR PER CASE BASIS

Item	Unit	Cost in cents per unit		
		Low	High	Average
Transplanting	plant	.23	1.0	.57
Staking	plant	.25	1.5	.8
Pruning and tying	plant	1.0	4.0	2.3
Harvesting, grading and packing	case	22.0	64.0	43.0

The harvesting, grading and packing operation makes a heavy demand on labor which is extremely difficult to avoid. Picking in the field is done entirely by hand labor as no machine has been developed, as yet, that is capable of selecting and harvesting fruit of the proper size and

maturity. Mechanical harvesters have been used on an experimental basis in some of the major tomato growing areas of the United States. But, before these machines can be utilized in the tomato harvest, a breeding program will be necessary to develop a type of tomato which can be handled satisfactorily in this manner. It would seem that this task is not unsurmountable as some progress has been made in that direction. A determinate variety producing one or two uniform maturing clusters of fruit is required for a once-over harvest. If this goal can be achieved tomato production labor requirements will be cut substantially.

The grading and packing operations used by growers leave a great deal of scope for improvement. Individually, it would be difficult and inefficient for growers to employ machines to streamline their sizing, grading and packing operations. But there are ample opportunities for growers collectively to set up facilities with a fair degree of mechanization that would materially reduce the costs and turn out a higher quality product. Grading and sizing is a specialized type of operation which requires experience on the part of those employed. With the labor situation being as discussed earlier, growers, when packing individually, are forced in many cases to use inferior help. With central packing, labor requirements would be reduced to a point where it would be possible to employ only experienced help.

The lack of proper sizing in the tomato pack (during the height of the tomato season) is losing markets for the Manitoba growers. Wholesalers are merchandising tomatoes twelve months of the year and have developed outlets for tomatoes sized and packed to narrow specifications. Local growers have shown a certain amount of apathy in their attempt to supply a product

that will fit into the system of merchandising that is now in operation. Local developments in tomato production have not kept abreast with overall developments occurring in the tomato industry, nationally and internationally. Greater attention to sizing in respect to merchandising trends could substantially increase markets for the local tomato growers. Hand labor for sizing is inefficient and unreliable. Machines are available for this operation and could be used to greater advantage to improve the quality of the local product.

Materials: The proportion of cost incurred for materials for the growing and marketing of tomatoes is extremely high (Table 10). One of the main reasons is the high cost of producing seedling plants. Tomatoes require a much longer growing season than we have in Manitoba (2) for economic production. Thus, to obtain profitable yields, plants must be started in the greenhouse well in advance of satisfactory growing conditions in the field. Costs of operating a greenhouse under Manitoba conditions are relatively high, making plant production a major item in material costs. Importation of plants from other areas has been considered as a method of reducing plant costs but has not met with any degree of success.

Containers used in marketing tomatoes is another input item that adds greatly to material costs. Because of the highly perishable nature of tomatoes they must be given maximum protection from possible damage during transit from the grower to the consumer. To ensure this protection wooden lugs are employed which add substantially to costs. Many secondhand lugs which become available once the imported tomato has been prepackaged into small containers, have been used and this has reduced the cost by approximately two-thirds. Containers from this source are becoming scarce as import

tomatoes are now arriving in cardboard cartons. These cartons are for tubing type tomatoes and do not lend themselves to the handling of the local tomato as it is sold as a bulk product which needs greater protection. Because of this shortage growers have been forced to purchase new containers which have a considerable effect on costs per case marketed. To reduce costs of the container, growers may find it advantageous to combine their purchases in order to buy in fairly substantial quantities. This would provide an opportunity to bargain for better prices.

Other major items which add to material costs are stakes, twine, fertilizer, insecticide and fungicide. Wooden stakes have a high mortality rate and must be replaced approximately once every four years. Material for stakes is becoming scarce and growers are paying up to four cents per stake at the lumber yards. Other growers have reduced this cost to one and one-half cents by making their own during the winter months, using labor which is available on most farms at that time.

Fertilization includes a high annual rate of application of chemical fertilizer in addition to periodic applications of manure. Chemical fertilizer is relatively inexpensive but manure, because of the acute shortage, has been priced out of reach of most growers. Insecticides and fungicides, were very small cost items in comparison with other material costs in this study. Considering their importance in the production of quality tomatoes, too little emphasis, it would seem, has been placed on their use. The low expenditure reported is an indication that plant protection from disease and insects has been seriously neglected.

Power and Machinery: Machinery and power play a very secondary role in tomato production on most of the acreage grown, except for irrigation and transportation. Outside of general land preparation and the occasional cultivation, the use of power and machinery in the field is confined to irrigation. Several growers have power sprayers or dusters but these are not used universally. The storage, grading and packing operations are carried out in the ripening room without the use of any mechanized equipment.

The value of irrigation for tomato growing was not questioned by the growers. They emphasized that without a supplementary water supply growing tomatoes would involve too great a risk. The capital investment in irrigation equipment for all crops grown varied from a low of \$1,000 to a high of \$12,000 for the larger systems. The cost of operation of these systems also varied considerably (Table 10). One of the main reasons for this variation was the varying extent to which the systems were utilized. The number of irrigations per season and the inches of water applied per acre varied widely from one grower to the next (Table 7). It is also indicated that growers should be making a closer analytical check on the moisture requirements of tomatoes (Table 6.) Yields recorded indicate that reduction in the rates of water application at the proper stage of plant growth could significantly reduce irrigation costs without materially affecting final yield and quality.

In the process of determining costs of production growers tend to omit transportation costs in marketing. This is especially true for the growers situated a short distance from their market outlets. It is difficult to determine an accurate figure for transportation of any one

crop as they are generally transported in combination with other crops. Also, in many instances the return trip from marketing produce is used to transport necessary supplies for future field operations. However, transportation is an essential part of production and must be given due consideration.

Data in Table 10 show a wide spread in transportation costs per acre between growers. This spread may be explained from the standpoint of yield differentials and distance from market of individual growers. Using cost per case as another indicator of transportation inputs, it was found from the study that it cost growers, on the average, six cents per 28 pound case to market their tomatoes. The individual's costs varied from four to ten cents depending on distance from market.

Overhead: The acreage under tomato production is situated mainly in areas in close proximity to residential developments. This has had an inflationary effect on land values and as a result interest on capital invested in land accounts for 80.5 percent of the overhead costs. This fact in itself is not important when the tomato crop is considered separately, as overhead accounts for only 5.4 percent of production costs. It is extremely important however, when all enterprises of an individual grower are considered. To protect himself against crop failures, or price levels, a grower combines a number of crops in his yearly operations. Very few of these crops produce gross returns comparable to that of tomatoes and overhead in respect to land plays a much greater role. Growers in many cases, especially those not producing tomatoes, have found it impractical to produce on land with present inflated values and have sold their land and moved on to other fields of endeavour.

However, there are growers who are unable to change their mode of employment due to lack of training and others who have reached that stage in life where they feel it is impractical to change. Growers in these categories discount interest on capital invested in land and do not consider opportunity costs.

The use of buildings for tomato production is mainly confined to the ripening processes. These are relatively inexpensive and need little care and maintenance. Overhead costs from this standpoint are insignificant.

The importance of taxes in overhead costs varies between growers. Growers who have a relatively small acreage and who combine the production of highly intensive crops find that taxes are a minor contributor to their total expenses. On the other hand, growers who produce crops which yield smaller returns per acre find that taxes are a significant cost item. Growers in the latter group are particularly concerned with rising taxes initiated by urban development.

Risk and Management: Tomato production, because of the many hazards encountered, the high cost of production, and the rapidly fluctuating nature of prices (Chapter IV) is placed in the category of an extremely high risk enterprise. Because of this the portion of gross income falling in the section for risk and management must be a substantial figure to encourage the continued production of this crop. Growers received on the average 24.3% of the gross returns on their 1961 crops for risk and management (Figure 2). This return is considered by the growers to be adequate to maintain continued interest in growing tomatoes. This is especially true for growers using family labor.

To analyse this situation a little further 68.3% of the total receipts per acre are distributed to labor and management. For any grower who is able to utilize family help to supply all or a portion of the necessary labor the above figure represents a sizeable income per acre to the family. Even though prices fall to a level where they only cover production costs, growers in this category are able to earn a fair income for their family labor input.

This situation, to some extent, explains the reason for the wide variation in yields obtained by the growers. When prices fall below the level where they will cover remaining costs of production and marketing, growers who hire all their help terminate their harvest. Growers with family help continue as they are still able to realize a sub-standard wage for the family help and maintain a higher level of living than they otherwise could.

It is evident from the above discussion that in many cases the family operation is preventing the maintenance of a price that will return a reasonable margin of profit to the commercial grower. The fact that the family operation will continue to deliver supplies even though prices are not sufficient to cover total costs keeps the prices at depressed levels and prevents them from rising to a level which will cover remaining variable costs of normal wage rates. The part-time operator who produces tomatoes as a sideline to a full-time job also contributes to supply situations which result in uneconomic returns to the producer. Any returns which he might receive for his time spent in production will increase his level of living.

