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MICHIGAN'S PURPLE PLUM INDUSTRY

By

Robert Wallace Anderson

A THESIS

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ABSTRACT

MICHIGAN'S PURPLE PLUM INDUSTRY

By

Robert Wallace Anderson

This study focused on identifying future problems and prospects in Michigan's purple plum industry. These problems and prospects were identified by reviewing the past and present situations, determining key market variables and analyzing the marketing and organizational practices of the industry.

Michigan's position in the total U.S. industry is one of rising magnitude and importance. Production has increased from less than 10,000 tons in 1962, to 15,000 tons in the late 1960's and will increase to an estimated 39,000 tons by 1975. Michigan is likely to become the largest producing state and will account for 30 to 40 percent of the total U.S. supply.

Washington, Oregon and Idaho are expected to increase production by approximately 10,000 tons which, when combined with Michigan's production, provides a total U.S. supply of slightly over 100,000 tons. This increased production potential presents the industry with a marketing and supply management problem.

Michigan growers and packers had difficulty in marketing the 15,000 ton crop in 1967. In most years, the fresh market handles approximately 30 percent of the available Michigan supply with the remainder being processed. Packers and Retailers of fresh products believe that, with current prices and marketing programs, sales cannot be expanded. The 13 processors in the state say that they are able to handle the supply increase physically, but, at present prices, no profit incentive exists to warrant increases in supply of the processed products.

A two stage, least-squares model was used to estimate the price elasticity of demand for both fresh and processed plums. Results indicate that both products are price inelastic with an elasticity of -.72 for processed and -.69 for fresh plums. This implies that a reduction in price by itself will not significantly increase the volume of sales, nor will it significantly increase returns to the industry.

Least-squares regression analysis defined a number of key variables affecting grower and processor prices. As expected, supply and population were two variables significantly affecting prices. An unexpected result was that the price or quantity of competing fruit, with one exception, did not appear as a significant factor in explaining variations in prices. The only exception is the grower price for apples for processing.

Major problems confronting the Michigan plum industry include inconsistent quality in the marketed products, very

little product promotion and marketing, a lack of organization within the industry and a supply situation which makes the other problems critical in the short run.

Product quality may be made more consistent at the market level through the use of a marketing order with strictly enforced quality criteria or by individual efforts of fresh packers. Canned whole plum quality may be made more consistent through a similar marketing order or possibly by creating two quality levels with a price premium for the higher quality.

Product promotion and marketing improvement requires a united effort if it is to be effective. This requires an industry effort. A bargaining association or a marketing order are considered as methods of bringing about the desired organization. Promotion and advertising are considered as methods of obtaining higher returns if the quality improvements are brought about first.

The analysis indicates that quotas present the most effective method of limiting supply for conditions in the plum industry. A storage program would be beneficial in situations where total supplies fluctuated from year to year but based on historical production levels the analysis shows that such a program would not be beneficial to the plum industry under similar conditions.

To my loving Wife, Irene

ACKNOWLEDGMENTS

The author is indebted to the Department of Agricultural Economics for providing assistance during his studies at Michigan State University. Sincere gratitude is extended to Dr. James Shaffer for his guidance as major advisor and as thesis co-advisor. Similar gratitude is extended to Dr. Donald J. Ricks for his guidance as thesis co-advisor. The author also appreciated the aid of other members of the staff particularly Dr. Marvin Hayenga and Dr. Vernon Sorenson who read the manuscript and made several helpful suggestions.

The author is especially grateful to his wife, Irene, for her continued support and encouragement throughout the production of this manuscript.

Formal recognition is made here of the continuing support provided to the author by his parents. Their support of the author's educational endeavors has been most welcome.

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CHAPTER I

INTRODUCTION

The immediate goal of this study was to identify future problems and prospects of the purple plum industry and provide information which can be useful in developing programs and practices to deal with the economic problems of this industry.

The Problem

Michigan's purple plum industry, facing increased supplies, finds itself confronted with the prospect of substantially decreasing prices and lower net returns. Heavy plantings several years ago are maturing and, in good crop years, may more than double Michigan's past purple plum production. Fresh plum consumption has declined from four-fifths to one-third pound per capita. Consumption of processed plum products has remained approximately steady at less than one-third of a pound per capita. This combination of supply and demand prospects must be dealt with, in some way, during the next decade.

Until 1960, Michigan's plum production was valued at slightly over half a million dollars. Since 1960, the

annual gross return to Michigan plum growers has more than doubled, exceeding one million dollars per year with the exception of 1961, 1962, and 1964. During this period when Michigan's plum production doubled in value, the gross returns from total U.S. purple plum production remained relatively constant. Although encouraged by the increased value of their production, Michigan growers are concerned that the lack of producer organization and a wide variation in quality in the industry may lead to reduced returns if the predicted supply increase materializes. In view of this increase in supply, concern exists as to whether the marketing channel can handle such an expansion.

Purple plums for the purpose of this dissertation are defined as the purple skinned varieties of plums such as the Italian and Stanley (including the Blufre). These plums are grown mainly in Michigan and the Northwest States of Washington, Oregon and Idaho, with a few grown in New York, Pennsylvania and New Jersey. They are different from the plums or plum prunes grown in California and parts of Oregon which have the high sugar content necessary to produce prunes. While the plum prunes could be substituted for purple plums in the fresh and canned markets, the prune market has always been much more profitable.

Objectives of the Study

The problems in the Michigan purple plum industry have stimulated discussion as to the actions necessary for improving the economic position of the entire industry.

The purpose of this study is to determine what alternatives are available to the industry as a whole and to individual segments of it. In evaluating the alternatives and the problems to be solved it is necessary to consider the economic environment in which the industry operates, the relationships among growers and between growers and processors, and the characteristics of the institutions involved.

Specific objectives of this study are:

(1) To describe various segments of the Michigan purple plum industry.

(2) To analyze factors affecting prices, and predict the effect that changes in demand or supply conditions may have on grower and processor returns.

(3) To analyze marketing and organizational practices of the industry.

(4) To recommend courses of action for the improved economic well-being of Michigan's purple plum industry.

Plan of Thesis

Michigan's purple plum industry and its relationship to the U.S. purple plum industry is described. The expected supply of purple plums is then projected through the 1970's. Responses from a survey of Michigan industry participants, designed to determine their current problems and any additional problems that can be expected to occur

in the 1970's with the increase in supply, is reported and their implications discussed. All of the processors that can whole plums or make baby food in Michigan were interviewed as well as numerous representatives from other groups within the industry. A statistical analysis is used to determine how significant certain variables are in explaining the demand for purple plums and the prices received by growers and processors. The variables tested are those indicated by industry participants or economic theory as affecting price and demand.

Using the results from the surveys and the statistical analysis, major industry problems are outlined. Selected programs or alternative actions that might contribute to the solution of these problems are discussed.

CHAPTER II

MICHIGAN PURPLE PLUM MARKETING CHANNELS AND PARTICIPANTS

As is the case with many fruits and vegetables, two major marketing channels exist for purple plums. The processed market accounts for approximately 60-70 percent while the fresh market handles the remainder. Although the processing channel buys a few plums from the fresh packers and a number of participants are common to both channels, they are considered as separate channels.

Processors usually perform a number of functions in the processing channel. They buy directly from growers, process the plums and sell them to retailers under private brand labels, thus bypassing handlers and brokers (Figure 1). These retailers who buy from processors and brokers seldom carry more than a 30 day supply, meaning that processors store the year's inventory as well. Brokers selling to cooperatives or independent chains do not store any of the product. Over 90 percent of the plums entering this channel are made into canned whole plums or baby food.[1]

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[1]Baby food percentages are not reported separately to avoid disclosing individual operations.

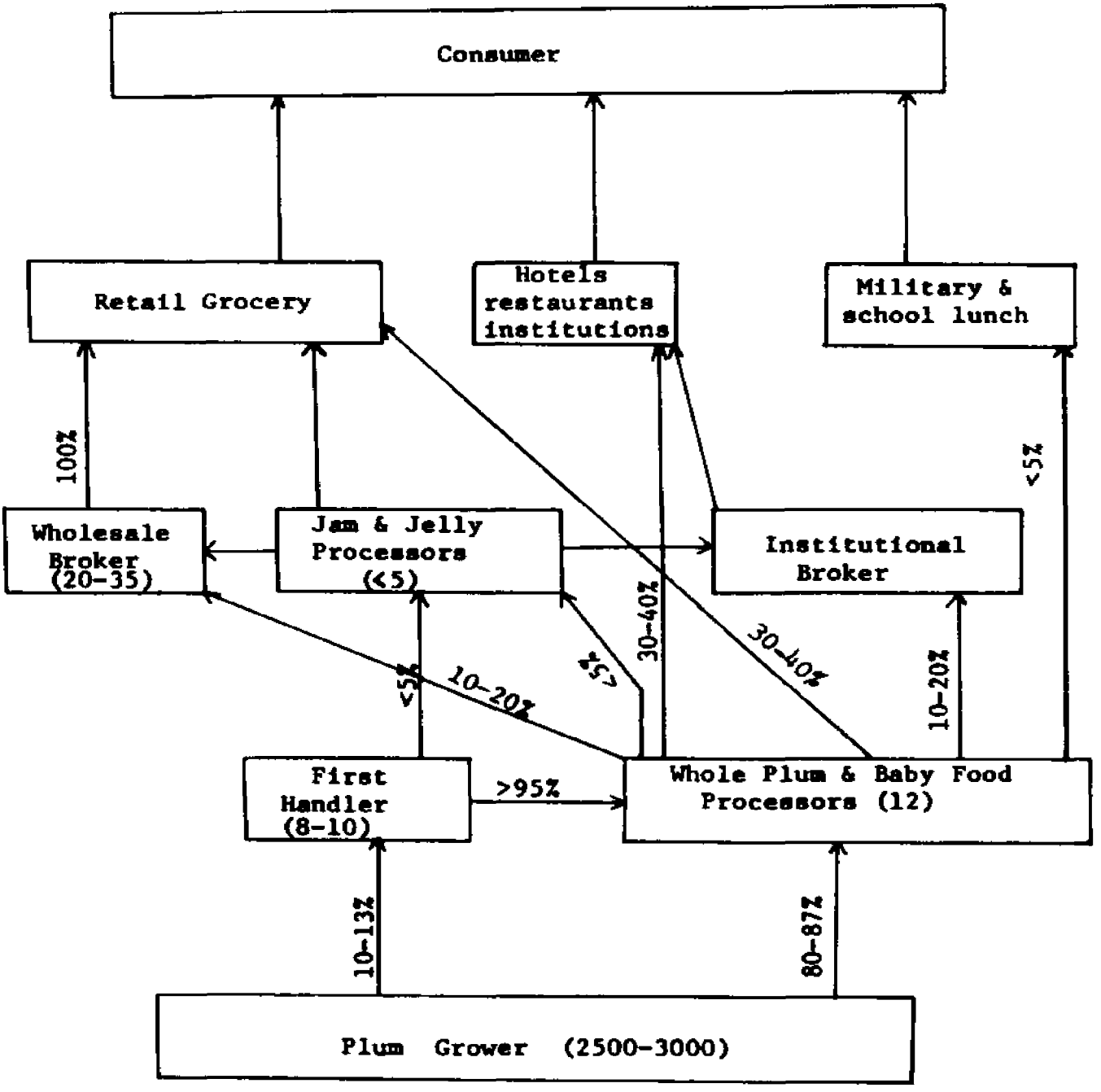

Figure 1. Marketing Channels for Process Type Plums*

*The percentage indications on the channel lines and numbers in the brackets are approximations made by the author for the 1969 situation. The values in brackets are numbers of participants. Values on the arrows are percent of that group's product going in the direction of the arrow.

Within this segment, twelve processors buy nearly 80 percent of their requirements directly from growers. About 11 percent of the plums sold to processors are handled by 8 to 10 receiving or handling firms that buy under agreement with processors. These handlers sell a few to the jam and jelly industry. But because the jam and jelly trade accounts for less than 5 percent of the handlers' plums, this portion of handler volume is rather insignificant.[2]

Approximately 5 to 8 percent of the processor's supply of plums come from the fresh packers as grade-outs.[3] In years when supply is abundant, processors buy fewer grade-outs, because they have sufficient amounts of orchard run fruit which is generally higher quality and available at low prices.

Processors market their plums as canned whole purple plums packed in a heavy syrup. A few are marketed in light sugar syrup or water as dietary plums. Approximately half are sold to the institutional market where processors bid on various sized government contracts or sell directly to private institutions.

At the retail level, a 29 or 30 oz. number 2 1/2 can size is most popular. Several smaller miscellaneous

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[2]Because the jam and jelly trade accounts for a very low percentage of the state's processed plums, of which many are neither Stanley nor Blufre, they receive very little attention here or elsewhere in the thesis.

[3]Grade-outs are plums delivered to fresh packers but graded out because of small size.

sizes are available. Whole purple plums are the major product but several baby food companies (one located in Michigan) market plums as baby food; some jams and jellies are also available from Michigan plums. At present, little or no commercial interest exists for plum baking goods or drinks.

Twelve to 18 packers handle between 50 and 60 percent of the volume in the fresh market channel (Figure 2). The Benton Harbor market handles approximately 23 to 35 percent of the remainder. The rest of the plums move directly from growers to roadside stands or from growers to brokers who market through retail outlets. At the other end, consumers buy at roadside fruit stands or retail grocery stores. While exact volume figures are not available, large chain stores do market, by far, the larger share.