CHAPTER IV

MARKETING

Extent of Markets and Sources of Supply

Fresh market tomatoes move through the various trade channels in Manitoba twelve months of the year. In 1961 supplies equivalent to 439 cars (650 - 750, 28 pound cases per car) were handled by the local dealers. Of this total Manitoba growers marketed 109 cars (Table 12). The bulk of the local supplies were placed on the market during the months of August and September. Marketings in July and October were very light.

The additional volume marketed through the Manitoba trade channels was composed of imports originating mainly in Mexico, California, Texas and Florida. The major source of supply was Mexico and California with Texas and Florida entering the picture when price differentials were satisfactory.

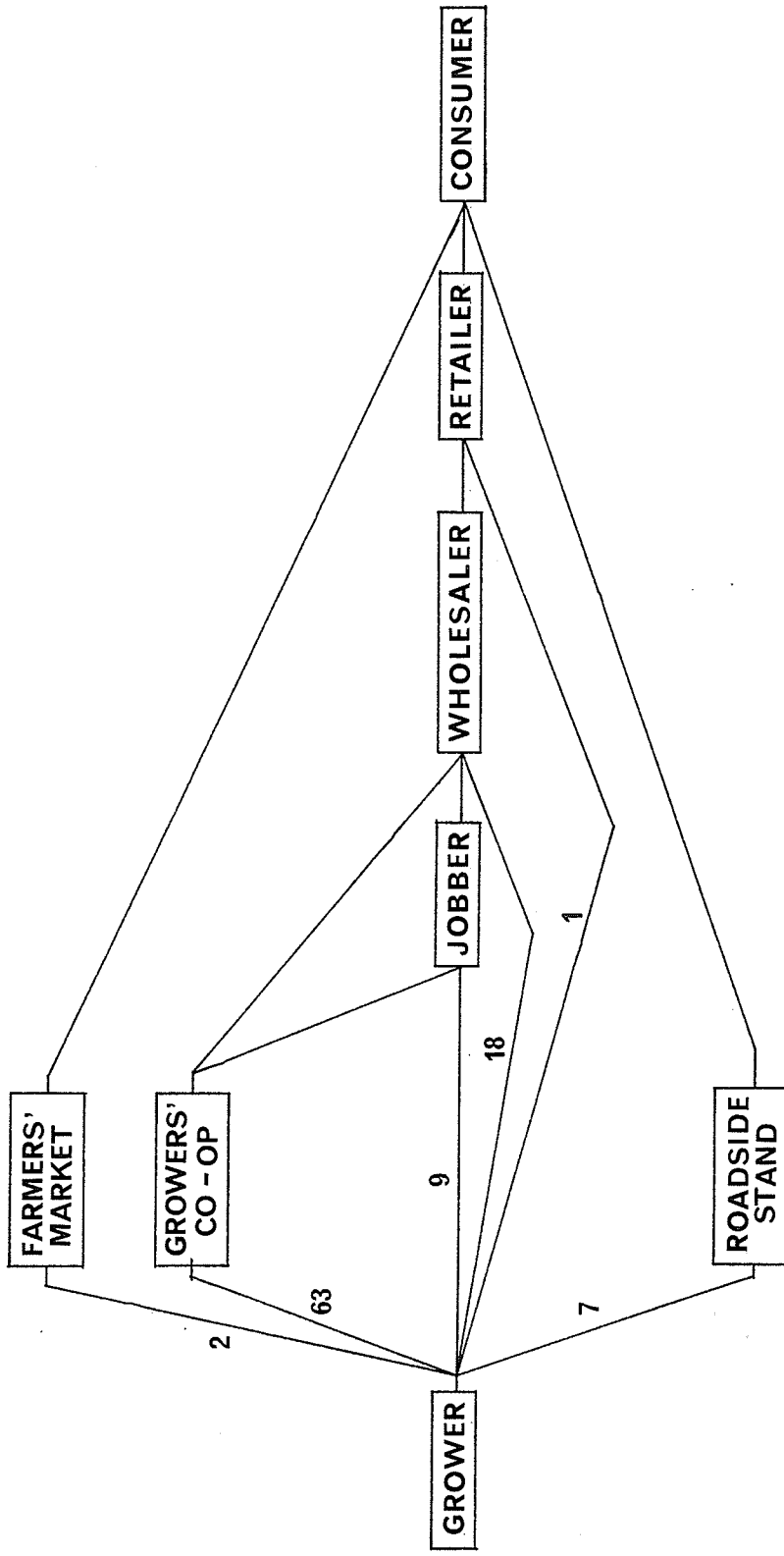
It is interesting to note that imports were on the local market during the height of the Manitoba tomato harvest. A total of 21 cars were imported in the months of August and September. The wholesalers state that there are two reasons for importing tomatoes at this time:

1. To assure a supply for trading purposes at all times.
2. To obtain the size-range necessary for the merchandising methods employed.

Marketing Channels

The Manitoba grown tomatoes are distributed to the consumer by way of several channels (Figure 3). The most important of these, by far, is

Figure (3) Marketing Channels for Manitoba Tomatoes from the Grower to the Consumer 1961★
 (volume in percent)



★ Source - Marketings of 25 growers.

TABLE 12

CARLOT UNLOADS OF FRESH MARKET TOMATOES IN MANITOBA, 1961*

Origin	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Manitoba							1	58	48	2			109
Calif.						10	40	12	8	21	15	1	107
Texas					24	23							47
Florida	1	4			6						3	19	33
Mexico	17	27	29	47	10						9		139
Ontario									1	2			3
Spain		1											1
Cuba		2											2
Total	18	34	29	47	40	33	41	71	56	25	18	29	439

* Source (23)

through the growers' organization (Gardeners' Sales Limited) directly to the wholesaler. Sixty-three percent of the volume covered in the study (Total volume 52,743 - 28 lb cases) was marketed in this manner (Figure 3).

It is significant that 90 percent of the total crop included in the study was handled by the wholesale trade on its way to the consumer. This definitely indicates that the wholesaler is a necessary cog in the marketing wheel for the local tomato crop. The large volume handled by the wholesaler is evidence also that the independent growers and the growers' organization realize the importance of working with the wholesalers in order to obtain maximum distribution. The opinion is that if growers were to market directly to the retailer it would bring them in direct competition with the wholesale trade. It is believed that activities of this nature would result in wholesalers bringing in imports to meet their market demand. Due to the price differential between local and import tomatoes it would probably be a losing operation for the wholesaler in the short run. However, the wholesaler has given indications that he is willing to just meet expenses or even to lose money over a short period of time in order to maintain his market outlets for the balance of the year. It could well be disastrous for the growers to compete directly with the wholesaler as this would not only reduce the wholesaler's return but also depress prices on the local market and the grower would stand to lose heavily. Furthermore, the export markets, both east and west, which have been developed and maintained by the wholesale trade plays an important role in the distribution of the local tomato crop and it appears advisable that growers continue to respect the wholesalers position in the marketing system.

The volume of tomatoes moving through the Farmers' Market (Nairn St) and roadside stands is still quite significant. This volume comes mainly from the small growers who are endeavouring to increase their annual earnings by obtaining retail prices. However, there is in addition a considerable volume of second grade tomatoes marketed by large growers in this manner. The outlet for this level of quality through wholesale channels is very limited. It is expected that future volumes moving through the Farmer's Market and roadside stands will remain fairly constant.