Many of these packers buy from growers and sell directly to stores, while others sell to brokers, who in turn sell to cooperatives, chain stores, independent stores and roadside fruit stands. These fruit stands sell their own produce, their neighbors, and what they buy from brokers, packers and the Benton Harbor market. Until recently, the Benton Harbor market has been an important link in the channel where growers who packed their own plums sold to brokers, fruit stand merchants, independent stores and occasionally to retail chains. Lately, fewer brokers and chains have dealt with the market because the plums sold there are not cooled and have a shorter shelf life.[4]

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[4]The Benton Harbor market is a wholesale market with no refrigeration facilities. In addition, the grower packers

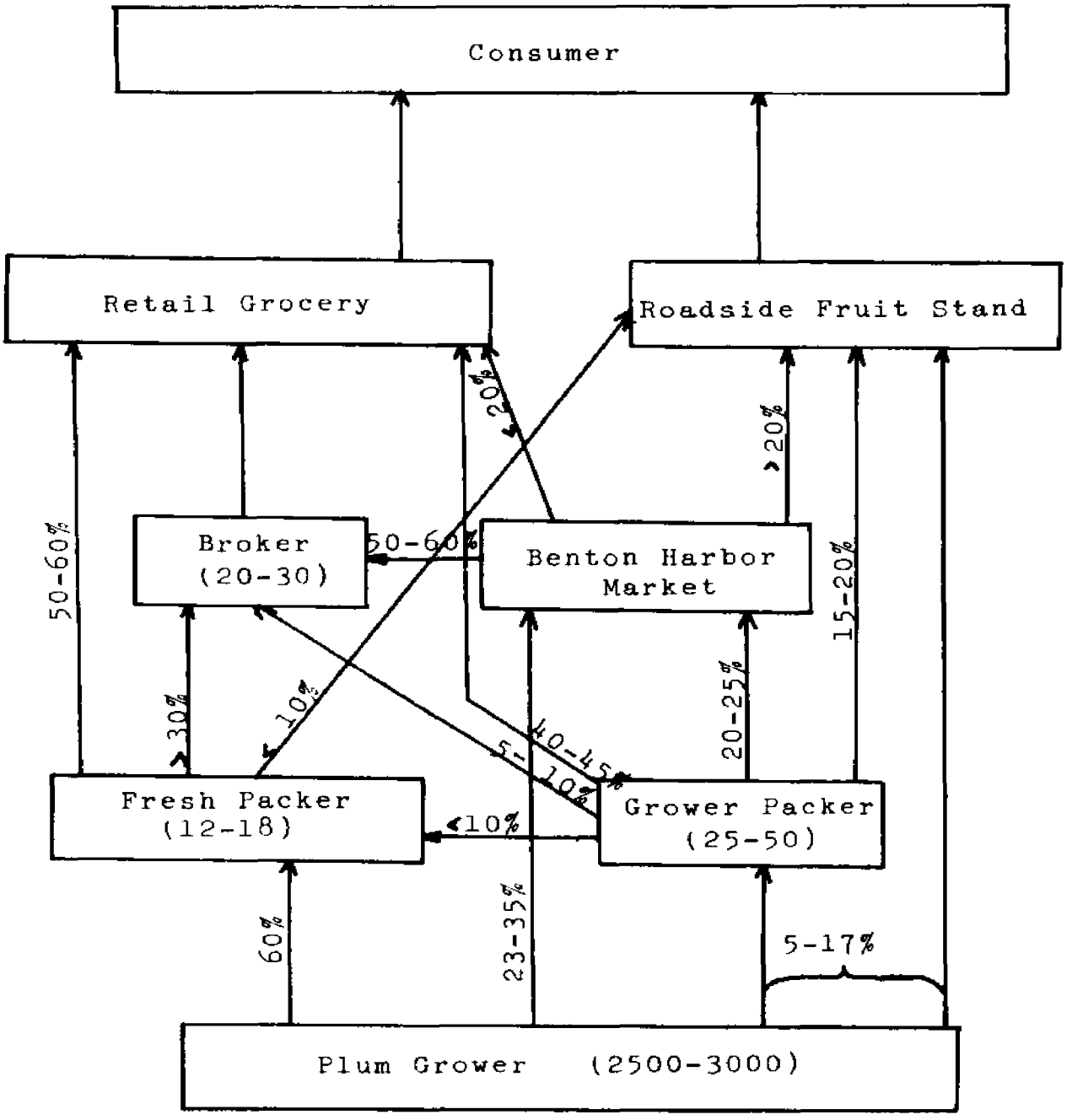

Figure 2. Marketing Channels for Fresh Plums*

*The percentage indications on the channel lines and numbers in the brackets are approximations made by the author for the present situation. The values in brackets are numbers of participants. Values on the arrows are percent of that group's product going in the direction of the arrow.

Growers

Most of Michigan's growers are located in the western part of the state (Figure 3). Individual grower size ranges from less than an acre to approximately three hundred acres. According to the 1964 census of Agriculture, there were 3,163 farms raising some plums. The next census is expected to show that the number of plum farms have decreased but that their average acreage has increased. Nearly all growers have other fruit crops with plums as a minor part of their total enterprise.

Plums, as a crop, have become popular with tart cherry fruit growers. This popularity has occurred because plums sold for processing can be mechanically harvested with the same equipment used in tart cherry shaking. By using a tart cherry harvester on plums, growers spread the overhead costs making possession of such a machine more justifiable on a per unit cost basis. Growers are also able to use the same production equipment for plums as is used for some other fruit crops.

Plum growers belong to various fruit crop organizations and have recently formed an organization through the Michigan Agricultural Cooperative Marketing Association (MACMA) multi-fruits division. With the exception of this new organization and a very few packer cooperatives, they

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who sell on the market have no cooling facilities and usually market only small quantities of plums. If plums were cooled before being brought to the market, refrigerated trucks and facilities would be necessary.

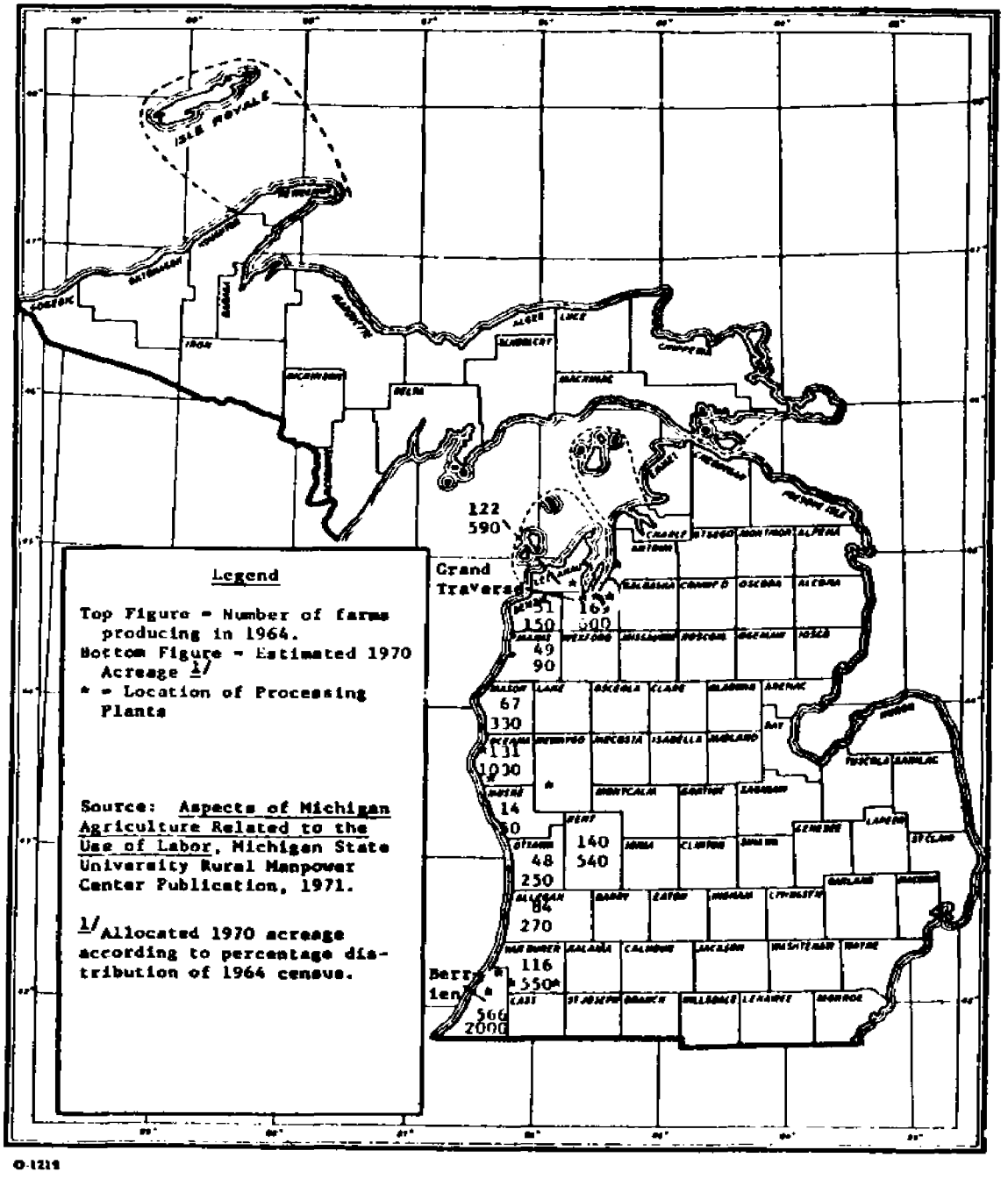

Figure 3. Number of Growers and Acreage in Major Purple Plum Producing Counties and Location of Processing Plants.

bargain with other market participants on an individual basis. Growers in the south, because of their bigger plums, sell to the fresh market packers while growers in the north sell mostly to processors.

Handlers or Receivers

A handler, or what is sometimes referred to as a receiver, is a small company that purchases plums from growers for processors. These companies often handle fresh plums as well, but never buy the plums outright, receiving only what the processor agrees in advance to accept. Approximately eight to ten of these handlers are in operation, usually receiving plums from less than a dozen small growers. Their volume is approximately one million pounds each.

Processors pay handlers a handling charge and growers receive a price similar to that received directly from the processor. Processors benefit from this arrangement by not having to handle all the small grower accounts and look after small quantities at the factory gates. As a rule, a handler will deliver plums from several growers at one time making a bigger load than if each grower delivered his plums independently. Individual handlers may receive for more than one processor each year, but they usually do so with the same set of processors each year. As a rule, handlers operate under a verbal agreement, although one or two written contracts have been used.

In addition to plums, they may handle tart cherries, sweet cherries, apples, pears and occasionally peaches. All

of these fruits, like plums, require storage facilities, bulk bins, lift trucks, and labor. Most handlers own or have access to cold storage facilities, although they try to deliver the plums before storage is necessary. If they must keep the plums for several days, they will chemically treat the plums to prevent the spread of brown rot.

Fresh packers

Fresh packers receive, sort by size, grade, chemically treat, cool, and pack plums. Located primarily in the mid and southwestern parts of Michigan, these packers handle Stanley and Blufre purple plums because of their size and color. Individual packers may handle annual quantities ranging from one hundred thousand to one million pounds.[5] Some packers are independently owned and handle the plums on consignment, while others operate as a marketing cooperative for grower members. Each grower's fruit is graded individually and given a grade of number one or grade-out. Number ones may be sold on the fresh market while grade-outs, those that are small, scarred, split, etc., may be sold or discarded depending on supplies of total plums. Some firms keep each grower's plums separate until final sale and pay the grower according to what was actually received minus a packing charge. Other packers average the total receipts for all number one plums and each grower

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[5]Volume per packer is usually determined by the quantity a packer can sell in a short time because plums will only store for approximately 30 days.

receives the same price per unit for number one plums. The former method requires additional book work, but as packers using this system usually buy from only a few growers, this procedure remains feasible.

Fresh plum packers all pack apples and may pack pears, peaches, cherries, strawberries and blueberries as well. Plum harvest season occurs in September just prior to early apples when facilities, including labor, are not heavily used for other fruit. Plums do not require any unusual equipment or facilities with the exception of a special plum grader. Recently some firms have been prepackaging the plums in overwrap type containers of varying sizes. Packers buy most of their plums from southwestern growers because size is greater there than in the north.

Brokers

Brokers dealing in fresh plums have purchased packed plums from growers, fresh packers and the Benton Harbor market and sold them to retail food outlets or roadside fruit stands. Most brokers do not have packing and storage facilities, although a few have acquired these facilities in the last few years. Some of these brokers are branching into the packing business as well, but, until recently, their contribution to the industry was mainly centered around their ability to collect and direct the fresh product to a final market such as wholesale or retail buyers. Their customers include small stores, roadside stands, retail chains and wholesale buyers. Each customer demands a slightly different service, with small

stores wanting small quantities, roadside stands riper plums, and wholesale and retail chain buyers needing less mature, cooled plums. Recent changes in the market indicate that more small food stores are now part of a cooperative buying organization with buyers who demand a cooled, less mature plum similar to that required by large chains and wholesalers. Roadside fruit stands, according to industry sources, are decreasing in number and becoming more sophisticated. Those remaining are using cold storage in which to keep their extra fruit. This means they require a cooled plum. As a result, brokers have found their sales area changing, forcing them to buy more plums from packers and fewer uncooled plums at the Benton Harbor market.

Processors[6]

The processing sector is composed of 12 plants, 5 in the Traverse City area, 3 in the Hart-Shelby area and 4 in the Benton Harbor-Paw Paw district. While plum processing is carried on by all 12 plants, 5 firms handle approximately 66 percent of the plums processed in the state. No firm processes plums exclusively. All firms handle other fruit crops and in some cases vegetable crops as well. Plums are a minor product for many firms, but the season comes when processing facilities would, in many cases, be idle, prior to

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[6]Processors includes one baby food manufacturer and the rest are canned whole plum processing companies.

the apple season. By processing plums, processors do not add to fixed costs for the plant, and even a small margin above variable costs would be sufficient to warrant a continuation of plum processing.

As the supply in Michigan increased, Processors, as a group, increased the quantity processed. While individual processors have sometimes refused to take more plums than they usually do in a big crop year, the industry, in general, has been able to handle the crop to date. Occasionally, some plums originally destined for processing were diverted to the fresh market, due to low market prices for process type plums.