Export Markets

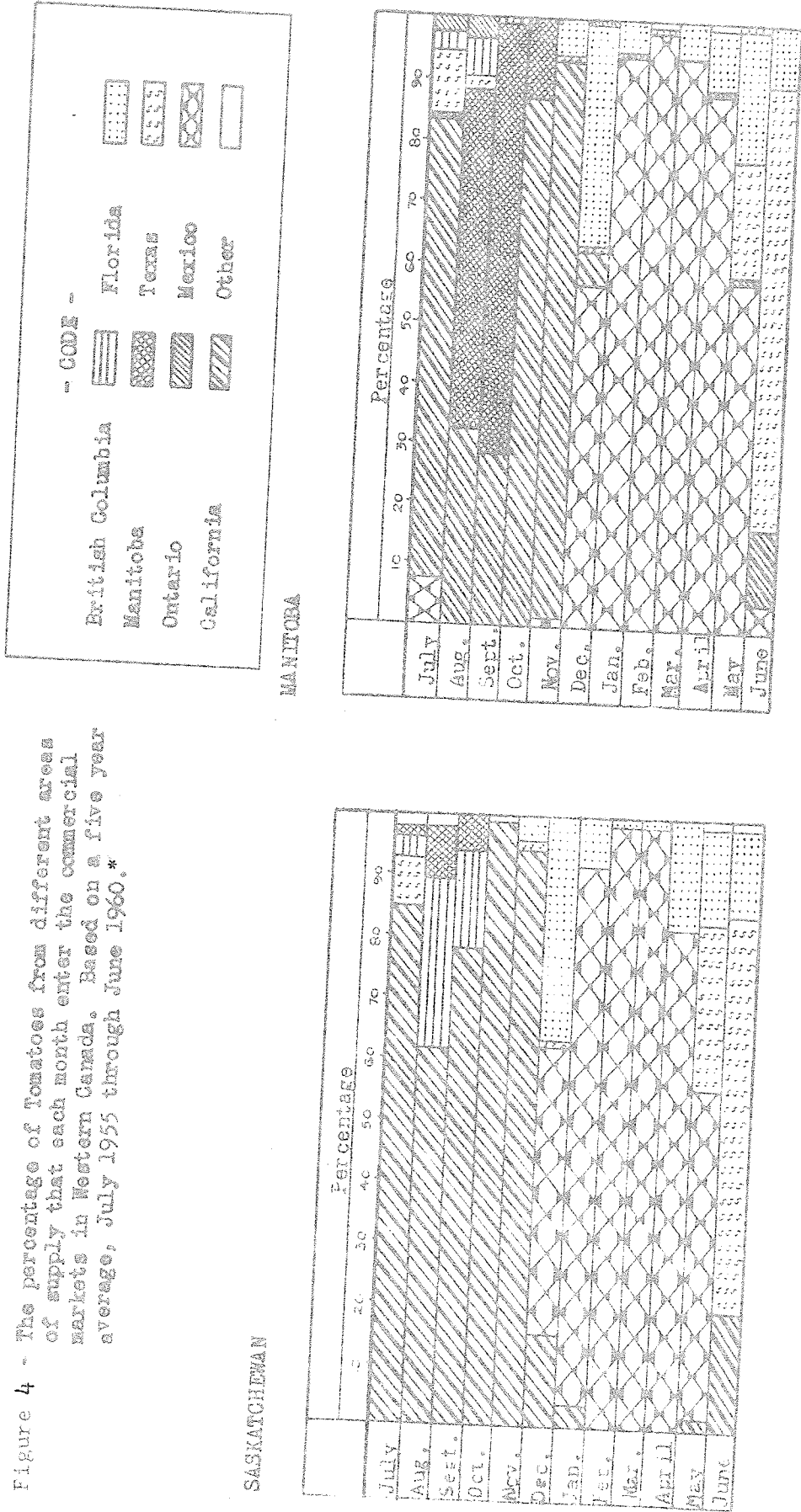
In 1961 Manitoba exported 25 percent of its local production of tomatoes. The greatest volume was shipped to points located in Saskatchewan and Northwestern Ontario. Minor shipments were made to markets in Alberta.

The growers' organization (Gardeners' Sales Ltd,) played the major role in the export markets outside of Manitoba. The balance of the exports were handled by jobbers and wholesalers with the exception of a few small shipments that were made directly by individual growers.

Wholesalers have often indicated that export markets for Manitoba tomatoes, especially in Saskatchewan, have been developed only to a very small degree (Figure 4). During the period from 1955-60 Manitoba, on the average, supplied less than 10 percent of the market demands in Saskatchewan for the months of August and September. California supplied 60 and 80 percent of the volume for the respective months with British Columbia taking over the remaining demands.

A comparison of transportation and seasonal tariff charges involved in shipping from alternative supply areas (Figure 5) appears to indicate that Manitoba is in a good position to compete for the Saskatchewan markets. The difference in price as shown in Table 14 also allows Manitoba a wide margin for competitive selling.

Figure 4 - The percentage of Tomatoes from different areas of supply that each month enter the commercial markets in Western Canada. Based on a five year average, July 1955 through June 1960.*



* Source (25)

Figure 5 - Areas of Supply for Fresh Vegetables to Western Canada, Transportation Costs, and Import Duties, 1959 - 1960. *



Relative Cost of Shipping i.e. (\$1.83 - \$3.40/cwt.)	
Celery	Highest
Corn	
Tomatoes	
Potatoes	Lowest

Table of Import Duties U.S.A. into Canada		
Commodity	Seasonal : duty : \$ / cwt.	Maximum : duration : in weeks
Cabbage	0.90	30
Carrots	1.00	40
Celery	2.00	24
Corn <u>1/</u>	1.50	8
Onions <u>2/</u>	1.50	44
Potatoes	0.37½	52
Tomatoes	1.50	32
Turnips	10% ad valorem	52

Based on rates effective April 10, 1959 to March 31, 1960.
1/ Corn on the cob. 2/ Excludes onion sets and shallots.

* Source (25)

The quality of Manitoba tomatoes in comparison to that of imports has been questionable at certain times in the past. This has caused some reluctance on the part of the buyers to handle the Manitoba product. There is every indication that if greater emphasis were placed on quality control of tomatoes leaving the province, markets could not only be expanded in Saskatchewan but also in Alberta and Northwestern Ontario.

Merchandising Methods

From the survey taken of the jobbers and wholesalers in 1961 it was found that 90 percent of the local tomatoes were handled in 28 pound cases. The remaining 10 percent were shipped in 14 ounce tubes or five pound baskets.

The 28 pound cases (lugs) are constructed of wood and the tomatoes are generally packed in them in two sizes known to the trade as "6/5's" or "6/7's". This indicates that there are two layers of six tomatoes packed lengthwise of the case and five across or six across and seven lengthwise. The tomatoes packed as "6/5's" are generally used in bulk displays and merchandized at the retail level in this manner. The tomatoes packed as "6/7's" are purchased mainly for prepackaging into 14 ounce tubes (9" x 2" x 2"). They are of such a size range that four fruits will fit firmly into the tube allowing a slight margin of weight over 14 ounces for shrinkage during its shelf life.

The five pound basket is used as a pack to promote volume sales during the peak of the local tomato harvest. It is of a size that can be conveniently handled by the consumer and carries sufficient volume of fruit for canning purposes. This method, which was first put into service during the 1960 season, has been quite effective in removing the pressures of heavy supplies on the market.

The cost of packing in this container is higher than that of case lots because of material costs and the extra time spent in the selection of more uniform sized fruits. Six baskets plus a master container cost approximately 50 cents in comparison to 30 cents for a new case or 12½ cents for a used case. Tomatoes sold in this manner must be priced somewhat higher to the retailer in order to recover the extra costs. The retailer is prepared to pay this extra cost because of the improved efficiency in moving these tomatoes through the store in comparison to that of bulk sales. The losses encountered due to spoiled fruit, caused by additional handling in bulk bins, are much less with the packaged product (3, p 10), thus, partially compensating for the higher purchase price.

The use of the 14 ounce tube for merchandising tomatoes which is a well established practice throughout Canada and the United States is very time consuming and takes considerable space for the operation. Because of this retailers have allowed this operation to move to the wholesale level where it is accomplished with a high degree of efficiency. In Manitoba, with the exception of one wholesale firm, the Scott Fruit Company, the packing of 14 ounce tubes is done by hand.

The Scott Fruit Company has installed "overwrap" equipment which has mechanized the packaging of the 14 ounce tube to a fair extent. Once the fruit has been placed in the carton the machine takes over. It closes the lid and wraps the entire carton in a transparent film. This film carries the brand name and all necessary grade regulations. A study conducted by the Scott Fruit Company in 1959-60 (Table 13) indicated

TABLE 13
 COMPARATIVE COSTS OF PACKING TOMATOES IN 14 OUNCE TUBES,
 BY MACHINE AND BY HAND, 1959-60*
 (Cents per tube)

Cost Item	Overwrap	Handpack
Stripping and sorting labor	1.08	1.08
Tubing labor	0.71	.53
Supplies	3.00	3.48
Overhead	0.29	0.23
Total	5.08	5.32

* From a six month study carried out by The Scott Fruit Company, Winnipeg.

a saving of .24 cents per 14 ounce carton through the use of the "over-wrap" equipment rather than hand labor. Since the time of this comparative study, labor costs are reported to have increased 12 percent. Also a plastic 14 ounce tube is now in use. However, its cost is very close to that of the original tube and its effects on material costs would be insignificant. The complete cost study is given in Appendix I. It is based on 30 tubes per 28 pound lug of tomatoes (Mexican).

The costs of packing tomatoes in tubes, whether by hand or with the aid of machines, are high but because of their efficiency in the movement of tomatoes at the retail level they are quite acceptable to the trade. The consumer is also receptive to this type of package as it is of a size that fits well into the shopping bag and contains a quantity of fruits that will look after the family needs with a minimum of waste. Generally tomatoes packed in individual tubes have a variation in maturity so that they may be used over a period of time.

Among the wholesalers contacted the percentage of their imported tomatoes sold in 14 ounce tubes varied from 30 percent to as high as 70 percent. These percentages fall considerably during the local tomato harvest but they are still quite substantial.

When questioned as to why such a small percentage (less than ten percent) of the local tomatoes were sold in tubes the wholesalers were unanimous in their reply that the local fruit as presently sized and packed did not meet the requirements for a tubing tomato. In all cases, they indicated the lack of a uniformly sized product and in most cases the over-all size was much too large. With only a small portion of each case having the proper size range, sorting presents a serious problem in respect to cost of packing. Wholesalers, rather than spend the extra money on sorting will import a high priced product which is much superior from the standpoint of size specifications for the tubing trade.