Geographically, processors are not restricted to any one area in obtaining their supply. In the early part of the season, northern processors buy plums in the south and move them north. Later as the northern plums ripen, southern processors buy plums in the north and transport them to the south. Some price differences exist that are usually related to product quality or added delivery costs to the grower. If prices were significantly different, growers would presumably supply their plums to the firm offering the best price. Most processors use fieldmen who work with growers that deal regularly with their company. Processors may be forced to raise prices when their requirements are beyond that available from regular growers; otherwise they usually pay the market price for plums supplied by regular growers. Grower loyalty appears to be based on having

received a price similar to that offered by other firms in the past, convenience of delivery, quality regulations, quantity of other fruit sold by a grower to that processor and other less quantifiable reasons. Processors do not use written contracts but work on verbal agreements between the fieldman and the grower.

Benton Harbor Fruit Market

Benton Harbor Fruit Market[7] refers to a wholesale public city market, located in the city of Benton Harbor, Michigan, to effect the exchange of fruit, vegetables and other produce. At the market, established in 1937, growers sell their produce to brokers, wholesalers or chain store buyers but not to individual consumers. Until recently, growers graded and packed their plums in half bushel units and sold them to buyers, who took them directly to retail outlets for resale in bulk form. Now, as fresh packers have increased in importance, growers have found it advantageous to let these packers grade and pack their plums, thus by-passing the market. A change in buyer requirements has further reduced market volume. All retail buyers now want large volumes of uniform quality, cooled plums which have a longer shelf life. These requirements are difficult to obtain on the Benton Harbor market.

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[7] J. C. Abbott. Marketing Fruit and Vegetables. FAO marketing guide No. 2, Rome, 1970. Appendix.

At one time the Benton Harbor market handled over 50 percent of Michigan's fresh plums, but now handle approximately 25 percent (Table 1). A further decline is expected as both demand and supply fall off. In the immediate future, large supplies may increase the volume offered, but even with lower prices the demand for uncooled plums is not likely to improve. The convenience, availability and longer shelf life of cooled plums make them more attractive than those sold on the Benton Harbor market.

Retailers

Retail chain stores account for most of the canned whole plum sales and a big share of fresh sales. Although they often carry from one to three brands of canned plums at one time, they seldom feature them because of the low volume. Some retail units carry brands from the Northwest as well as Michigan brands or occasionally in place of Michigan's brands. The most popular can size for the whole plum packed in heavy syrup is the number 2 1/2 can while the dietary plums are sold in the number 303 can. In fresh sales, retailers switch from Northwestern to Michigan plums as soon as the latter are available. Hydro-cooled plums have become more popular because of the longer shelf life. Fresh plum sales drop off near the end of September due to competing fruit and perhaps because the novelty of fresh fruit is wearing off.

Table 1. Benton Harbor Plum Sales: Total and Percentage of Michigan Sales 1960-1970.

Year	Total Benton Harbor	Sold fresh in Michigan	B.H. as % of Mich.
	tons	tons	
1960	1348.2	2500	52
1961	1272.6	3200	41
1962	1121.4	2600	42
1963	1083.6	2200	50
1964	1890.0	6600	28
1965	1146.6	4100	34
1966	1524.6	5000	30
1967	1297.8	4600	28
1968	743.4	3000	23
1969	1767.5	5200	35
1970	1225.0	4800	25

Sources: Col. 1 Benton Harbor Fruit Market Annual Summary Federal-State Market Survey.

Col. 2 Total volume of plums sold fresh in Michigan as reported by the Michigan Crop Reporting Service.

Col. 3 Col. 2 as a percent of Col. 1.

Some firms continue to sell plums in bulk, free choice form while others have switched to packages ranging in size from one to ten pounds.

Fresh plums are featured or advertised much more often than canned plums. Stores use point of sale advertising as well as printed ads to promote fresh plums. The Northwestern states have a plum promotion organization that supplies retail stores with point of sale materials.

Other Participants

A number of other participants interact to a lesser degree within the industry. One jam and jelly company outside of the state was consulted concerning the use of Michigan plums. They use very few purple plums and have started replacing other Michigan plum varieties with the Santa Rosa variety from California. Institutional brokers were not contacted separately because it was assumed that their function is very similar to that reported under the section titled "Brokers." The one baby food company, as mentioned earlier, was included with canning processors to avoid the divulgence of individual firm information. No information was available, nor did time and funds permit the gathering of information on the military and the institutional markets. No roadside fruit stand owners were interviewed, but brief mention was made of these participants under the title of "Brokers." Consumers are discussed in later chapters.

Summary

A number of trends and forces are affecting changes on the marketing channels. Demand for cooled plums is forcing the decline of the Benton Harbor market as a point of exchange. This in turn forces growers to increase their home packing to include cooling facilities or sell tree run plums directly to packers. The cooling requirement is forcing a similar change in roadside stands, where a number have installed refrigeration. While the number of growers is believed to be declining, their individual acreage is increasing as plums have become a complementary crop with tart cherries. Some retailers have started selling fresh plums in overwrapped trays forcing others to follow and putting some pressure on packers to perform this service. With these exceptions the remaining parts of the channels indicate little change.

CHAPTER III

UNITED STATES PURPLE PLUM INDUSTRY

Introduction

Michigan's plum industry is part of a four state commercial purple plum industry in the United States (Figure 4). The other states are Washington, Oregon, and Idaho. Annual grower revenue from plums in these states is approximately nine million dollars. While small by comparison with such huge fruit industries as apples, grapes, and peaches, the total revenue is important to the fruit industries in the four states involved. Until recently, purple plums have been lumped together with California's plum and prune industry making it a much larger value and volume crop. This lumping has resulted in the purple plum segment being completely overshadowed by the larger California plum and drying prune industry. Recently more data and information has been available on this industry. The following sections provide some of the more important data now available for the purple plum industry.

Production

Commercial plum and prune production is most significant in California, Oregon, Washington, Idaho, and Michigan.

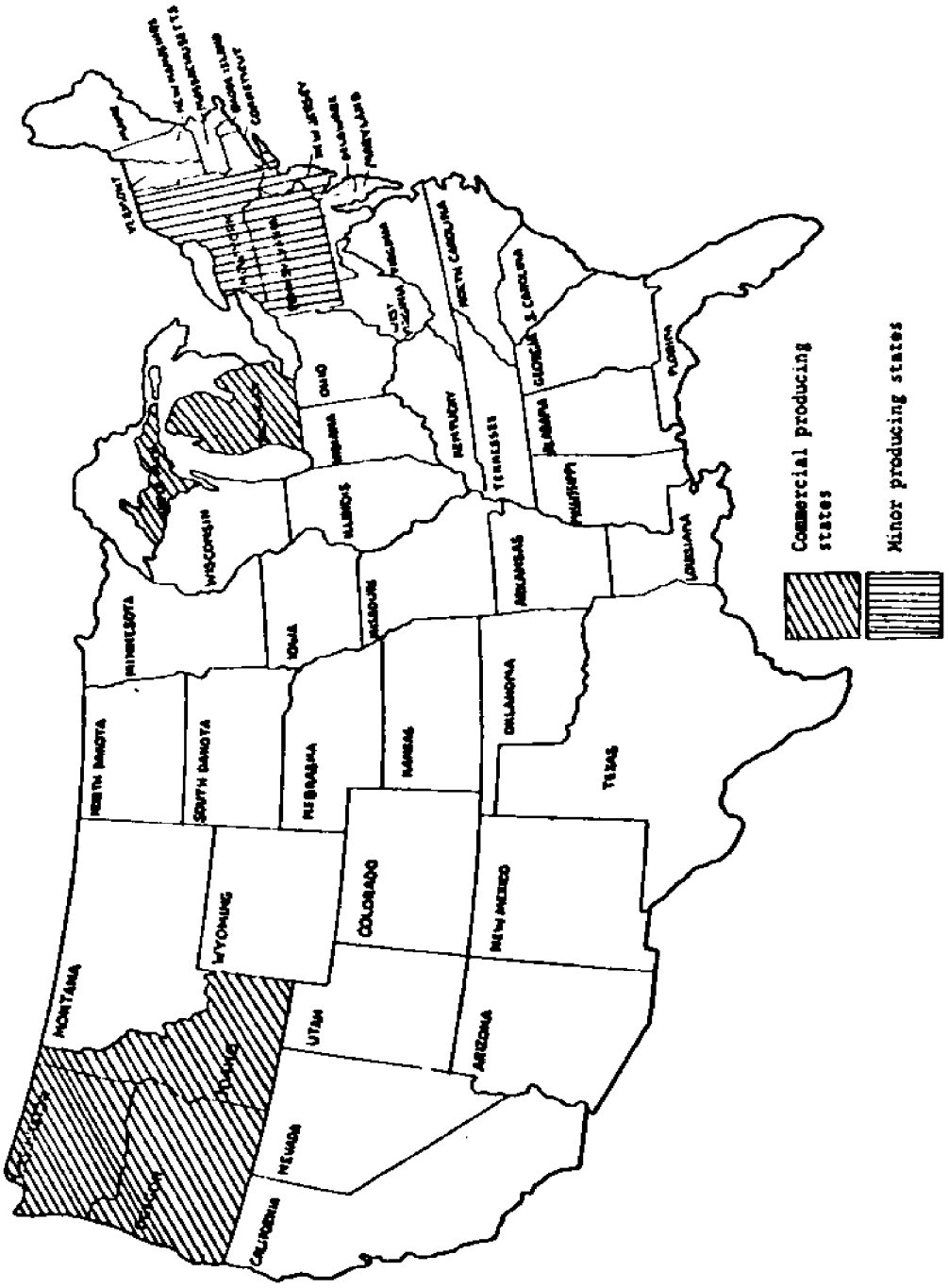

Figure 4. Purple Plum Growing Regions of the United States.

California specializes in soft-fleshed plums and the relatively firm fleshed prune type plum which is made into a dried prune. The other four states specialize in the firm fleshed prune type plum. These prune type plums require a high sugar content if they are to be made into dried prunes. This excludes Washington, Idaho, Michigan and parts of Oregon where the plum sugar content is too low for making high quality dried prunes. These four areas sell their plums fresh or canned as purple plums and may be identified as the purple plum subsector.[1]

Purple plum production in the U.S. has fluctuated from slightly over 216,000 tons in 1939 to a low of 32,700 tons in 1960 (Table 2). Part of this big drop in production may be explained by the fact that Oregon sells a lot of plums in some years for dried prune making. In addition, Oregon's production fluctuates annually resulting in a few years when supplies are very much above average. With the per capita consumption of fresh plums and prunes dropping by 60 percent and the consumption of dried prunes dropping by 75 percent, the demand for prunes has decreased, causing Oregon to reduce their prune production. Even with the reduced production in Oregon, their growing conditions contribute to a substantial supply fluctuation in this state, so the total U.S. supply also fluctuates erratically.

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[1] A subsector is a "meaningful grouping of economic activities related vertically and horizontally by market relationships." J. D. Shaffer, On the Concept of Subsector Studies. Paper presented at the Technical Seminar on Subsector Modeling of Feed and Agricultural Industries, Department of Ag. Economics, University of Florida, March 30, 1970.

Table 2. Prunes and Plums: Total Production in Principal States (1939-1970).

Crop year	Michigan	Idaho	Washington	Oregon	4 State Total
			Tons		
1939	5,600	23,500	32,900	154,300	216,300
1940	5,000	21,500	18,900	42,700	88,100
1941	5,900	21,000	22,300	69,400	118,600
1942	4,200	18,200	23,500	70,500	116,400
1943	2,500	7,800	23,000	104,000	137,300
1944	4,500	23,300	25,800	60,400	114,000
1945	1,700	28,200	26,000	92,100	148,000
1946	6,000	22,400	29,100	101,100	158,600
1947	5,200	37,000	23,100	34,400	99,700
1948	4,800	20,800	19,000	48,800	93,400
1949	7,500	27,100	23,700	107,700	166,000
1950	6,500	10,000	13,600	22,300	52,400
1951	4,600	22,600	12,700	59,800	99,700
1952	7,500	24,800	17,100	45,100	94,500
1953	6,700	20,900	22,100	48,400	98,100
1954	6,300	12,700	15,100	42,500	76,600
1955	5,200	22,200	25,000	52,600	105,000
1956	4,900	25,500	17,500	59,000	106,900
1957	7,300	22,000	16,000	34,000	79,300
1958	7,800	19,100	13,500	19,700	60,100
1959	6,800	22,600	22,500	44,000	95,900
1960	8,000	10,600	10,100	4,000	32,700
1961	9,000	20,500	19,100	27,400	76,000
1962	8,000	16,700	21,400	46,000	92,100
1963	10,500	19,000	16,100	6,300	51,900
1964	14,500	23,500	23,300	23,000	84,300
1965	11,500	21,000	13,700	28,000	74,200
1966	13,000	11,000	17,200	25,000	66,200
1967	15,000	16,500	12,700	30,500	74,700
1968	13,000	6,480	9,800	11,000	44,000
1969	14,500	17,500	27,200	30,300	89,500
1970*	10,000	7,150	9,400	20,300	46,850

*Preliminary

Source: Fruits Noncitrus by States: Production, Use, Value: Annual Reports.

Over the past 30 years when total U.S. production was decreasing, Michigan's production increased. From 1930 to 1970, Michigan increased its share of the purple plum subsector from less than 5 percent to more than 20 percent. Idaho and Washington have produced more plums than Michigan in the past but have on the average decreased their production by approximately 30 percent during that same period. Their production has remained relatively stable during the past ten years; hence Michigan, in some years, produces more than they do. Oregon's production varies depending on the year, but in good years they have outproduced all states. If the predicted production occurs, Michigan could become the leading plum producer.