The varieties grown in Manitoba produce a very small percentage of their fruits in the size range for tubing. Thus, the growers are reluctant to sort out the smaller fruits for a special tubing pack because of the inconvenience and extra time required. It would seem that the growers are losing a sizeable market by not selecting out the smaller fruits produced by the larger fruiting varieties or by growing varieties that will mature fruit within the necessary size range.

Recently, there has been a move to change the shape of the 14 ounce tube (now 9' x 2" x 2") to allow for the tubing of a larger tomato. This is a trend that should be fully explored as the larger tomatoes are generally of superior quality and (according to some of the wholesalers) find greater acceptance at the consumer level.

Merchandising of tomatoes is an intricate operation and a complete

study of the various aspects such as cost of packaging in various sized containers, comparative fruit losses at retail level, and consumer acceptance and willingness to pay higher prices for packaging could be invaluable to the grower as well as to the wholesale and retail trade.

Prices and Price Differentials

Prices paid to growers for locally grown tomatoes are substantially lower than prices paid for imports arriving on the market during the same period as well as for imports moving at any other time of the year (Table 14). This would suggest that price is strongly influenced by the supply of local tomatoes. Prices of tomatoes in other growing areas seldom affect the price level of locally grown tomatoes.

Several growers feel that too large a portion of the local crop is being marketed by growers who are not aware of the changing situation of supply and demand. Lacking knowledge of the market situation they are in no position to demand higher prices when stocks are short nor to anticipate downward supply changes and hold out for improved prices. It was reported that because of this situation the wholesaler, by having a fuller knowledge of the supplies available, is able to increase his normal margins at two points: 1. By anticipating long supplies he will buy from the grower at reduced prices well in advance of a drop in his price to the retailer; 2. By recognizing a short supply situation in advance the wholesaler raises his price to the retailer but continues to buy from the grower at the same level.

Importation of tomatoes periodically results in depressed prices for local growers. The main reason for this is not price competition but an oversupply situation which is brought on by the presence on the

TABLE 14

MONTHLY WHOLESALE PRICES OF FRESH MARKET TOMATOES, 1961*
(Dollars per case)

Origin	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Imports	4.00-	4.50-	4.00-	4.75	4.00-	6.50-	6.50-	4.75-	5.00-	5.25-	5.50-	5.25-
	4.80	5.00	5.50	5.50	5.00	7.50	7.50	6.25	6.00	5.50	6.50	5.75
Local								2.50-	1.75-			
								3.25	2.50			

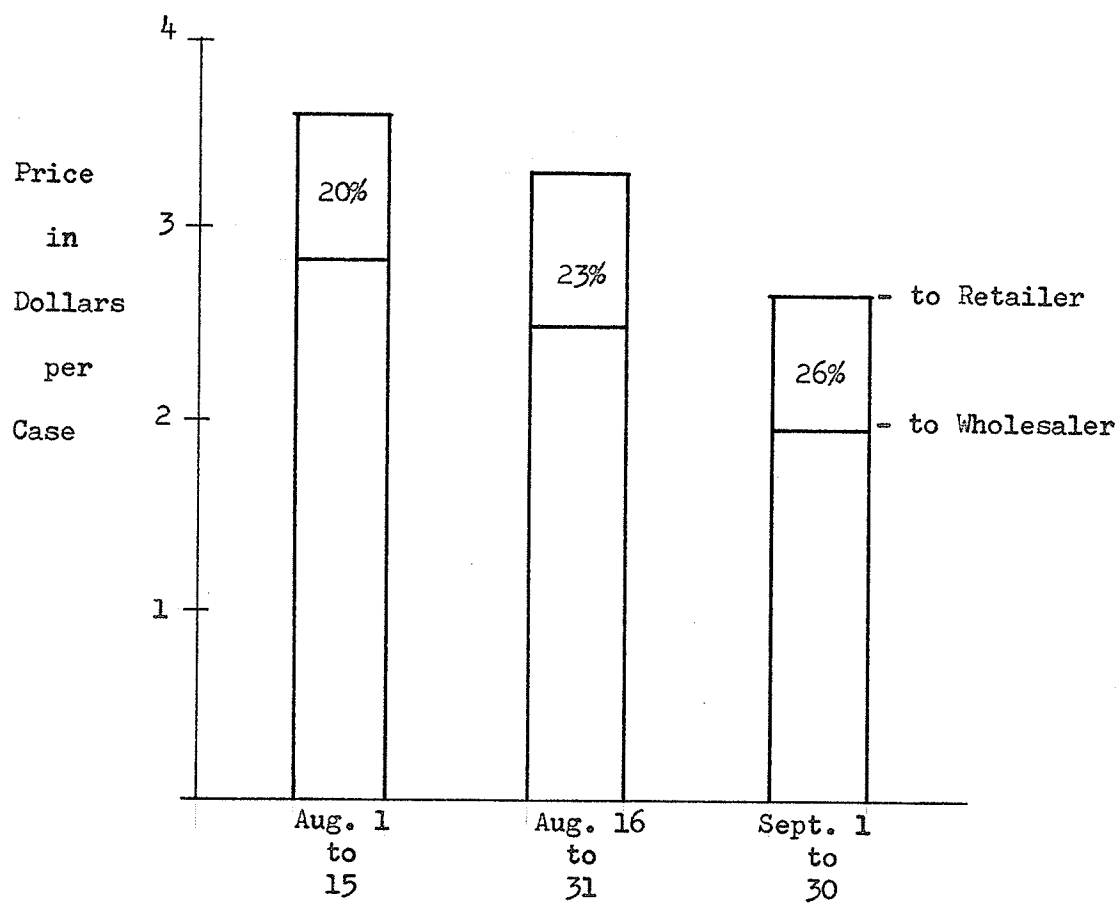
* Source ('23)

market of excessive imports. The question might be asked as to why high priced tomatoes are brought in to a low priced market. Generally importations occur early in the local marketing season when local supplies are not consistent or are uncertain. However, information in respect to local supplies, present and future, is not too clear and often greater volumes than needed are imported and an oversupply situation occurs with reduced prices resulting. The availability of more accurate information for the wholesaler in respect to the potential volume of local tomatoes that will arrive on the market during any given time period would help to discourage the importance of additional supplies and prevent the unnecessary depression of prices.

There has always been considerable controversy over the amount taken by the wholesaler for services rendered. The markup is fairly constant at approximately 70 cents regardless of level of price (Figure 6). It is axiomatic, therefore, that the wholesale percentage markup changes with a change in the price to the retailer. In the short run any reduction in price to the retailer is accompanied by an equivalent reduction in the growers' price paid by the wholesaler.

If the situation as illustrated in Figure 6 is accurate, the wholesaler is more directly concerned with the price that will move the greatest volume than with the price the grower receives. Therefore, it is quite logical to expect that wholesale pressures will keep the price as low as necessary to move total supply into consumption.

Figure 6 - Price of Mature-green Tomatoes to Wholesaler and Retailer and Percent Wholesale Markup, 1961*



* Source: From survey of ten wholesalers

CHAPTER V

DISCUSSION AND CONCLUSIONS

Discussion

The production of fresh market tomatoes is situated mainly in the areas immediately adjacent to Winnipeg and is carried out by a relatively small group of growers who operate farms varying in size from eight to sixty acres. Involved in this enterprise are many highly specialized operations which demand a great deal of skill and knowledge not only from management but also from the labor employed. The ability to apply advanced technology plays an important role in the success of the overall operation.

Tomato plants having an indeterminant growth habit are used on 89 percent of the acreage grown. The small acreage of determinant type plants is, according to growers, due to the inferior fruit quality. The growers realize the additional labor costs involved with the indeterminant type plants but are convinced that this is the only type that will produce fruit that will find ready acceptance from the trade.

The difficulty in obtaining skilled labor is of great concern to management. Greater consideration is being given to the use of equipment that will not only reduce the need for labor but also reduce the necessity for skilled labor. Some growers feel that, if help requirements cannot be reduced substantially by the combined use of mechanical aids and determinant type plants, labor may become a limiting factor in the future development of the tomato industry in Manitoba.

A combination of enterprises that would utilize labor over the entire year or a major portion thereof could be a partial solution to the problem of maintaining competent help. Several growers are taking a

serious look at this aspect of their business and are making changes in their production patterns accordingly.

Generally speaking, growers engaged in the production of tomatoes are limited in their land resources. The areas of suitable soil along the Red River originally available for vegetable production are slowly being engulfed by urban development. Thus, the growers must utilize their remaining land resources more fully.

It is anticipated that because of pressure from residential development there will be a partial shift in the location of production. This is particularly true for the acreage situated in the East St. Paul municipality where prices of land are becoming very attractive and growers are yielding to the pressure to sell.

The areas chosen for relocation of the tomato crop will depend to a considerable extent on the general trend of relocation of the vegetable production areas. There are indications that the alluvial soils of the Assiniboine River in the vicinity of Portage la Prairie will attract a considerable acreage. This certainly will be the case if there is a swing from the production of indeterminate type varieties to that of determinate types. The soils are excellent from the standpoint of productivity and their texture is such that mechanized operations can be very effectively worked into the production patterns.

Under the present methods of merchandising (in mature-green stage) the distance from market is not the limiting factor that it was when growers harvested and sold their crop in the ripened stage.

No doubt transportation costs will be greater from distant areas but reduction in production costs will have a compensating effect.

There are still many aspects of technology that need clarification. This is especially evident in the information obtained in respect to seedling production, plant spacing in the field, fertilizer rates, and irrigation. The information available concerning these practices is limited and each grower is relying on his past experience for guidance. In many instances the assumptions made in this manner are questionable. More specific information in relation to these fields could greatly improve the efficiency of land resource utilization.

The adoption of additional varieties that will capture a still greater portion of the local market by supplying a fruit more suited to the present method of merchandising, could substantially increase demand for the Manitoba product. Packers find it difficult and expensive to prepack local tomatoes in 14 ounce tubes. The varieties grown, however, are quite suitable for the bulk trade.

The problem of harvesting only fruits that have reached the mature-green stage is one that will continue to concern the grower at all times as skilled labor for the operation will continue to be limited. On the other hand, a great deal of improvement can be made in the quality of the ripened product. Greater attention is needed in respect to temperature controls in the ripening rooms. Improper ripening processes are causing disappointments to the wholesale receivers and there is a certain amount of resistance to the locally grown tomato especially for export purposes. Minor capital investments in proper buildings equipped with temperature and humidity controls could not only materially improve the quality of the ripened fruit but also eliminate many of the losses due to culls. There is a definite lack of knowledge at the grower level as to the optimum conditions needed for the ripening process.

Differences in the ripening characteristics of varieties is another factor with regard to which the growers lack knowledge. More specific information in respect to the particular conditions of ripening needed for each variety may solve some of the problems in the ripening process and ensure a much higher quality product to the consumer.

Complete records of production costs, with one exception, were non-existent among the growers surveyed. Most growers are well aware of individual costs involved in the various operations but no attempt has been made to analyse completely the economic aspects related to the production and marketing of tomatoes. Without accurate records there is little opportunity for the grower to effectively analyse his operation and adopt changes that will effect more efficient use of his resources. Undoubtedly certain areas of production could be improved upon if full knowledge was available. This would permit an increase in efficiency of performance in the use of land, labor and capital. The variation between growers in gross and net returns clearly indicates this possibility.

The use of mechanized methods in both the production operations and those involved in ripening, sorting, grading and packing offers some possibilities of reducing the hours of labor required. Mechanical planters have been proven satisfactory and the newer types do not require skilled personnel for their operation. The use of fruit sizing machines and endless-belt sorting tables accompanied by an assembly line operation would reduce the labor requirements to a minimum. Perhaps it would be necessary for several growers to combine their efforts in this direction to make the capital investment feasible, but this would seem like a logical move in developing greater efficiency within this phase of the

enterprise. Resulting grades would naturally be more uniform than when the product is hand packed by many individual growers.

The Gardeners' Sales Company with 60 percent of the tomato growers in its membership, would be the logical place to undertake an operation of this nature. It was through this organization that central grading, sizing and packing was undertaken in 1958 but due to lack of space and equipment it was later abandoned. With the additional opportunities afforded the organization by the opening of a new building in 1961 it would seem that this function could be satisfactorily incorporated into their overall operations.

The operation which involves the pruning, staking and tying of the tomato plants is a phase of production where extremely large reduction in production costs may be possible in the foreseeable future. If plant breeders are able to produce a determinant type plant, or select one from those presently available, which will produce fruit exhibiting the required characteristics equal to or exceeding those varieties of the indeterminant types now in production the outlay on labor could be reduced by 30 percent on the average. Potential savings of this magnitude certainly warrant thorough investigation.

The use of mechanical harvesters is now under investigation in major production areas of the United States. If mechanization occurs in this phase of production, growing of tomatoes will become a large scale operation with which the small grower will have little ability to compete.

Material costs in terms of actual cash outlay are extremely high. The two main items involved are seedling plants and containers for marketing the final product. They account for 77.3 percent of material

costs. The possibilities of reducing costs of seedlings are very remote as fuel and labor are the two major items contributing to cost of seedling production and there is little possibility of relief in this respect. The use of imported plants is a practice which warrants investigation as it may provide some measure of relief in respect to plant costs.

The inputs required in the purchase of containers are of considerable concern to the growers. The shortages of used crates resulting from imports has substantially increased the cost by forcing growers to purchase new crates at much higher prices. There has been an attempt by the growers to obtain price reductions by placing volume orders in the winter months. This has resulted in only small gains on the part of the grower as there would appear to be a situation of oligopoly existing in respect to the production and marketing of wooden type containers in Manitoba. The only other opportunity left to the grower is to switch to a corrugated carton. Production areas in the south are now using them and apparently finding them quite satisfactory.

The use of power and machinery are responsible for only 6.8 percent of the total costs involved and any saving in this respect would not reduce total costs significantly. However, there are indications in many cases that irrigation costs could be cut with the more knowledgeable use of supplementary water in the production of tomatoes. Research information indicates that it is not the total amount of water but the timing of its application that determines maximum yields.

Overhead costs are composed mainly of interest charged against capital investment in land. For those who could find more profitable alternative uses for their invested capital this is a matter of concern. But many,

because of lack of training, are unable to enter any other field of endeavour and thus do not consider interest on capital invested in land as an item entering into production costs.

The margin needed to cover labor costs differs somewhat with the type of grower involved. The completely commercial grower (one who must hire all his labor) tends to terminate his marketings when prices are not sufficient to cover total remaining costs. The grower who is operating with the aid of family help will continue to market even though prices do not provide normal wages for his family labor indicating that he is satisfied as long as he gets some return on his family labor. This situation is reasonable as in most cases the family labor has no alternative use. Once his family help is old enough to seek employment elsewhere at a higher hourly wage this situation no longer exists. Most of the growers in the tomato industry have reached this stage in respect to their families and are becoming more aware of the full commercial cost of producing the product. The opportunities available to married women in industry have created alternative uses for another portion of the family labor supply. The returns to labor in vegetable production must be fairly substantial in order for the wives to continue to take part in the growing operations.

The opportunities for alternative uses for family labor will no doubt improve as industries develop in Manitoba. Thus, it is quite logical to assume that the effect on prices of output from family farms will become less significant in the future.

The marketing of fresh market tomatoes in Manitoba is carried on twelve months of the year with imported supplies being obtained mainly from Mexico and California. Manitoba's production supplies a large portion of the

market during the months of August and September. The local product to date has been unable to capture the market completely, during those two months. The main reasons given are: 1. That the local supplies have been unpredictable and wholesalers wanting to be assured of supplies at all times import continuously to guard against shortages, 2. That the local product does not have all the necessary size ranges to meet the market demands. It would appear that both deficiencies in the local situation have occurred due to lack of knowledge on the part of both the grower and the wholesale trade. An improved market reporting service could keep the wholesaler better informed of the local supply situation and greatly reduce his need for guarding against shortages by importing. If the grower, on the other hand, was made more aware of the size range of fruit needed for merchandising and the potential market associated with each category he would be able to make the necessary changes in production to take advantage of all available outlets.

The wholesaler is well respected for the important role he plays in the distribution of tomatoes as only a very small percentage of the total volume bypasses this segment of the industry. Improved relations and closer co-operation with the wholesaler in respect to his demands could ultimately lead to greater outlets for the growers.

The Manitoba grown tomatoes were distributed mainly in case lots (28 pound lugs). Other containers used were the 5 pound baskets and 14 ounce tubes. Not more than 10 percent were handled in the latter two methods. The 28 pound lugs and the 5 pound baskets were packed at the grower level while 5 pound baskets and 14 ounce tubes were packed by the jobber and wholesaler. The grower found it much more expensive to pack

the 5 pound baskets as the baskets plus the master container were much higher in price than the 28 pound lug. In addition to material costs much more time was needed in packing because of the uniform fruit size needed. However, the growers found that they were able in most cases to recover the extra costs and the product moves much faster in this manner at the retail level. This basket shows considerable promise for moving large volumes at the peak of the harvesting season.

The 14 ounce tubes have not been used too extensively as the size range of the local product is not especially suited to this type of packaging. However, the volume of traffic in respect to the 14 ounce tube is sufficient to warrant consideration at the production end.

The types of containers used in the merchandising of tomatoes are not static. There are continuous efforts being put forth at all times to select containers that will help find greater acceptance for the packed product. At the present time there is a move underway to change the shape of the 14 ounce tube to make it possible to tube a larger tomato which is generally accepted as being of higher quality. Continuous efforts of this nature are essential if the tomato industry is to continue to receive its share of the consumer's dollar.