Commercial production in the two areas is dependent on two major plum varieties. In the Northwest these consist mainly of the Italian (Fellenberg) prune and several early maturing varieties derived from it, especially the Richards, Demaris, and Wetherspoon. Other important varieties of European origin include the French Petite prune and the President plum. The Italian prune resembles the Michigan Stanley plum in color and is usually slightly larger. Michigan's Italian prunes are not the Fellenberg variety and are usually much smaller than Stanley plums.

Michigan's plum industry is primarily composed of the Stanley prune plum which accounted for 74.8 percent of Michigan's plum trees (according to the 1968 tree survey) (Table 3). A new variety called "Blufre" which became popular in

Table 3. Number of Plum and Prune Trees in Commercial Orchards by Variety, and Year Set, Districts and State, Michigan, 1968.

Variety	Number of Trees by Year Set								Trees of all ages
	1967	1965-66	1963-64	1960-62	1955-59	1950-49	1945-49	1944 & earlier	
					State				
Stanley	25,194	104,226	165,107	125,485	113,329	49,892	32,494	12,209	627,936
Blufre	25,974	47,281	42,786	19,000	447	94	398	---	135,977
Damson	1,227	2,487	8,672	429	5,135	8,445	7,770	8,441	42,605
German Prune	---	3,349	2,049	1,201	1,268	113	4,237	1,483	13,699
All Others	749	2,141	5,126	4,394	2,346	1,135	1,888	1,990	19,765
Total All Varieties	53,144	159,484	223,740	150,509	122,525	59,679	46,787	24,123	839,982
					Northwest District				
Stanley	12,802	34,148	28,478	49,981	32,101	8,437	10,790	3,088	179,825
All Others	2,844	4,521	9,034	5,883	1,761	430	573	5,129	30,171
Total All Varieties	15,646	38,669	37,512	55,864	33,862	8,867	11,363	8,217	209,996
					West Central District				
Stanley	3,548	28,410	76,615	37,602	41,862	23,584	12,848	4,557	229,025
All Others	4,962	3,763	6,530	289	1,311	4,821	7,116	2,175	30,966
Total All Varieties	8,510	32,173	83,145	37,891	43,173	28,405	19,964	6,732	259,991
					Southwest District				
Stanley	7,925	39,699	51,204	31,817	34,783	17,089	8,509	4,333	195,360
Blufre	17,477	44,113	38,325	17,532	426	94	---	---	117,966
All Others	724	1,889	2,915	1,162	5,441	4,410	5,695	4,431	26,667
Total All Varieties	26,126	85,701	92,444	50,511	40,650	21,593	14,204	8,764	339,993
					Other District				
Stanley	919	1,969	8,810	6,085	4,583	782	347	231	23,726
All Others	1,943	972	1,829	158	257	32	909	179	6,276
Total All Varieties	2,862	2,941	10,639	6,243	4,840	814	1,256	410	30,002

Source: Michigan Crop Reporting Service, Michigan 1968 Fruit Tree Survey.

the early sixties accounted for 16 percent of the 1968 tree count in Michigan. Blufre's are a cross between Stanley and President plums, similar in color to Stanley's and Italian's and usually bigger than the Stanley in Michigan. Because of their size Blufre's have been used in the fresh market. Stanley plums serve both the fresh and processing markets. A few Damson plums, used mostly for jam and jelly are grown in the state but are meeting stiff competition from California's Santa Rosa plums. Several other varieties including the German prune exist in small numbers but are insignificant in the Michigan market.

Blufre plum plantings have increased in the southern part of Michigan which produces for the fresh market and prefers a larger size plum. Nonetheless, even there, with the exception of 1965-1967 planting years, Stanley plums have been more popular. In the Northern district where most plums are sold for processing, 86 percent of the plantings are of the Stanley variety. While plantings of Blufre plums have increased during the sixties, some growers and handlers are reported to have encountered sufficient difficulties with growing and handling them, that they are not expected to replace the Stanley. Those difficulties mentioned included a distorted shape in some years, less uniform ripening and breakdown of the flesh soon after picking. The extent of these difficulties has not been documented. Problems with Blufre plums were mentioned infrequently by industry people in the surveys.

Ontario, New York, New Jersey, and Pennsylvania are minor plum producing areas. Here, as is the case with the

major areas, the varieties of Stanley and Italian (Fellenberg) prune plums dominate plantings. Stanleys are slight favorites while no other variety seriously challenges either of the two predominate varieties.

New York's plantings are slightly less than 30 percent of the number of trees in Michigan. No statistics are available on production, utilization or value for New York. Their extension people indicate that a number of the plums go into the baby food industry and the rest are sold as fresh.

Ontario's tree numbers are reported here because major Ontario cities are potential markets for Michigan's fresh purple plums. In Ontario the Italian (Fellenberg) variety accounts for slightly over 50 percent of the total tree numbers and Stanley's represent about 41 percent (Table 5). However, Ontario's tree numbers are decreasing, Italian's more so than Stanley's. If this decrease continues, Michigan might find a market there for more fresh plums.

Pennsylvania, with less than fifty thousand trees, has experienced a decrease in new plantings (Table 4). While Stanley plums are the most popular variety in Pennsylvania, they represent less than half of the total tree number. If the planting trend continues, Pennsylvania will not be a serious competitor in the U.S. purple plum subsector.

Several industry people have mentioned that New Jersey has been planting more plum trees. According to a 1966 tree survey, New Jersey had less than fourteen thousand trees at that time (Table 4). Even with a heavy tree planting program, New Jersey is not likely to become a big producer for several years.

Table 4. Plum and Prune Trees by Age and Variety--New Jersey, Pennsylvania, New York.

Part A - New Jersey: Plum & Prune Trees by Age and Variety, 1967

Variety	Year set or age in 1967							Total all ages
	1965-66 1-2 years	1963-64 3-4 years	1960-62 5-7 years	1955-59 8-12 years	1950-54 13-17 years	1945-49 18-22 years	Before 1945,23 yrs. & over	
Italian	--	37	25	7	3	70	5	147
Stanley	658	1,608	6,688	105	748	35	--	9,842
Misc. varieties	37	1,088	1,590	912	78	22	120	3,847
State totals	695	2,733	8,303	1,024	829	127	125	13,836

Source: New Jersey Crop Reporting Service, 1967 New Jersey Orchard and Vineyard Survey

Part B - Pennsylvania: Number of Plum and Prune Trees by Varieties & Age Groups

Variety	1965-66 1-2 years	1963-64 3-4 years	1960-62 5-7 years	1955-59 8-12 years	1950-54 13-17 years	1965-49 18-22 years	1944 & earlier 23 yrs. & over	Total trees of all ages
Stanley	2,079	2,231	2,782	4,865	4,854	1,711	358	18,880
Fellenburg	284	368	211	1,367	1,639	1,321	40	5,230
Santa Rosa	139	457	1,355	1,333	244	652	--	4,180
Damson	8	16	1,286	744	238	592	426	3,310
York State	8	97	32	703	331	268	1,086	2,525
Wickson	13	21	5	179	52	48	1,622	1,940
Shiro	103	180	123	290	825	253	21	1,795
President	103	545	934	77	26	--	--	1,685
Other varieties	1,210	963	1,835	2,033	1,700	1,900	319	9,960
Total all varieties	3,947	4,878	8,563	11,591	9,909	6,745	3,872	49,505
Percent of total	7	10	18	23	20	14	8	100

Source: Pennsylvania Crop Reporting Service, Pennsylvania Fruit Tree and Grapevine Survey, 1967.

Table 4 Continued

Part C - New York: Number of Plum and Prune Trees by Varieties and Age Groups

Variety	1965 (1 yr)	1963-64 (2-3 yr)	1960-62 (4-6 yr)	1955-59 (7-11 yr)	1950-54 (12-16 yr)	1940-49 (17-26 yr)	1939 & earlier 27 yr & over	Total trees of all ages
Stanley	3,608	19,707	16,332	19,277	17,275	15,676	1,033	92,978
Fellenberg	479	4,297	5,247	2,606	9,843	30,317	11,674	64,124
French Damson	1,986	924	1,348	824	2,139	6,186	2,060	15,467
Burbank	--	--	255	50	100	151	35	591
Grand Prize	--	1,150	1,370	534	130	--	--	3,184
Shropshire Damson	--	600	--	--	--	--	--	600
Misc.	1,687	2,224	3,209	1,478	1,924	1,216	530	11,921
Total	7,760	28,902	27,761	24,769	31,411	53,546	15,332	188,865

Source: New York Crop Reporting Service: New York Fruit Tree and Vineyard Survey - 1966.

Table 5. Number of Prune Trees in the Province of Ontario Reported in the 1966 Survey Compared with Numbers in 1956 and 1961 Surveys.

Part A:

Variety	1956	1961	1966	1966 as % of 1961
	No trees	No. trees	No. trees	%
Stanley	43,296	45,188	42,727	94.55
Italian (Fellenberg)	81,812	67,611	52,245	77.27
German	19,313	10,466	6,707	64.08
Other Varieties	972	2,447	1,471	60.11
TOTAL	145,393	125,712	103,150	82.05

Part B: Number of Prune Trees in the Province of Ontario Classified by Variety and Age Group.

Variety	1 to 7 years	8 to 15 years	16 yrs. & over	Total	Var. as a % of Total Trees
	No. trees	No. trees	No. trees	No. trees	%
Stanley	10,190	16,090	16,447	42,727	41.40
Italian	8,682	15,532	28,031	52,245	50.62
German	442	2,716	3,549	6,707	6.50
Other Varieties	896	281	294	1,471	1.43
TOTAL	20,210	34,619	48,321	103,150	100.00
Age Group as a % of Total Trees	19.59	33.56	46.85	100.00	

Source: Ontario Department of Agriculture and Food, Parliament Buildings, Toronto, Tender Fruits, 1966 Fruit Tree Census Part II.

The Stanley prune plum, highly favored by Michigan growers, has become more popular in nearby states, replacing the Italian (Fellenberg) plum. These other states, unlike Michigan, have had substantial plantings of the Italian type plum. This interest in Stanley plums is apparently based on the fact that Stanley's are suitable for both the fresh and processing markets. They are also a high producing variety. According to one industry source, some of the growers in the Northwest region are looking at Stanley's as a possible replacement for the Italian (Fellenberg).

The Northwestern plum season usually precedes that of Michigan by at least one month. Plums from Washington and Oregon are ready to market about August 1 and continue through the end of August. Idaho's season begins in mid-August and lasts through the second week in September. These dates are consistent from year to year. Michigan's plums are ready in the first week of September and usually last until the first of October. Michigan's season overlaps Idaho's season by two weeks and must compete with them for shelf space.

Utilization

Michigan ranks third behind Idaho and Washington in fresh sales supplying close to one-sixth of the total output of plums sold fresh in the U.S. (Table 6). Oregon has a very erratic fresh production record because their fresh production comes primarily from the Milton-Freewater area which encounters weather problems in most years. While Michigan's share of the fresh market has been slowly increasing, total U.S. fresh

Table 6. Purple Plum Fresh Sales (Four Major States)

Crop year	Michigan	Idaho	Oregon	Washington	Total U.S. (Four Major States)
			tons		
1939	4,760	20,500	19,700	13,300	58,260
1940	4,230	19,700	16,600	8,400	48,930
1941	5,030	19,200	13,200	9,600	47,030
1942	3,500	16,800	19,000	15,000	54,300
1943	2,150	7,300	17,600	12,300	39,350
1944	3,560	22,300	17,800	15,610	59,270
1945	1,350	26,800	23,600	13,400	65,150
1946	4,110	20,800	18,100	10,600	53,610
1947	4,360	33,300	13,000	10,830	61,490
1948	4,105	18,100	21,200	11,130	54,535
1949	5,615	21,100	21,000	10,160	57,875
1950	4,720	8,850	4,650	9,470	27,690
1951	2,910	19,900	10,300	8,010	41,120
1952	4,935	20,900	14,900	10,330	51,065
1953	4,520	17,500	16,300	13,620	51,940
1954	3,235	12,200[a]	4,900	9,850	30,185
1955	2,560	17,400	17,500	14,400	51,860
1956	2,410	24,750[a]	6,440	12,200	45,800
1957	3,910	21,350[a]	4,200	12,340	41,800
1958	3,950	18,540[a]	2,300	10,900	35,690
1959	4,140	22,150[a]	5,200	14,900	46,390
1960	3,460	10,370	1,050	7,870	22,750
1961	4,300	16,685	3,280	11,800	36,065
1962	3,530	13,860	5,800	13,450	36,640
1963	3,600	12,285	5,000	8,150	29,035
1964	6,500	6,501	9,150	13,950	35,451
1965	4,100	16,071	5,700	8,900	34,771
1966	5,000	10,600	2,200	13,600	31,460
1967	4,600	12,803	6,650	8,100	32,153
1968	3,000	3,740	9,760	6,900	23,400
1969	5,200	13,600	1,580	18,000	38,380

[a]Includes canned and frozen.

Source: Fruits Noncitrus by States: Production, Use, Value: Annual Reports.

sales have been declining. This downward trend in total U.S. fresh sales, although slow, is cause for concern in Michigan's plum industry, with the expected increase in total production. Competing for a smaller total volume is much more difficult than capturing part of a growing market.

Plum sales for processing have fluctuated more than fresh sales. Processing requires plums with a high sugar content not usually attained until the plum is completely tree ripened. By the time the sugar content is adequate for processing, the plums are already too ripe for the fresh market. Thus the grower must usually decide prior to harvesting whether he will sell fresh or for processing.

Usually, fresh market prices are higher, in part reflecting the extra cost of hand picking and handling. As the fresh season comes to a close, prices may drop because of lower plum quality, a decrease in demand and an increase in supply. The supply increase comes from plums originally heading for the process market. This happens when the price for process type plums is much below that available in the fresh market. As the process price is not available until near the end of the fresh season, only a limited quantity of plums, normally sold for processing, end up in the fresh market. The size and shelf life of process type plums usually keeps most of them out of the market. The announced process price usually remains relatively fixed throughout the season.

Within the past ten years, Michigan has taken over second place in processing sales behind Oregon, (Table 7).