Conclusions

1. Specialized skill and knowledge is needed not only on the part of the operator but also on the part of labor in the production and marketing of fresh market tomatoes.
2. The lack of skilled labor may be a limiting factor in future expansion of the tomato acreage in respect to the indeterminate type.

3. The combination of other enterprises with tomato production that would utilize labor over the entire year or major portion thereof could help alleviate the problem concerning the shortage of skilled (trained) labor.
4. It is anticipated that continued pressures from urban development will force relocation of the tomato acreage in the near future.
5. The areas of relocation will depend on the type of tomatoes under production. If research develops a determinant type with the necessary characteristics to meet the requirements of production and marketing the acreage will move to areas of lighter textured soils. Failing this development, the acreage will in all likelihood remain on the alluvial soils of the Red and Assiniboine rivers in close proximity to Winnipeg.
6. Technology in respect to production methods, such as seedling production, plant spacing in the field, fertilizer requirements, and the application of supplementary water, needs further clarification in respect to Manitoba growing conditions.
7. Greater markets will be available with the introduction of a tomato variety that will produce economic yields of fruit suitable for packing in the 14 ounce tube.
8. Quality of ripened fruits could be much improved by the addition of facilities in the ripening rooms to maintain temperatures and humidity at optimum levels.
9. Growers should be encouraged to keep more detailed records of their operations thus allowing for a full analysis of this enterprise each year. This would greatly increase the opportunities to effect changes that could result in more efficient use of their resources.

10. The advantages to be gained in mechanizing the sizing, grading, and packing operations warrant serious consideration. Centralizing this operation for all growers could minimize capital expenditures, reduce the amount of skilled labor needed, and produce a much more uniform grade. The most practical way of initiating central packing would be to incorporate it into the existing facilities presently available at Gardeners' Sales.
11. Labor requirements could be substantially reduced if determinant type plants could satisfactorily replace the indeterminant type plants presently in use. Pruning, staking and tying now account for 30 percent of the labor costs needed to carry out the operations at the growers' level.
12. With the advent of mechanical harvesters tomato production will become a large-scale operation and small growers will find it very difficult to continue in this enterprise. This development is still in the experimental stages.
13. The possibilities of reducing seedling plant costs is very remote as fuel and labor are the two major inputs. The reduction of plant costs by the use of imported stock needs full investigation.
14. Serious consideration should be given to ways and means of reducing container costs. Some type of corrugated cardboard carton similar to that in which tomatoes are imported may help reduce outlay in this regard.
15. The price levels at which it is profitable to market tomatoes differs between growers. Growers using family help will continue to sell so long as there is some return for labor. Growers using mainly hired help market only when prices are sufficient to cover total remaining costs.

16. Alternative uses for family help are becoming more plentiful, thus the returns to labor in future tomato production must be sufficient to warrant continued activities in this enterprise. Assuming that this statement is correct, supply and demand for local tomatoes must adjust in the future so that the price is sufficient in the long-run to cover more realistic costs of production.
17. Supplies of tomatoes are imported twelve months of the year to meet consumer demand. Locally grown supplies capture approximately 83 percent of the market during August and September.
18. It is impossible for local production to capture 100 percent of market demands during August and September as growing conditions prevent regular supplies of the local product from reaching the market at all times, thus forcing wholesalers to import at certain stages to guarantee supplies to meet demands.
19. The wholesaler is a very important link in the distribution chain of local tomatoes. If the growers were to by-pass the wholesaler in the marketing of the local tomato crop it would seriously reduce the market outlets as wholesalers would take recourse in imports to fill their orders.
20. The roadside stand and the farmers' market play an important role in the marketing of second grade tomatoes. There is little or no market available for this produce at the wholesale level. An indication of this is that they are not handled by the large stores and supermarket chains.
21. Consumer acceptance of a product depends to a considerable degree on the size and type of container in which it is packed. Growers

must accept this fact and be prepared to produce a tomato of a size that is best suited to the packaging trends. Wholesalers, on the other hand, must be encouraged to continue their work with experimental packages in order to maintain and expand future sales.

22. The price of tomatoes during August and September is determined mainly by the supply of local tomatoes on the market. Import tomatoes only affect price when they occur in such volume as to cause an oversupply and thereby depress local prices.
23. The wholesale markup on local tomatoes is fairly constant in actual monetary terms and does not vary with changes in the price level. Consequently, the percentage wholesale markup rises as the price falls.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Watts & Watts. The Vegetable Growing Business. Orange Judd Publishing Company, N. Y.
2. Thompson & Kelly. Vegetable Crops. Fifth Edition, McGraw-Hill Publishing Book Company, Toronto.
3. Sorensen, H. B., Marketing Texas Green-wrap Tomatoes, Bulletin 861, Texas Agricultural Experimental Station.
4. Elliot, R.S., Campbell, B.A., Thair, P.J., The Marketing of Fresh Fruit and Vegetables in Greater Winnipeg, Manitoba Department of Agriculture, 1946.
5. Heady, E.O., Economics of Agriculture Production and Resource Use. Prentice-Hall Publishing Company.
6. Campbell, D.R., Ayers, H.D., Dollars and Cents in Ontario Irrigation. Publication 322, 1960. Ontario Department of Agriculture, Toronto.
7. Anderson, G.R., Custom Rates for Farm Operators in Manitoba, Agricultural Economics Bulletin No 4, 1961. Department of Agricultural Economics and Farm Management, The University of Manitoba, Winnipeg.
8. Gorby, B.J., et al. Cost of Field Operations in the Prairie Region. Publication 1051, 1959, Research Branch, Canadian Department of Agriculture, Ottawa.
9. Pulner, G., Staniforth, S., Figuring Irrigation Costs. Circular 519, 1956, University of Wisconsin, College of Agriculture, Madison, Wisconsin.
10. Thompson, J.L., Wenhardt, A. Cost Charges for Agricultural Machinery (Western Canada) Publication 881, Experimental Farm Service, Department of Agriculture, Ottawa, Ontario.
11. Nelson, J.B., A Summary of Tomato Production Costs, Circular 199, 1954, Farm Economic Branch, Ontario Department of Agriculture, Toronto, Ontario.
12. Cost of Production Report, Tomatoes for Processing, 1954, Farm Economics Branch, Ontario Department of Agriculture, Toronto, Ontario.

13. Redit, W.H., Hamer, A.A., Protection of Rail Shipments of Fruits and Vegetables, Agricultural Hand Book No. 195, 1961, Market Quality Research Division, Agricultural Marketing Service, U.S.D.A.
14. Trossman, W.A., The Artificial Ripening of Mature-green Tomatoes, M.Sc., Thesis 1949, McGill University, Montreal, Que.
15. Walkof, Chas., Staking and Bush Type Tomatoes, Annual Proceedings of Vegetable Growers' Association of Manitoba, 1962, Winnipeg, Manitoba.
16. Ehrlich, et. al., Report of Reconnaissance Soil Survey of Winnipeg and Morris Map Sheet Areas Soils Report 5, 1953, Manitoba Soil Survey, The University of Manitoba, Winnipeg.
17. Ellis, J.H., The Soils of Manitoba, Economic Survey Board, Province of Manitoba, 1938.
18. Ferguson, A.C., Fertilizer and Plant Spacing Effects on Tomatoes 1960-61. Proceedings of Ninth Annual Convention, Vegetable Growers' Association of Manitoba, 1962, Winnipeg, Manitoba.
19. Annual Meteorological Summary, Winnipeg, 1961. Canada Department of Transport, Winnipeg, Manitoba.
20. Lambeth, V.N., Studies in Moisture Relationship and Irrigation of Vegetables. Research Bulletin 605, 1956, University of Missouri, College of Agriculture, Columbia, Miss.
21. Manitoba Regulations 38/60 being a Regulation under the Fruit and Vegetable Sales Act, 1960. Provincial Government of Manitoba, Winnipeg.
22. Beach, W.S., Tomato Spraying in absence of Late Blight. Bulletin 603, 1955, College of Agriculture, Penn. State University, University Park, Pennsylvania.
23. Annual Unload Report Fruit and Vegetables on 12 Canadian Markets, Canadian Department of Agriculture, Production and Marketing Branch, Market Information Section, Ottawa.
24. Zwarich, M.A., Water Losses by Evaporation and Transpiration Using Field Tomatoes, Proceeds Manitoba Soil Science Association, 1961.
25. King, E.E.R., The Market for Eight Fresh Vegetables in Western Canada, Economics Division, Canadian Department of Agriculture, Ottawa, 1962.