Table 7. Purple Plums Sold for Canning

Crop year	Michigan	Idaho	Washington	Oregon	U.S. (total of four states)
			tons		
1939	300	na	8,100	10,300	18,700
1941	420	na	7,870	28,200	36,390
1942	280	na	3,700	15,500	19,480
1943	50	na	4,370	31,000	35,420
1944	400	na	6,030	14,800	21,230
1945	50	na	7,700	19,000	26,750
1946	730	800[a]	14,890	42,200	58,620
1947	250	900[a]	9,570	13,700	24,420
1948	235	200[a]	4,950	9,200	14,585
1949	585	1,300	4,940	21,000	33,090
1950	1,280	400	3,030	11,000	15,710
1951	1,290	1,900	3,220	28,550	34,960
1952	1,830	1,800	5,690	18,000	27,320
1953	1,860	1,800	5,430	14,500	23,590
1954	2,785	[b]	4,500	23,300	30,585
1955	2,240	2,200	8,900	17,050	30,390
1956	2,250	[b]	4,900	28,050	35,200
1957	2,500	[b]	3,260	12,400	18,160
1958	3,630	[b]	2,250	12,700	18,580
1959	2,310	[b]	5,900	18,700	26,910
1960	4,220	[b]	1,705	1,500	7,425
1961	4,350	3,500	5,900	12,620	26,370
1962	4,270	2,570	5,800	22,300	34,940
1963	6,340	6,490	6,760	265	19,855
1964	7,135	5,133	7,200	8,100	27,568
1965	6,835	4,133	3,600	14,600	29,168
1966	7,050	na	2,560	14,400	24,010
1967	9,250	3,279	3,000	14,300	29,829
1968	8,825	2,670	2,700	800	14,995
1969	8,480	3,820	9,000	19,200	40,500

na not available.

[a]Includes some frozen and other.

[b]Included with fresh sales to avoid disclosure of individual operations.

Source: Fruits Noncitrus by States; Production, Use, Value: Annual Reports.

Processing sales in Michigan have fluctuated less than in any other state. This may be accounted for by the fact that most of Michigan's northern plums are sold for processing and that area, according to survey responses, has a better than average record for consistent production. Oregon's processing volume has varied drastically from over twenty thousand to less than one thousand tons per year. For Michigan and Oregon, processing sales are more important than fresh sales while the reverse is true in Idaho and Washington.

The total annual U.S. pack and carryin of canned whole purple plums indicates the variation in quantity available for processing on a year to year basis, (Table 8). Carryin stocks, which are the remaining inventory of the previous years pack, provide additional supplies in short crop years. As a result of this carryin the total U.S. supply of canned whole purple plums remains relatively stable.

Purple plums are frozen in small quantities for later processing into baby food and preserves. Only two states, Michigan and Oregon, still freeze plums (Table 10). This use is small and most industry sources report very little potential for expanding. Michigan's frozen plums account for less than 10 percent of their total volume, and Oregon's percentage is less than 5 percent.

Oregon dries some of their purple plums to make prunes. For this product a high concentration of sugar is needed to produce a high quality prune that will compete with Californian prunes. Oregon is the only state of the four which has the proper sugar content. Their dried prune industry fluctuates

Table 8. U.S. Canned Purple Plum Pack, Carry in and Total Annual Supply 1947-1970.

Crop year	Carryin as of June 1	Total U.S. Pack	Total Supply
	-- 000's of cases, 24 No. 2 1/2's --		
1947	848*	1,816	2,664
1948	430*	921	1,351
1949	162*	1,830	1,992
1950	238*	1,026	1,364
1951	95	2,360	2,455
1952	526	1,623	2,149
1953	433	1,399	1,832
1954	330	1,706	2,036
1955	501	1,698	2,199
1956	525	2,330	2,855
1957	783	1,077	1,860
1958	197	1,271	1,468
1959	260	1,701	1,961
1960	276	374	650
1961	38	1,637	1,675
1962	382	2,060	2,442
1963	736	1,170	1,906
1964	568	1,497	2,065
1965	562	1,729	2,291
1966	733	1,488	2,221
1967	462	1,858	2,320
1968	518	731	1,249
1969	251	2,209	2,460
1970	917	840	1,757

*Estimates

Source: Canner Packer, Yearbook Editions 1947-57, Vance Publishing Corporation, 300 West Adams Street, Chicago, Illinois 60606
Fruit Situation, Economic Research Service, USDA, 1958-1970.

Table 9. Total U.S. Purple Plum Pack by Sizes 1950-1969.

Crop year	Case and Can Size					
	48/8 oz.	24/303	24/2 1/2	6/10	24/2	Misc.
	--000's actual cases--					
1950	38	17	630	236	27	33
1951	130	282	1,339	611	41	70
1952	68	208	826	486	30	50
1953	55	158	789	338	12	60
1954	50	260	941	481	3	15
1955	107	192	988	484	29	23
1956	85	385	1,251	727	2	5
1957	73	215	536	299	(a)	4
1958	67	280	558	557		3
1959	70	256	843	719		17
1960	18	99	141	180		1
1961	81	353	778	656		10
1962	75	385	1,059	793		14
1963	49	252	636	394		--
1964	65	366	755	533		11
1965	63	317	1,091	444		19
1966	48	275	738	601		19
1967	63	372	962	701		3
1968	28	186	385	234		11
1969	90	548	1,008	899		17

(a) no longer reported.

Source: The Almanac of the Canning, Freezing, Preserving Industries, Edward E. Judge & Son, Seventy-Nine Bond Street, Westminster Maryland 21157.

Table 10. Purple Plums Sold for Freezing and Drying Major States 1939-1969.

Crop year	Michigan Frozen	Oregon Frozen	Oregon Dried[a] Basis	Washington Dried[a] Basis	Washington Frozen
			tons		
1939	--	--	26,500	2,100	--
1940	--	--	2,500	100	--
1941	--	100	6,400	400	30
1942	--	1,500	5,900	100	400
1943	--	11,500	11,300	600	1,500
1944	--	7,300	4,100	250	1,130
1945	--	8,300	7,700	250	1,750
1946	420	5,700	8,200	250	510
1947	95	1,100	300	100	150
1948	na	800	1,500	50	150
1949	na	3,300	9,200	200	300
1950	na	2,500	700	b	b
1951	na	2,650	3,771		
1952	na	800	2,143		
1953	na	2,600	2,457		
1954	na	2,400	2,828		
1955	na	1,050	4,114		
1956	na	1,550	5,700		
1957	na	700	2,828		
1958	na	200	943		
1959	150	500	5,150		
1960	120	150	210		
1961	150	650	2,954		
1962	--	1,000	4,641		
1963	360	80	147		
1964	615	275	1,660		
1965	365	1,000	1,716		
1966	750	600	2,029		
1967	950	1,450	2,147		
1968	975	--	90		
1969	620	2,200	2,055		

na not available

[a]Approximately 3.5 lbs. of fresh fruit for each pound of dried fruit.

[b]Reported with canned from this year forward.

Source: Fruits Noncitrus by States; Production, Use, Value: Annual Reports.

annually and is governed to a large degree by what happens in California. Oregon's dried plum volume has fluctuated from a high of 26,500 dried tons in 1939 to a low of 90 dried tons in 1968 (Table 10).

Value of Production

Michigan, on the average, receives less for their fresh plums than any of the other states (Table 11). Michigan's lower price may be partially explained by the fact that their plums enter the market at the end of the season and are often less uniform in size than plums brought in from the Northwest. A Northwestern federal market order requires that all Washington and Oregon plums shipped to the fresh market have a minimum diameter of 1 1/4 inch and a minimum of 1 1/8 inch in Idaho. Washington fresh prices are usually above those in other states, although this may not be the case for particular years. Oregon, while predominantly a processing production area, receives better fresh prices than Idaho. The size difference mentioned above may account for Idaho's lower price.

Michigan's increase in supply could also account for lower fresh plum prices. As supply increased, Michigan's historical market may have become saturated, resulting in lower prices. Some of this increase in supply might have been marketed in Northwestern market areas, if Michigan had a fresh marketing program. By marketing some of the increase in other markets, there would be reduced downward pressure

Table 11. Price Received by Growers for Purple Plums Sold Fresh. Four Major States and the U.S. 1944-69 (Season Average Price)

Crop year	Michigan	Idaho	Washington	Oregon	Total U.S.
		---dollars per ton---			
1944	130.00	96.00	114.00	116.00	107.00
1945	140.00	86.20	113.00	114.00	102.00
1946	96.50	114.00	128.00	104.00	113.00
1947	110.00	69.00	119.00	104.00	86.50
1948	83.40	65.70	68.80	85.40	74.70
1949	58.00	41.50	43.50	62.70	50.40
1950	94.30	117.00	120.00	145.00	124.00
1951	117.00	69.50	103.00	123.00	90.90
1952	85.00	67.00	101.00	127.00	94.00
1953	109.00	73.00	110.00	101.00	93.30
1954	110.00	149.00	166.00	112.00	148.00
1955	112.00	61.70	91.00	82.40	77.60
1956	130.00	117.00	149.00	68.70	119.00
1957	98.00	109.00	155.00	75.80	121.00
1958	105.00	131.00	187.00	105.00	149.00
1959	110.00	91.70	145.00	94.00	112.00
1960	155.00	214.00	235.00	199.00	222.00
1961	124.00	133.00	201.00	127.00	158.00
1962	134.00	93.70	143.00	115.00	117.00
1963	145.00	130.00	182.00	148.00	150.00
1964	92.00	104.00	142.00	116.00	122.00
1965	143.00	107.00	176.00	150.00	136.00
1966	130.00	170.00	209.00	119.00	177.00
1967	142.00	146.00	181.00	165.00	158.00
1968	174.00	180.00	214.00	181.00	190.00
1969	113.00	130.00	186.00	157.00	155.00

Source: Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts 1944-1958, Crop Reporting Board, USDA, 1944-1958. Noncitrus Fruit Prices by States and United States 1959-1969 Crop Reporting Board, SRS, USDA.

on Michigan prices. However, without a marketing program, Michigan plums have encountered generally lower prices than those experienced by the Northwest.

For the four states as a group, the average price received for all fresh plums has ranged from a low of $50.40 in 1949 to a high of $222.00 per ton in 1960. This fluctuation indicates the unstable supply situation in the industry. Fortunately this fluctuation has been less drastic in the past ten years, possibly because Michigan's annual production was fairly stable.

The price received by all U.S. growers in the past ten years for plums sold to processors has averaged $90.00 per ton less than prices received for fresh plums in that same period. Michigan growers received a higher price for processing plums than either Washington or Oregon growers (Table 12). Idaho processing prices are not available. Some of this price difference may be partially explained by transportation cost differences.

Northwestern canned whole plums, to compete in Midwestern and Eastern markets, must do so on a price basis. This means that Northwestern plums must be available to retailers at prices equal to or only slightly above Michigan prices. Since they have a greater transportation cost, processors in the Northwest would have to pay lower prices for raw plums and/or take lower profits if they are to compete with the same processing costs and case yields per ton of plums. The fact that they do compete directly with Michigan processed plums in Michigan indicates that the Northwest,

Table 12. Price Received by Growers for Purple Plums Sold to Processing (except dried) Four Major States and the U.S. 1944-1969. (Season Average Price)

Crop year	Michigan	Idaho	Washington	Oregon	U.S.
		---dollars per ton---			
1944	na	na	60.00	53.20	54.60
1945	na	na	56.00	54.90	54.70
1946	89.20	82.50	67.60	63.80	64.70
1947	56.80	46.40	59.10	58.80	57.60
1948	47.90	40.00	38.60	39.20	39.00
1949	52.00	20.60	20.80	20.80	20.80
1950	73.70	82.10	93.10	97.50	96.20
1951	96.50	47.60	50.00	50.00	49.80
1952	73.60	45.00	51.00	51.00	50.60
1953	66.90	48.00	39.00	41.70	41.60
1954	79.00	na	47.00	46.60	46.40
1955	79.00	na	40.00	41.20	40.50
1956	85.00	na	45.00	44.80	44.80
1957	65.00	na	37.00	37.20	37.30
1958	63.00	na	80.00	90.00	86.80
1959	82.00	na	39.00	39.60	39.80
1960	119.00	na	125.00	147.00	129.00
1961	81.00	na	80.00	80.10	77.30
1962	81.00	na	39.10	40.10	39.50
1963	99.00	na	93.00	95.90	79.80
1964	50.00	na	38.10	51.30	44.10
1965	75.00	na	62.00	56.10	59.10
1966	68.00	na	82.00	51.50	59.10
1967	71.00	na	67.70	64.70	67.00
1968	87.00	na	79.00	105.00	81.40
1969	62.00	na	50.00	53.90	53.80

na not available

Source: Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts 1944-1958, Crop Reporting Board, USDA. 1944-1958, Noncitrus Fruit Prices by States and United States 1959-1969 Crop Reporting Board, SRS, USDA.

despite the transportation cost, is able to produce these plums for less or is losing money. Despite receiving higher prices for plums sold to processors, Michigan alternates with Oregon as to who receives the lowest combined fresh and processed price (Table 13). This combined price reached a low of $40.40 per ton in 1949 and a high of $186.00 per ton in 1960 for U.S. growers as a whole.

The difference between Michigan prices received for fresh plums and for plums sold to processors has been increasing (Table 14). Since 1959, the five-year average price received for fresh market plums has been increasing to the point where the average difference for the period 1966-69 (only four years) was $67.75 per ton. Some doubt exists as to whether prices quoted for Michigan fresh market plums have had marketing costs such as packaging, grading, cooling, and treating removed or not. For plums packed and sold by growers on the Benton Harbor market, the price includes payment for grading and packaging. If this is the price reported, then it is not the price he received for production only. Part of this confusion has come about as a result of a change in Michigan's marketing channels; more plums are now going directly to fresh packers before being sold to retailers rather than through the Benton Harbor market.