A P P E N D I X

APPENDIX I

A SIX MONTH STUDY OF THE COSTS OF PACKING TOMATOES
IN 14OZ TUBES BY HAND AND BY MACHINES, 1959-60
SCOTT FRUIT CO; WINNIPEG

Freight Charges to Winnipeg, per Lug, From:	<u>Florida</u>	<u>Mexico</u>	<u>California</u>	<u>Texas</u>
Freight	1.11	1.25	.83	.83
Ice, Etc.	.14	.10	.10	.10
Crossing	-	.10	-	-
Buying	.05	.05	.05	.05
Customs Broker	.01	.01	.01	.01
Home Office	.10	.10	.10	.10
	<u>\$1.41</u>	<u>\$1.61</u>	<u>\$1.09</u>	<u>\$1.09</u>

SORTING AND STRIPPING LABOROriginal Stripping: (650 lug car)

1 Man	10 hours @ 1.50	\$15.00	
6 Women	10 hours each @ 1.25	<u>75.00</u>	\$90. 00

(Estimated run 20% of original car)

Second Sorting:

1 Man	8 hours @ 1.50	12.00	
5 Women	8 hours each @ 1.25	<u>50.00</u>	62. 00

Final Sorting:

1 Man	4 hours @ 1.50	6.00	
5 Women	4 hours each @ 1.25	<u>25.00</u>	<u>31. 00</u>

Plus 15% for unabsorbed labor and expenses

27. 45

\$210. 45

Cost per Lug

32. 88¢

Cost per Tube

1. 08¢

TUBING LABOR - OVERWRAP MACHINE

Estimated Maximum Production - 10,000 tubes per 8 hour day. These figures calculated as follows:

Machine Speed - 32 tubes per minute. Estimated labor efficiency 7 hours out of 8. Production at 100% machine efficiency 13,440 tubes per day. Allowance for stoppages of all kinds 25%. Net maximum production 10,080 tubes per day.

1 Man	8 hours @ 1.50	\$12.00	
5 Women	8 hours each @ 1.50	<u>50.00</u>	\$62. 00
Plus 15% for unabsorbed labour and expenses		<u>9. 30</u>	\$71. 30
Cost per Tube			0. 71¢

COST OF SUPPLIES PER TUBE - OVERWRAP MACHINE

Overwrap Cello	0. 50¢	
Tray	1. 44	
1/14 of Flat & Divider @ \$148.46 M	<u>1. 06</u>	3. 00¢

NOTE

We are presently using plain trays and printed cellophane (MSAT 450 gauge). The following are present day costs on cellophane, per tube:

(1) MSAT 450 Gauge, Printed	0.89¢
(2) MSAT 450 Gauge, Plain	0.63¢
(3) LSAT 300 Gauge, Printed	0.76¢
(4) LSAT 300 Gauge, Plain	0.50¢

The following are latest quotations on trays ex Gair & Co., including freight to Winnipeg (Minimum purchase 500M).

(1) 14 Oz. Tubes, Plain	1.22¢ ea.
(2) 14 Oz. Tubes, Printed	1.44¢ ea.
(3) 16 Oz. Tubes, Plain	1.34¢ ea.
(4) 16 Oz. Tubes, Printed	1.56¢ ea.

Supply costs then compare as follows for 14 Oz. tube:

	<u>PRINTED</u> MSAT - 450 & Plain Tray	<u>PLAIN</u> MSAT - 450 & Printed Tray	<u>PRINTED</u> LSAT - 300 & Plain Tray	<u>PLAIN</u> LSAT - 300 & Printed Tray
Overwrap	0.89¢	0.63¢	0.76¢	0.50¢
Tray	1.22¢	1.44¢	1.22¢	1.44¢
1/14 of Flat and Divider	1.06¢	1.06¢	1.06¢	1.06¢
	<u>3.17¢</u>	<u>3.13¢</u>	<u>3.04¢</u>	<u>3.00¢</u>

While Polyethelene Bag Company recommended using MSAT - 450 Cellophane, Dupont of Canada Ltd, suggest LSAT - 300 Gauge. Therefore, for purposes of the following schedules, we are using the cheapest combination, plain LSAT - 300 and printed trays.

TUBING LABOR - HAND PACK

1 day's production - 3,500 tubes

1 Man	4 hours @ 1.50	\$6.00	
2 Women	8 hours each @ 1.25	<u>10.00</u>	\$16. 00
Plus 15% for unabsorbed labor and expenses			<u>2. 40</u> \$18. 40
Cost per tube			0. 53¢

COST OF SUPPLIES PER TUBE - HAND PACK

Tube	2.42¢	
1/14 of Flat and Divider	<u>1.06</u>	3. 48¢

WINNIPEG TOMATO DEPARTMENT

	<u>ORIGINAL COST</u>	<u>BOOK VALUE JAN.1.1960</u>	<u>1960 RENTAL</u>
Stripping & Sorting Machinery	1,142.55	374.34	93.59
Overwrap Machinery	3,304.75	1,205.47	301.37
Toledo Scale	99.47	8.54	2.13
	<u>\$4,546.77</u>	<u>\$1,588.35</u>	<u>\$397.09</u>

AREA RENTAL

Tomato Rooms	3,070.00
Overwrap	980.00
Hand Pack	200.00
	<u>\$4,250.00</u>

ESTIMATED YEARLY PRODUCTION

Overwrap Machines	1,250,000 tubes
Hand Pack	450,000 tubes
	<u>1,700,000</u>

MACHINE CHARGE PER YEAR

	<u>Total Cost</u>	<u>Overwrap Cost per tube</u>	<u>Hand Pack Cost per tube</u>
Stripping & Sorting Machinery	95.72	0.0056¢	0.0056¢
Overwrap Machine	301.37	0.0241	-

Continued from previous page

<u>AREA RENTAL PER YEAR</u>	<u>Total Cost</u>	<u>Overwrap Cost per tube</u>	<u>Hand Pack Cost per tube</u>
Tomato Rooms	3,070.00	0.1806¢	0.1806¢
Overwrap	980.00	0.0784	-
Hand Pack	200.00	-	0.0444
	<hr/>	<hr/>	<hr/>
	\$4,647.09	0.29¢	0.23¢
	<hr/>	<hr/>	<hr/>

SUMMARY OF PROCESSING COSTS PER TUBE

	<u>OVERWRAP</u>	<u>HAND PACK</u>
Stripping & Sorting Labor	1.08¢	1.08¢
Tubing Labor	0.71	0.53
Supplies	3.00	3.48
Overhead	0.29	0.23
	<hr/>	<hr/>
	5.08¢	5.32¢
	<hr/>	<hr/>

PRICE OF MEXICAN TOMATOES - TUBED ON FLOOR *

(Comparing Handpack and Machine Overwrap)
(Duty Free)

Per lug Invoice Price FOB Mexico	Freight etc	Duty Free	Laid in Cost Tomatoes Only		Processing Cost per Tube		Packaging Div. Charge		Packaged Price per Tube		Rounded Price per Tube	
			lug	per tube	Over-wrap	Hand-pack	Over-wrap	Hand-pack	Over-wrap	Hand-pack	Over-wrap	Hand-pack
\$2.00	1.61	-	\$3.61	12.03¢	5.08¢	5.32¢	0.5¢	0.5¢	17.61¢	17.85¢	17 ³ / ₄ ¢	18¢
2.25	1.61	-	3.86	12.87	5.08	5.32	0.5	0.5	18.45	18.69	18 ¹ / ₂	18 ³ / ₄
2.50	1.61	-	4.11	13.70	5.08	5.32	0.5	0.5	19.28	19.52	19 ¹ / ₄	19 ¹ / ₂
2.75	1.61	-	4.36	14.53	5.08	5.32	0.5	0.5	20.11	20.35	20 ¹ / ₄	20 ¹ / ₂
3.00	1.61	-	4.61	15.37	5.08	5.32	0.5	0.5	20.95	21.19	21	21 ¹ / ₄
3.25	1.61	-	4.86	16.20	5.08	5.32	0.5	0.5	21.78	22.02	21 ³ / ₄	22
3.50	1.61	-	5.11	17.03	5.08	5.32	0.5	0.5	22.61	22.85	22 ² / ₄	23
3.75	1.61	-	5.36	17.87	5.08	5.32	0.5	0.5	23.45	23.69	23 ¹ / ₂	23 ³ / ₄
4.00	1.61	-	5.61	18.70	5.08	5.32	0.5	0.5	24.28	24.52	24 ¹ / ₄	24 ¹ / ₂
4.25	1.61	-	5.86	19.53	5.08	5.32	0.5	0.5	25.11	25.35	25 ¹ / ₄	25 ¹ / ₂
4.50	1.61	-	6.11	20.37	5.08	5.32	0.5	0.5	25.95	26.19	26	26 ¹ / ₄
4.75	1.61	-	6.36	21.20	5.08	5.32	0.5	0.5	26.78	27.02	26 ³ / ₄	27
5.00	1.61	-	6.61	22.03	5.08	5.32	0.5	0.5	27.61	27.85	27 ¹ / ₄	28
5.25	1.61	-	6.86	22.87	5.08	5.32	0.5	0.5	28.45	28.69	28 ¹ / ₂	28 ³ / ₄
5.50	1.61	-	7.11	23.70	5.08	5.32	0.5	0.5	29.28	29.52	29 ¹ / ₄	29 ¹ / ₂
5.75	1.61	-	7.36	24.53	5.08	5.32	0.5	0.5	30.11	30.35	30 ¹ / ₄	30 ¹ / ₂