Michigan's total returns from plums have been increasing, while the other three states have experienced fluctuations and decreases in returns (Table 15). This increase would seem to indicate that Michigan plums have some advantages, the most important of which are a fairly constant supply,

Table 13. Price Received by Growers for all Sales of Purple Plums As Sold 1944-1969 (Season average price) Four Major States and the U.S.

Crop year	Michigan	Idaho	Washington	Oregon	Total U.S.
		---dollars per ton---			
1944	130.00	96.00	95.10	78.10	86.10
1945	140.00	85.20	87.30	77.10	80.80
1946	95.00	113.00	91.00	77.00	85.10
1947	106.00	67.20	89.90	78.50	76.80
1948	81.00	65.40	58.90	68.20	65.30
1949	57.50	40.30	35.20	41.60	40.40
1950	89.90	115.00	113.00	105.00	110.00
1951	111.00	67.60	87.00	67.80	70.40
1952	82.00	65.20	83.20	81.90	77.50
1953	96.70	70.70	89.80	69.70	74.70
1954	95.70	147.00	129.00	61.10	91.30
1955	96.10	59.00	72.50	67.20	66.80
1956	108.00	115.00	119.00	49.40	78.20
1957	85.10	106.00	132.00	56.70	91.40
1958	84.90	126.00	170.00	97.20	127.00
1959	99.40	87.10	117.00	66.60	85.40
1960	135.00	205.00	215.00	163.00	186.00
1961	102.00	121.00	161.00	99.60	121.00
1962	105.00	84.50	112.00	64.00	81.90
1963	115.00	108.00	142.00	139.00	123.00
1964	65.20	76.00	107.00	82.20	86.00
1965	99.70	93.00	143.00	81.40	98.50
1966	92.00	160.00	189.00	68.00	119.00
1967	93.00	130.00	150.00	93.30	110.00
1968	107.00	128.00	176.00	174.00	145.00
1969	81.00	111.00	141.00	67.00	100.00

Source: Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts 1944-1958, Crop Reporting Board, USDA., Noncitrus Fruit Prices by States and United States 1959-1969 Crop Reporting Board, SRS, USDA.

Table 14. Prices Received by Michigan Farmers for Purple Plums 1944-1969 (Season average price)

Crop year	Fresh Sales	Processed Sales	All Sales	Difference[a,b] between fresh and processed price
		---dollars per ton---		
1944	130.00	na	130.00	na
1945	140.00	na	140.00	na
1946	96.50	89.20	95.00	7.30
1947	110.00	56.80	106.00	53.20
1948	83.40	47.90	81.00	35.50
1949	58.00	52.00	57.50	6.00
1950	94.30	73.70	89.90	20.60
1951	117.00	96.50	111.00	20.50
1952	85.00	73.60	82.00	11.40
1953	109.00	66.90	96.70	42.10
1954	110.00	79.00	95.70	31.00
1955	112.00	79.00	96.10	33.00
1956	130.00	85.00	108.00	45.00
1957	98.00	65.00	85.10	33.00
1958	105.00	63.00	84.90	42.00
1959	110.00	82.00	99.40	28.00
1960	155.00	119.00	135.00	36.00
1961	124.00	81.00	102.00	43.00
1962	134.00	81.00	105.00	53.00
1963	145.00	99.00	115.00	46.00
1964	92.00	50.00	65.20	42.00
1965	143.00	75.00	99.70	68.00
1966	130.00	68.00	92.00	62.00
1967	142.00	71.00	93.00	71.00
1968	174.00	87.00	107.00	87.00
1969	113.00	62.00	81.00	51.00

na not available.

[a]The difference between processed and fresh prices: Col. one minus Col. two.

[b]Five year averages for column 4. 1946-50 (5 years) 24.65; 1951-55 (5 years) 27.60; 1956-60 (5 years) 36.80; 1961-65 (5 years) 50.40; 1966-69 (4 years) 67.75.

Source: Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts 1944-1958, Crop Reporting Board, USDA. 1944-1958 Noncitrus Fruit Prices by States and United States 1959-1969, Crop Reporting Board, SRS, USDA.

Table 15. Value of Purple Plum Production by State and U.S. 1944-1969.

Crop year	Michigan	Idaho	Washington	Oregon	U.S.
		---000's of dollars---			
1944	585	2,237	2,453	4,458	9,733
1945	238	2,402	2,270	6,202	11,112
1946	570	2,527	2,647	7,458	13,202
1947	551	2,487	2,077	2,424	7,539
1948	389	1,249	1,054	2,586	5,278
1949	397	935	627	3,241	5,200
1950	584	1,150	1,537	2,342	5,613
1951	511	1,528	1,105	3,878	7,022
1952	584	1,532	1,423	3,563	7,102
1953	648	1,421	1,792	3,081	6,942
1954	603	1,867	1,948	2,597	7,015
1955	500	1,204	1,726	3,488	6,918
1956	529	2,932	2,086	2,915	8,462
1957	566	2,332	2,112	1,644	6,654
1958	662	2,407	2,295	1,915	7,279
1959	676	1,968	2,492	2,930	8,066
1960	1,080	2,173	2,123	652	6,028
1961	918	2,480	2,914	2,729	9,041
1962	840	1,411	2,195	2,944	7,390
1963	1,208	2,052	2,153	876	6,269
1964	945	896	2,290	1,891	6,022
1965	1,147	1,895	1,816	2,279	7,137
1966	1,196	1,725	3,100	1,700	7,721
1967	1,395	2,102	1,695	2,766	7,958
1968	1,391	829	1,725	1,914	5,859
1969	1,174	1,942	3,835	2,030	8,981

Source: Fruits Noncitrus by States; Production, Use, Value: Annual Reports.

a good quality preserving plum (the Stanley), market proximity, and mechanical harvesting equipment available for cherries. These factors also help explain Michigan's increase in market share and point out that Michigan enjoys a comparative advantage in purple plum production.

The value of total U.S. purple plum production has generally followed production (Figure 5). The value of production has fluctuated with the absolute volume more closely in recent years. This may be explained by the fact that total production has decreased since 1947 while the total value has remained steady or gained.

Market Location

Specifying the location of the purple plum market is not possible with the data available. Most of the information on purple plum markets has been recorded under the title of prunes or just plain plums. None of the industry sources in Michigan have reported exporting canned products, although they have indicated selling some fresh plums to Canada. Substantial quantities of prunes are exported but, as indicated earlier, most of the prune production is in California and Oregon and has very little effect on the purple plum situation.

In the domestic market, Michigan industry sources report sales in the Midwest and Eastern parts of the U.S., with few sales in the South and West. Without regional sales data, it is difficult to support these reports. However, since the major population centers are in the above

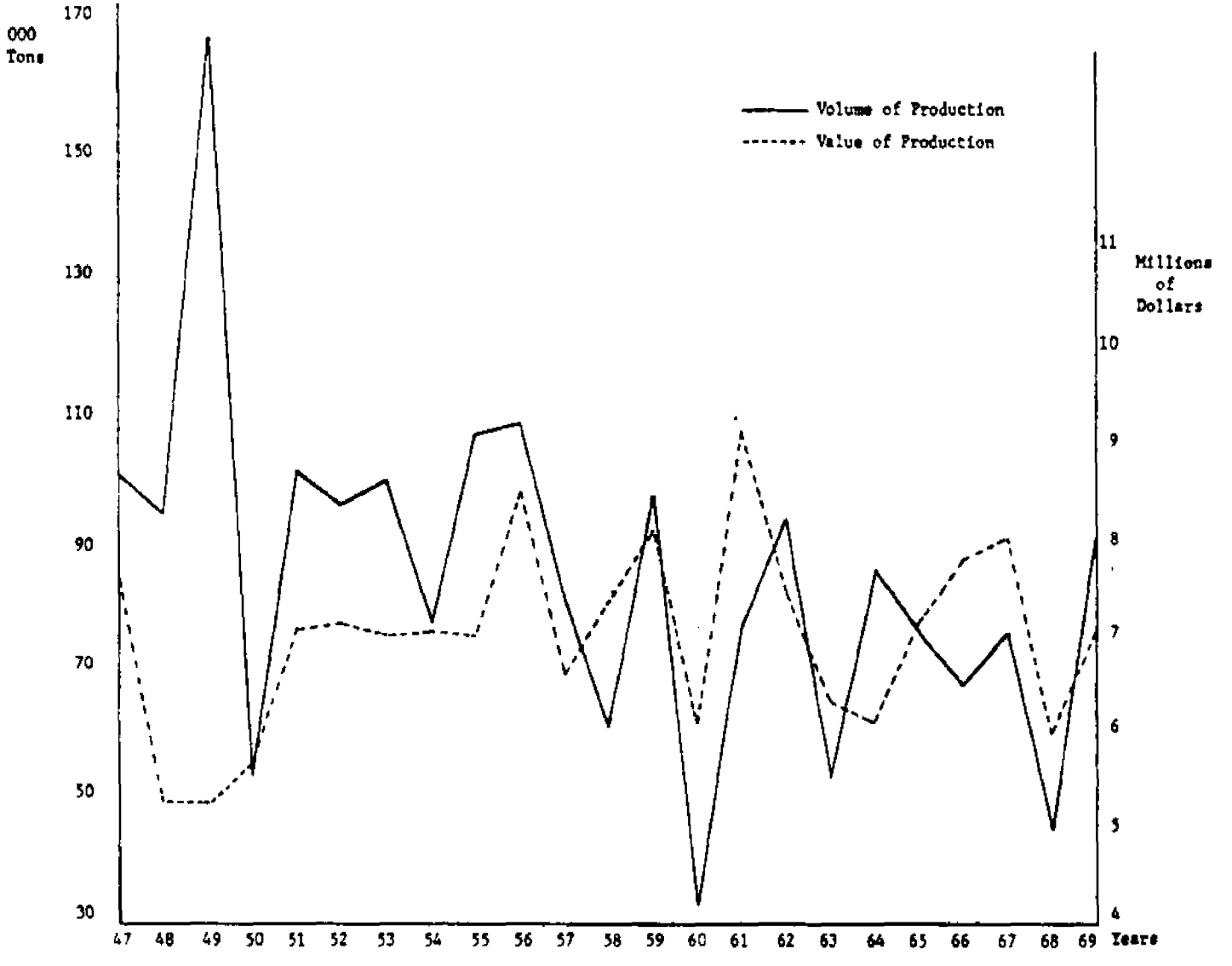

Figure 5. Total U.S. Production of Purple Plums (Michigan, Oregon, Washington, Idaho) 1947-1969 and Value of U.S. Production of Purple Plums.

regions, these reports sound reasonable. The best markets for canned whole plums and fresh plums are reported to be the Jewish communities of the east.

Unfortunately, purple plums have not been included in regional consumption surveys. Canned purple plums are included under the title "Plums." Consumption of fresh plums and prunes, prune juice and dried prunes has decreased while consumption of canned plums and prunes remained relatively steady (Table 16). These consumption figures include prunes and soft-fleshed plums. In an attempt to estimate the total disappearance of purple plums only, the total annual purple plum per capita disappearance was computed (Table 17). In the case of canned plums, the annual quantity consumed or disappearing each year includes any change in carryin stocks. When computed in this manner fresh consumption has decreased since the late 1940's but leveled off in the late 1960's, while canned and frozen consumption has remained relatively steady.

Regional consumption data, if available, would allow plum promotional programs to be more specific according to the requirements of each consuming region.

Production Projection

Michigan and Northwestern purple plum growers are interested in future production estimates because of the direct relationship between supply, prices and returns. As previously related, Michigan's production has become a larger part of total production. Until 1962, Michigan averaged

Table 16. U.S. Per Capita Consumption of Plums, Prunes and Prune Products 1930-1969.

Year	Fresh plums and prunes	Canned plums and prunes	Prune juice	Dried prunes
		---lbs---		
1930	3.8	.3		1.9
1931	2.8	.3		1.6
1932	2.8	.2		1.7
1933	2.3	.4		1.5
1934	2.9	.4	.01	1.6
1935	2.5	.6	.02	2.2
1936	2.7	.7	.04	1.8
1937	2.6	.6	.18	2.2
1938	2.7	.5	.20	1.6
1939	2.7	.6	.07	2.1
1940	2.5	.5	.06	2.0
1941	2.4	.6	.06	1.6
1942	2.4	.6	.43	1.3
1943	2.2	.6	.46	2.1
1944	2.7	.5	.57	1.6
1945	2.3	.7	.89	2.0
1946	2.7	.7	.90	1.4
1947	2.3	.6	.75	.9
1948	2.1	.5	.74	.8
1949	2.3	.5	.80	1.0
1950	1.7	.4	.93	1.06
1951	2.2	.3	.78	.81
1952	1.7	.4	.87	.96
1953	2.0	.5	.94	.84
1954	1.4	.4	.97	.95
1955	1.7	.5	1.01	.71
1956	1.9	.5	1.26	.82
1957	1.5	.5	1.21	.87
1958	1.1	.4	1.05	.66
1959	1.6	.3	.87	.71
1960	1.2	.3	1.06	.62
1961	1.3	.2	1.05	.62
1962	1.3	.4	1.06	.68
1963	1.3	.3	1.11	.58
1964	1.6	.3	1.11	.66
1965	1.4	.3	1.16	.59
1966	1.2	.4	1.10	.54
1967	1.3	.4	1.09	.56
1968	1.2	.3	.75	.66
1969	1.0*	.3	.73	.50

*Preliminary

Source: Fruit Situation, Economic Research Service, USDA, September, 1970.

Table 17. U.S. Per Capita Purple Plum Production--Fresh and Processed 1947-1969

Year	Fresh	Canned and frozen
	---lbs---	
1947	.853	.355
1948	.739	.208
1949	.766	.481
1950	.360	.237
1951	.526	.481
1952	.642	.353
1953	.639	.323
1954	.366	.400
1955	.619	.375
1956	.536	.430
1957	.481	.217
1958	.404	.212
1959	.517	.307
1960	.249	.081
1961	.389	.293
1962	.389	.381
1963	.304	.212
1964	.364	.294
1965	.355	.311
1966	.317	.256
1967	.321	.321
1968	.231	.157
1969	.375	.423

Source: Col. 1--Total U.S. fresh production as reported in Table 6 expressed on a per capita basis using U.S. population as reported in Table 32.