* Source - The Scott Fruit Company, Winnipeg

PRICE OF MEXICAN TOMATOES - TUBED ON FLOOR *
(Comparing Handpack and Machine Overwrap)
(Duty 10%)

Per lug invoice Price FOB Mexico	Freight etc	Duty 10%	Laid In Cost Tomatoes Only		Processing Cost per Tube				Packaging Div. Charge per Tube				Rounded Price per Tube	
			per lug	per tube	Over-wrap	Hand-pack	Over-wrap	Hand-pack	Over-wrap	Hand-pack	Over-wrap	Hand-pack	Over-wrap	Hand-pack
\$2.00	\$1.61	\$0.20	\$3.81	12.7¢	5.08¢	5.32¢	0.5¢	0.5¢	0.5¢	18.28¢	18.52¢	18 1/4¢	18 1/4¢	
2.25	1.61	0.225	4.085	13.62	5.08	5.32	0.5	0.5	0.5	19.20	19.44	19 1/2	19 1/2	
2.50	1.61	0.25	4.36	14.53	5.08	5.32	0.5	0.5	0.5	20.11	20.35	20 1/2	20 1/2	
2.75	1.61	0.275	4.635	15.45	5.08	5.32	0.5	0.5	0.5	21.03	21.27	21	21 1/4	
3.00	1.61	0.30	4.91	16.37	5.08	5.32	0.5	0.5	0.5	21.95	22.19	22	22 1/4	
3.25	1.61	0.325	5.185	17.28	5.08	5.32	0.5	0.5	0.5	22.86	23.10	23	23 1/4	
3.50	1.61	0.35	5.46	18.2	5.08	5.32	0.5	0.5	0.5	23.78	24.02	24	24	
3.75	1.61	0.375	5.735	19.12	5.08	5.32	0.5	0.5	0.5	24.70	24.94	24 1/4	25	
4.00	1.61	0.40	6.01	20.03	5.08	5.32	0.5	0.5	0.5	25.61	25.85	25 1/4	26	
4.25	1.61	0.425	6.285	20.95	5.08	5.32	0.5	0.5	0.5	26.53	26.77	26 1/2	26 3/4	
4.50	1.61	0.45	6.56	21.87	5.08	5.32	0.5	0.5	0.5	27.45	27.69	27 1/2	27 3/4	
4.75	1.61	0.475	6.835	22.78	5.08	5.32	0.5	0.5	0.5	28.36	28.60	28 1/2	28 3/4	
5.00	1.61	0.50	7.11	23.7	5.08	5.32	0.5	0.5	0.5	29.28	29.52	29 1/2	29 1/2	
5.25	1.61	0.525	7.385	24.62	5.08	5.32	0.5	0.5	0.5	30.20	30.44	30 1/4	30 1/2	
5.50	1.61	0.55	7.66	25.53	5.08	5.32	0.5	0.5	0.5	31.11	31.35	31 1/4	31 1/2	
5.75	1.61	0.575	7.935	26.45	5.08	5.32	0.5	0.5	0.5	32.03	32.27	32	32 1/4	

* Source - The Scott Fruit Company, Winnipeg

APPENDIX II

WATER LOSSES FROM VARIOUS TREATMENTS FOR SELECTED PERIODS - 1960, 1961

Dates	No. Days	P.E.T. (in)	P.E.T. in/day	Water losses per period (A) and per day (B) - inches																	
				C			NC			C+I			NC+I			M-3			M-1½		
				A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B		
1960																					
June 20-	23	4.23	0.18	0.44	0.02	1.59	0.07	0.33	0.01	1.37	0.06	1.13	0.05	0.82	0.04						
July 13-	13	1.94	0.15	1.35	0.10	2.78	0.21	1.70	0.13	3.05	0.23	1.66	0.13	2.09	0.16						
July 26-	20	3.10	0.16	1.42	0.07	1.60	0.08	2.76	0.14	2.18	0.11	0.76	0.04	1.22	0.06						
Aug. 16-	29	2.14	0.07	0.00	0.00	1.50	0.05	0.00	0.00	2.49	0.09	1.61	0.06	1.50	0.05						
Sept 14																					
1961																					
June 19-	21	5.20	0.25	0.61	0.03	0.64	0.03	0.61	0.03	0.64	0.03										
July 10-	23	2.51	0.11	1.50	0.07	3.48	0.15	1.54	0.07	3.39	0.15										
Aug. 2-	22	3.83	0.17	2.42	0.11	3.36	0.15	3.88	0.18	4.71	0.21										
Aug. 24-	21	1.97	0.09	0.67	0.03	0.53	0.03	0.36	0.02	0.64	0.03										
Sept 14																					

C - Covered, NC - Noncovered, NC-1 - Noncovered and irrigation,
 C - 1 Covered and irrigation, (M - 3") - Mulch 3"

Source (24)

APPENDIX III

RATE OF RIPENING AT VARIOUS TEMPERATURES OF ASGROW
AND GULF STATE MARKET TOMATOES PICKED IN THE MATURE-
GREEN AND TURNING STAGES

Variety, con- dition when picked, and ripening tem- perature (°F.)	Percentage of ripened fruit at intervals shown after picking						
	4 days	7 days	9 days	14 days	21 days	28 days	34 days
Asgrow							
Mature green							
40°	0	0	0	0	0	0	0
50°	0	0	6.6	13.3	20	60	100
60°	0	13.3	40.0	60.0	100	-	-
70°	0	33.3	60.0	100	-	-	-
Turning							
40°	0	0	0	30	50	60	70
50°	50	70	100	-	-	-	-
60°	100	-	-	-	-	-	-
70°	100	-	-	-	-	-	-
Gulf State Market							
Mature green							
40°	0	0	0	0	0	0	0
50°	0	0	0	13.3	53.3	73.3	100
60°	0	26.6	33.3	60.0	100	-	-
70°	0	26.6	60.0	100	-	-	-
Turning							
40°	0	0	0	0	20	20	33.3
50°	0	0	6.6	80	100	-	-
60°	46.6	100	-	-	-	-	-
70°	66.6	100	-	-	-	-	-

Source: 14

APPENDIX IV

COST OF PRODUCTION STUDIES OF FRESH MARKET TOMATOES, 1961

Department of Agriculture, Economics and Farm Management,
The University of Manitoba

Name _____

Address _____

Location of Land	Owned	Rented	Mun. Assessments	Present Value	Taxes
		ac. \$	ac. \$	\$	
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Soil type _____ Part time _____

Livestock _____ Value \$ _____

Full time operator _____

Off Farm Work _____

Materials used

<u>Items</u>	<u>Cost/acre</u>			
Plants	_____	Grown _____	Purchased _____	No. of Flats _____
Fertilizer Starter	_____	Type _____	Rate/acre _____	lbs. _____
Chemical	_____	_____	_____	_____
Manure	_____	_____	_____	_____
Liquid Fr.	_____	_____	_____	_____
Insecticide	_____	_____	_____	_____
Fungicide	_____	_____	_____	_____
Stakes	_____	No _____	_____	_____
Twine	_____	_____	_____	_____
Crates	New _____	No _____	Cost/acre Used _____	No _____
Land Rent/acre	_____	_____	_____	_____

Total _____

LAND USE

O- Owned

R- Rental

Crop	O R	Acres	Crop	O R	Acres
Asparagus			Lettuce		
Beans			Peppers		
Beets			Parsnips		
Cabbage	Early		Tomatoes	Valiant	
	Late		Egg Plant		
Cauliflower	Early				
	Late				
Celery			Turnips		
Corn			Vine crops		
Cucumber	pickling		Potatoes		
	slicing				
Carrots					
Onions	cooking		Forage		
	Spanish		Cereal		
	pickling		Summer Fallow		
Total					

HAND LABOR USE ON TOMATOES

Operation	Hired (H)	Total No.	Adult Children	Total Hours Used	Total	
	Contracted (C) Family (F)				Per Hour or/ acre	Total Cost
Planting						
Hand Weeding						
Staking						
Pruning and Tying						
Harvesting						
Grading and Packing						
Stake Removal						
Irrigation						
				Total		

Do you find competition for Labor between Crops?

MACHINERY OPERATIONS

Scott	Acres			Machinery				Labor		
	Field size	Times over	Total acres	Tractor Size	Tractor Hrs	Tractor T. Cost	Tractor Size	Tractor Miles	Tractor H C	per hour Cost
o-owned										
r-rental h-hired										
Plowing										
Cultivating										
Harrowing										
Bow Marking										
Hauling Flats										
Cultivation										
Dusting										
Irrigation										
Picking										
Delivery										
Labor Pickups										
Total										

Fall, 1960

Pre-Plantings

Plantings

Summer Operations

INVENTORY

Item	Year	Purchase Price	Present Value	Make	Size	Amount allotted to tomato