Col. 2--Total canned and frozen production as reported in Tables 7 and 10 expressed on a per capita basis using U.S. population as reported in Table 32.

between 250,000 and 300,000 bearing trees, but since then has quickly increased to reach 600,000 in 1969 (Figure 6). This increase will continue, possibly reaching a peak of 680,000 in 1973 (Table 18). As plum trees do not bear for at least the first three years after planting and do not reach full production until approximately twelve years,[2] total plum production did not double between 1962 and 1969 but increased by 80 percent as illustrated in Figure 7.

Weather conditions, such as spring frosts and poor pollination weather, are important factors in U.S. plum production. This factor has been responsible for much of Oregon's variation in production. Idaho and Washington seem less susceptible to erratic weather conditions while Michigan, with the most uniform production, exhibits a definite resistance to production variations caused by weather (Figure 7). Michigan's production has experienced minor changes from year to year but the trend has been up. In 1970, Michigan weather conditions for purple plums were judged as being extremely unfavorable yet plum production for the state was approximately 10,000 tons. While this production is the least during the last five years, it is near the top of all previous years.

Projected Production 1971-1975.

In order to handle the increase in supply, it is necessary to know as much about the magnitude of the problem

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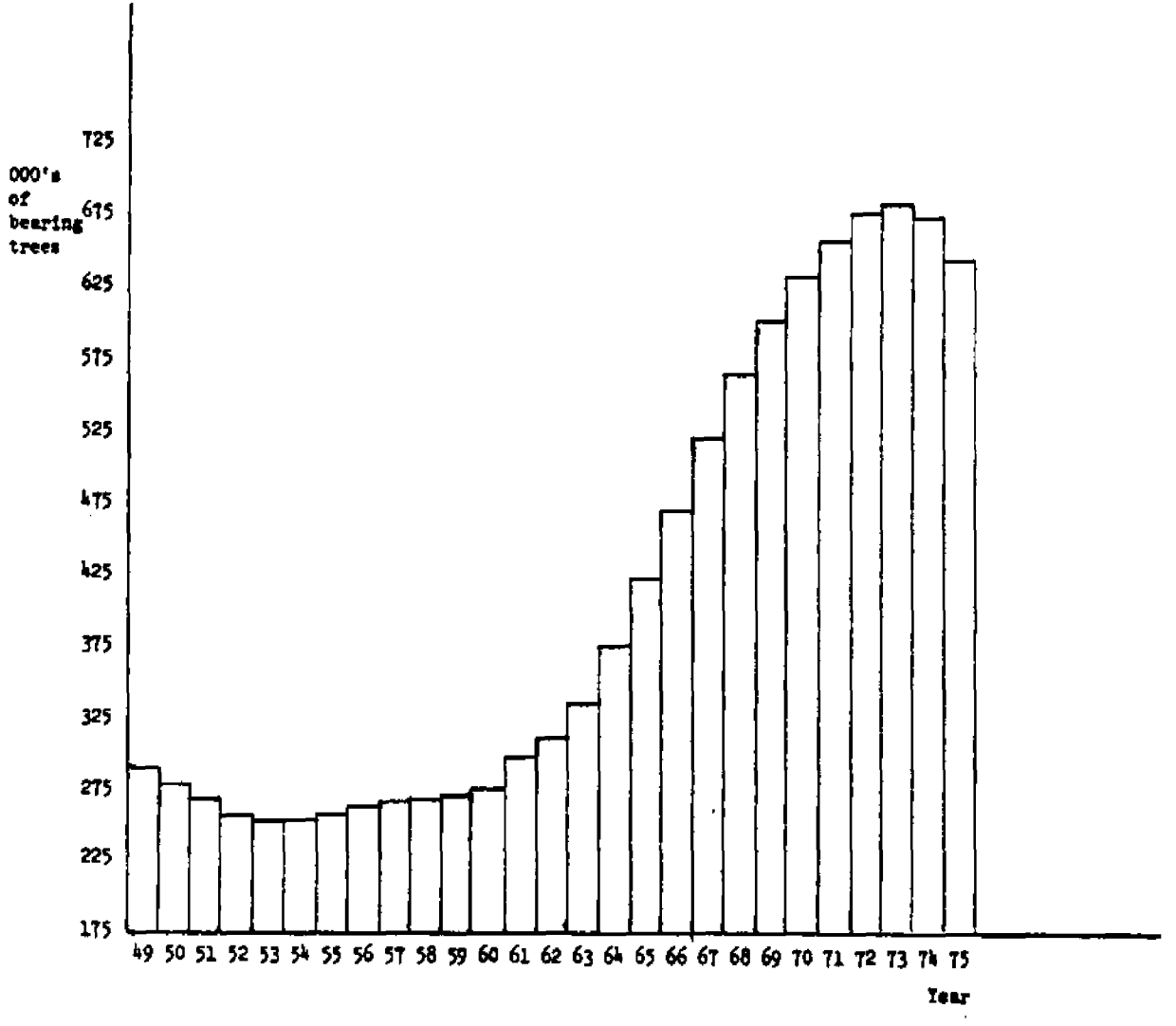
[2]D. J. Ricks, R. P. Larsen, and R. G. Wheeler, Inputs and Relative Yields for Young Orchards, Cooperative Extension Service, Fact Sheet for Michigan Agriculture, January 1961.



Source: Table 18

Figure 6. Historical and Projected Bearing Plum Trees in Michigan 1949-1975.

Table 18. Michigan Purple Plum Bearing Trees, Yearly Plantings, Production, and Estimated Production, 1945-1975.

Crop year	1 New plantings No. of trees[a]	2 Bearing Trees No. of trees	3 Change in No. Bearing Trees No. of trees	4 Actual Production Tons	5 Projected Production Tons A	5 Projected Production Tons B
1945	9,357	267,000		1,700	---	
1946	9,357	280,000	13,000	6,000	---	
1947	9,357	284,000	4,000	5,200	---	
1948	9,357	284,000	---	4,800	---	
1949	9,357	287,000	-6,000	7,500	---	
1950	11,936	277,000	-1,000	6,500	---	
1951	11,936	269,000	-8,000	4,600	---	
1952	11,936	256,000	-13,000	7,500	---	
1953	11,936	254,000	-2,000	6,700	---	
1954	11,936	254,000	---	6,300	---	
1955	24,505	256,000	2,000	5,200	---	
1956	24,505	258,000	2,000	4,900	---	
1957	24,505	260,000	2,000	7,300	---	
1958	24,505	263,000	3,000	7,800	---	
1959	24,505	265,000	2,000	6,800	---	
1960	50,169	275,000	10,000	8,000	---	
1961	50,169	295,000	20,000	9,000	---	
1962	50,169	310,000	15,000	8,000	---	
1963	111,870	335,000	25,000	10,500	---	
1964	111,870	375,000	40,000	14,500	---	
1965	79,742	420,000	45,000	11,500	---	
1966	79,742	470,000	50,000	13,000	---	

1967	53,144	520,000	50,000	15,000	---	
1968	40,000[b]	565,000	45,000	13,000	---	
1969	40,000[b]	600,000	35,000	14,500	---	
1970	40,000[b]	630,000[c]	30,000	10,000[e]	---	
1971	40,000[b]	655,000[c]	25,000	---	21,109	24,201
1972	---	675,000[c]	20,000	---	21,749	27,974
1973	---	680,000[c]	5,000	---	21,906	31,757
1974	---	674,000[d]	-6,000	---	21,713	35,666
1975	---	668,000[d]	-6,000	---	21,519	39,063

[a]Tree plantings were reported for a group of years and have been reported here as being planted in equal numbers for each of the years involved.

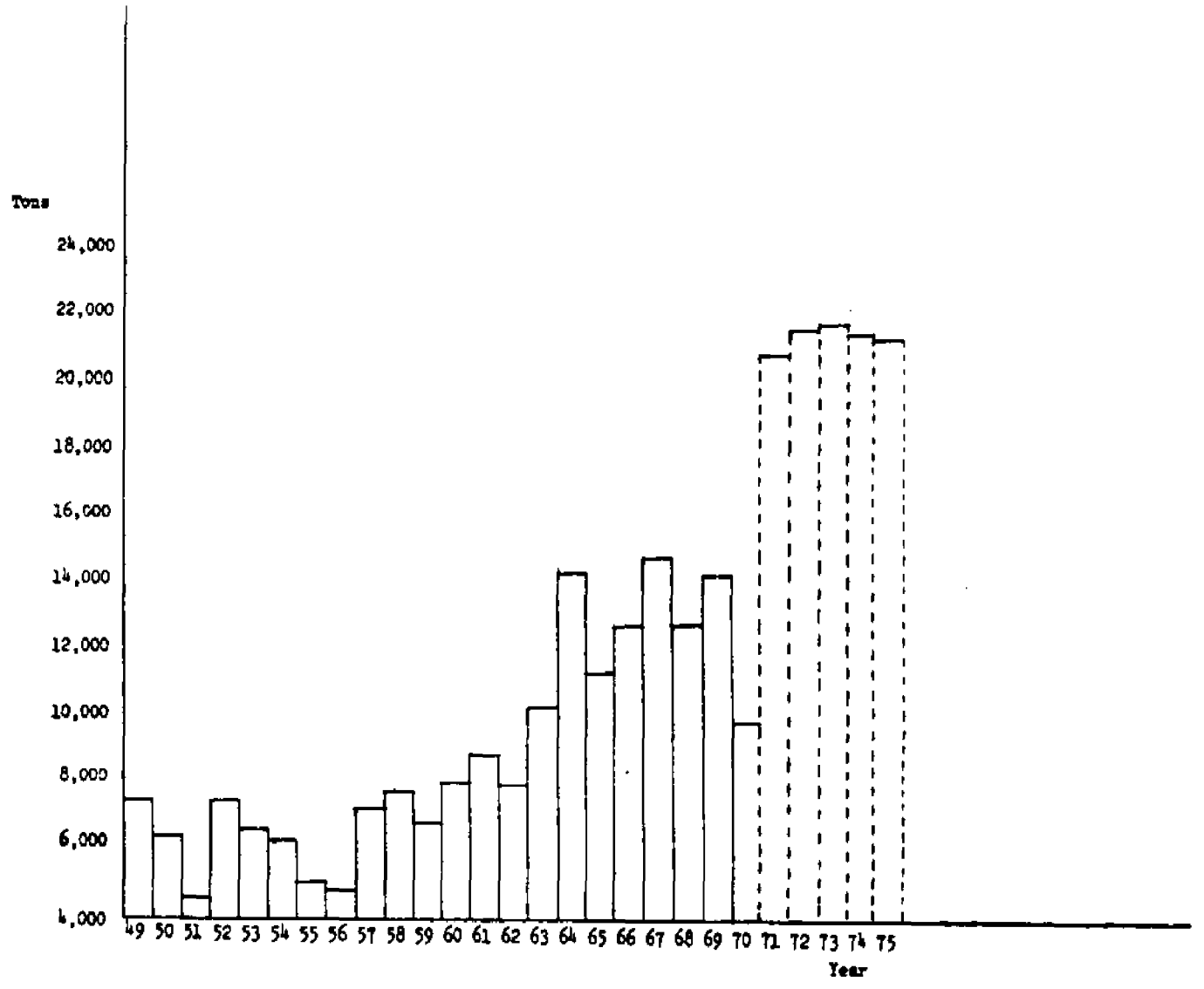
[b]Rough industry estimates of new plantings.

[c]Estimates based on plantings actually reported up to 1967. According to earlier plantings, newly planted trees appear as bearing trees approximately five years later.

[d]These values use the estimates in column one as reported by Footnote b.

[e]1970 was a short crop year due to weather conditions.

Source: Col. 1 Michigan Crop Reporting Service: "1968 Fruit Free Survey," April, 1969.
Col. 2 Michigan Crop Reporting Service: Michigan Agricultural Statistics 1970.
Col. 3 Absolute annual change in column 2.
Col. 4 Fruits Noncitrus by States; Production, Use, Value: Annual Reports.
Col. 5 Estimates using alternatives A and B respectively as described in the text.



Source: Table 18, Column 4

Figure 7. Actual and Projected Purple Plum Production (Michigan 1949-1975).

as possible. To achieve this, two approaches are used to estimate the supply for the years 1971-1975. These alternative estimation procedures are explained in this section with the necessary assumptions.

Assumptions are necessary for such variables as weather, disease, tree removal and green drop. Weather extremes are generally excluded, although a production estimate based on historical supply usually includes a weather factor. A similar situation exists with disease problems such as a heavy infestation of the Black Knot disease. Here the use of historical data is assumed to include the effects of disease. Supply projection further assumes that neither a tree removal nor a green drop program occurs in the projected period. Both of these are justified on the ground that tree removal now, results in the loss of growers' investments and a green drop program usually requires an organized supply management program which, at present, is non-existent.

Alternative A

Using reported new tree plantings which were available until 1967, the number of bearing trees was estimated on an annual basis (Table 18). The annual increase in the number of bearing trees was assumed to follow a pattern as evidenced by the period 1960-1969. For the period 1968-1971, new plantings were estimated at 40,000 per year. This is based on rough industry estimates as no factual counts are available.

This planting level is sufficient to maintain 600,000 bearing trees if new trees have a five year non-bearing period and a tree life of 20 years. This assumes that 200,000 non-bearing trees are needed to maintain 600,000 bearing trees. Estimates of annual tree plantings after 1971 become nearly impossible, because the expected increase in production with the anticipated low prices may cause growers to reconsider their planting program. This will be even more true if growers are made aware of the fact that supply is expected to increase and likely to be accompanied by low prices.

After estimating the number of bearing trees per year, 1964 was selected as a base year when 375,000 bearing trees were recorded. An index was created by expressing the number of bearing trees in each year as a percent of those bearing in 1964. This index was multiplied by the average annual production for the period 1962-1967, which was 12,083 tons, yielding the estimated annual production as shown in column 5, part A of Table 18.[3] An average production value was used to allow for some weather variation and an increase in production as the trees mature.

Alternative B

Alternative B uses a maturity scale which indicates the expected percent of mature yield per acre in each year

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[3]An example of alternative A is the year 1972. To obtain the estimate, take the number of bearing trees from column 2 which is 675,000 and express it as a percent of the number of trees in 1964 which is 375,000. The percentage is

after planting.[4] For example, a four year old plum tree can be expected to yield 10 percent of its fully mature potential. This maturity scale is used assuming a mature production level of 6 tons per acre.[5] At 60 pounds per bushel, 6 tons represents 200 bushels per acre which, according to many growers, is exceeded by good mature orchards. Six tons per acre is above the State average yield per acre but represents production for a mature orchard. An earlier study used a yield of 7.5 tons per acre for an above average producer.[6] While most new orchards have slightly more trees, 98 trees per acre were used to convert number of bearing trees to number of bearing acres. This value is arrived at by averaging the number of bearing trees reported with the number of bearing acres for the period 1965-1969.[7]

$\frac{675,000}{375,000} = 1.8$. Then take this index and multiply it by the average production for the years 1962-1967 as follows: 1.8 x 12,083 = 21749 tons. This is the estimated production. Other years may be determined in a similar fashion.

[4]D. J. Ricks, R. P. Larsen, and R. G. Wheeler, Inputs and Relative Yields for Young Orchards, Cooperative Extension Service, Fact Sheet for Michigan Agriculture, January, 1961.

[5]A mature yield of 6 tons was used after talking with growers and extension people. The reference listed in the preceding footnote suggests a 7 ton per acre yield for high standard mature trees. The 6 ton value may be more reliable for all mature trees and if a bit low it may compensate somewhat for unrecorded tree removals.

[6]Stephen Harsh, Myron P. Kelsey, and Glen Antle, Economics of Plum Production in Western Michigan, Agricultural Economics Report No. 162, Department of Agricultural Economics, Michigan State University, May 1970, pp. 10.

[7]Michigan Agricultural Statistics, Michigan Department of Agriculture, July 1970, pp. 22.

A twenty year period was used to estimate each years' production.[8] Trees twelve years or older were assumed to be fully mature bearing at the rate of 6 tons per acre. As each new year was added, the twenty year old trees were dropped. In some cases, orchards last longer than twenty years but horticultural sources indicate that twenty years is an average life span.

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[8]An example using alternative B for the year 1972.

Year or Years	No. of Trees from column 1 Table 18	No. of Acres (No. of trees/98)	Maturity level (percent)	Tons per acre	Estimated Production Col 2 x Col 4
1952-1960	158,333	$\frac{158,333}{98}$=1616	100	6.0	7696
1961	50,169	$\frac{50,169}{98}$=	95	5.7	
1962	50,169	$\frac{50,169}{98}$=	90	5.4	
1963	111,870	$\frac{111,870}{98}$=	75	4.5	
1964	111,870	$\frac{111,870}{98}$=	60	3.6	
1965	79,742	$\frac{79,742}{98}$=	50	3.0	
1966	79,742	$\frac{79,742}{98}$=	30	1.8	
1967	53,144	$\frac{53,144}{98}$=	20	1.2	
1968	40,000	$\frac{40,000}{98}$=	10	.6	
1969	40,000	$\frac{40,000}{98}$=	0	0	
1970	40,000	$\frac{40,000}{98}$=	0	0	
1971	40,000	$\frac{40,000}{98}$=	0	0	

Estimates from the two alternatives differ only slightly for 1971 but by 1975 alternative B suggests a yield which is almost double that predicted by alternative A (Table 18). This difference can be explained by the fact that B gives more weight to the maturity of the trees. Alternative A used an average period in which the trees are assumed to be uniformly distributed between new and old trees. With the heavy plantings in the short period of four years, such an assumption will not be valid. When the 400,000 trees reach maturity, over two-thirds of the trees will be at a mature bearing age, whereas during the period 1962-1967 there were only about one-third fully mature. Although alternative A ignores the big plantings in a short period it does provide a conservative estimate that may occur if the big plantings don't come to full maturity because of disease or removal.

These results indicate that Michigan's future purple plum production can range from a low of 21,000 tons to a high of 39,000 tons during the 1972-75 period.

An important factor that could affect the Michigan supply is the type of rootstock used. Plum trees are usually grown on myroblin plum or peach rootstocks. Some growers prefer peach rootstock because trees bear earlier and heavier on a peach base. Myroblin supporters point out that plum trees on peach stock do not last nearly as long, possibly only as long as ten good bearing years. Results from different rootstocks appear to depend on location, in many cases, with myroblin standing out as the long term stock. Unfortunately, statistics indicating which rootstock was used for

the heavy plantings of the early 1960's are not available. If they were predominately peach stock, the total life of these orchards may be shorter than anticipated. This would mean that a bigger supply might materialize in the short run but not be as long lasting. If market demand is expanded on the basis that a big supply will be available for a long period of time, then a shorter tree life could prove very costly to the industry. After spending money and time to develop the market channels and expand demand, a supply less than that needed to meet demand would mean unfulfilled orders and a loss of consumer interest. As the supply increases and the market is expanded, attention should be directed to maintaining the desired supply level. This will require accurate planting statistics, including types of rootstock used.

Since Michigan is only part of the total purple plum subsector, it is necessary to estimate production in the Northwestern states. Assuming that 25 percent non-bearing trees are needed to maintain a constant bearing acreage in the Northwest, available data indicates that Washington and Oregon can be expected to increase their bearing tree numbers by 14 and 25 percent respectively, with Idaho's bearing acreage remaining relatively stable (Table 19). This increase in bearing acreage was reported in the 1964 census and will reach full maturity between 1973 and 1976 assuming, as in Michigan, a twelve year growth period to full maturity.

As was the case with future production in Michigan, two ways were used to arrive at an estimated annual yield. The first approach is to use production figures in the

1962-1967 period to arrive at an average value and increase this value by 25 percent for Oregon and 14 percent for Washington.

Table 19. Plum Tree Numbers, Northwestern States

		Oregon	Washington	Idaho
		--- 000's of trees ---		
Bearing Trees	1954	1,290	435	299
	1959	1,026	276	296
	1964	801	339	363
Non-bearing Trees	1954	123	30	63
	1959	255	95	87
	1964	394	133	89
Non-bearing Trees as percentage of Bearing Trees	1954	10	6	21
	1959	25	24	29
	1964	49	39	24

Source: U.S. Department of Agriculture, Crop Reporting Board.

This will result in a uniform value for each year since individual annual plantings are not available. An alternative method is to assume that those non-bearing trees reported in 1964 were evenly planted over the previous five years then use the maturity scale worked out for Michigan, to approximate annual production. But Michigan's maturity scale is not completely applicable to the Northwest. By using the former method a conservative production estimate becomes available.

Using this conservative method described above, Idaho's production should remain close to the six year average of 17,950 tons while Washington increases to approximately 19,836 tons and Oregon to approximately 33,082 tons. Their total projected production is estimated to be 70,871 tons compared with the six year average for 1962-1967 or 61,816 tons.

Total U.S. production in the 1970's, according to the above estimates, will be in the range of 88,850-92,777 tons with Michigan accounting for approximately 24 percent. Marketing this supply will be a challenge for the total U.S. purple plum industry and particularly for Michigan where much of the increase in production is expected to occur.

Summary

This chapter reveals a number of facts necessary for market planning in the 1970's. It shows that approximately 400,000 trees were planted in the four year span of 1963-1966. Because of the delay between planting and full maturity, these trees will just be entering full production in the early 1970's. Given their existence and level of maturity, they will provide Michigan with at least twice and maybe four times as many plums as in 1970. When this quantity is added to that expected from the Northwest states, the total U.S. supply will be double that of 1970 and 23 percent above the average production for the last fifteen years. With most of the increase in production within this state, Michigan could become the largest purple plum producing state. As a result, most of the adaptation to increased supplies will have to come from Michigan.

CHAPTER IV

PRODUCTION PROBLEMS AND COSTS OF GROWING PLUMS IN MICHIGAN

Introduction

This chapter discusses current cultural problems and costs affecting the economic position of Michigan purple plum growers.

Production Problems

Plums, as with all fruit, are dependent upon such weather conditions as late spring frosts which kill the flower buds, cold and damp weather that retards pollination, or high winds and rain just prior to harvest that may result in crop failure. With the exception of 1970, Michigan's plums have managed to survive most of the weather conditions. According to growers, plums have an advantage over some fruit crops in that they can withstand cooler temperatures and damper soils. Recent plantings have tended to be on good fruit locations of light soil, even temperature, and a frost free elevation. As a minor enterprise, plums had often been poorly located on land left over from other fruits. Yields may increase as a result of this change in planting location.

A major disease which threatens plum trees is Black Knot, a growth which often girdles the limb, causing the external part of the branch to die. If left uncontrolled it spreads quickly within the orchard and to nearby orchards. Some growers have had good success in controlling this disease by using lime sulfer early in the season, although the presence of mites may prevent use of this method. Pruning of infected areas plus the use of Zineb has worked for some growers. Very few growers report having no Black Knot.

According to growers, if the Black Knot disease were to go unchecked it could force the removal of some orchards or at least reduce their output. This possibility will become more important when supplies increase putting pressure on prices. As growers try to reduce costs, many may stop their Black Knot treatment. The result may be a drop in supply similar to what might occur if a supply management program were instituted. While an epidemic of Black Knot may serve as a means of limiting supply, it is irreversible in that heavily infected orchards must usually be removed. To help overcome this disease, growers say they require a better chemical than currently exists.

Brown rot was mentioned as a very serious problem encountered by growers. This disease is not peculiar to plums alone.[1] It is prevalent among most stone fruits. It may reduce fruit set, kill or blight twigs or destroy

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[1] How to Recognize and Control Brown Pot of Stone Fruits, Extension Folder F-262, Michigan State University, Cooperative Extension Service.

the crop prior to harvest. This disease attacks the plum fruit by causing it to rot while the fruit is on the tree, in transit or in the market. Brown rot spreads very quickly under warm moist conditions. Infection is most likely to occur during bloom or just prior to harvest. Blossom and before harvest sprays are recommended control procedures. Unfortunately none of the chemicals currently in use guarantee complete control. As a result this disease threatens Michigan's entire fresh plum industry.

Brown rot, by causing the fruit to rot, reduces the quality of the plum for processing and for the fresh market. Even if plums appear not to be infected at the packer level, they may start rotting on the retail counter or shortly after a consumer buys them. If consumers are exposed to infected fruit they may not buy plums again or possibly reduce their future purchases. If the retailer has to destroy plums because they start rotting, he may discontinue selling Michigan plums. As more plums become available fresh packers will be attempting to expand the fresh market season through storage. If the plums have brown rot disease present, they will rot in storage causing a production and storage loss to growers. In addition, if consumer demand for fresh plums is to be expanded, occurrences of brown rot at the consumer level should be avoided if at all possible. Several chemicals are used to treat plums in an effort to impede the development of the brown rot spores. This treatment is not totally effective and is expensive. Development of a better chemical to control brown rot is very important to the purple plum industry.

Stanley purple plums have a problem with fruit dropping early in the season. This is apparently caused by the ova dieing. While this is not serious in years of a big supply or in areas where growers want larger plums, it is a problem for short supply seasons and southwestern growers who usually have adequate plum size. Some growers are interested in looking for a material that would prevent the fruit from dropping even if the ova aborts. In light of the oncoming supply, this problem has a low priority.

Peach borer is a minor problem for most plum growers. Growers may control it by proper spraying of Thiodan. This chemical is costly and growers are interested in a cheaper chemical.

Stanley and Blufre plums require a pollenizing variety. If all Stanley's or all Blufre are planted in a block, they may pollinate themselves, however, best results will occur if these two varieties are mixed or if some other pollinating variety is included.[2] The disadvantage of having to use a pollinator is that two varieties of plums are in the same block. Both varieties are usually not ripe at the same time nor can they be marketed together. Blufre are not very good for processing and ripen about one week after the Stanley. If other varieties of plums are used there is usually very little demand for the fruit. In addition to having a poor market, pollinators require valuable orchard space and reduce mechanical harvesting efficiency. Improved varieties or strains might remove this problem.

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[2] Hilltop Orchards and Nurseries Catalog for Commercial Orchardists, Hilltop Orchards and Nurseries, Inc.

Plum size is a problem for most Michigan growers. Fresh growers in particular require a good sized plum if they are to compete with Northwestern plums. Northern Michigan growers have difficulty some years in attaining the minimum size accepted by processors. Some growers have attempted thinning their plums using the mechanical shakers that are later used for harvest. The problem with this method is that when plums are shook they do not fall until several days later making it difficult to know whether sufficient plums have been dropped. A chemical thinner has not yet been developed, but a chemical of this nature is being developed for other fruits and may eventually be of use to the plum industry. Size may be improved through irrigation and fertilization. Michigan growers do not usually irrigate, but have been fertilizing to improve size. It is not known at this time whether irrigation in Michigan would pay. Pruning will reduce the number of plums but should increase the average size making the crop more acceptable on the fresh market. The possibility of adopting practices to improve size becomes important as one of the possible activities to expand the demand for fresh plums.

Technology

Plum technology, with the exception of harvesting, has remained relatively unchanged. Since plum growing activities are similar to those of many other fruits, new technology adopted in other areas is often transferred to plums directly. For example, spraying and pruning equipment is usually directly transferable.

Technological advancement in plum harvesting is a by-product of a development in tart cherry harvesting. Many plum growers have access to a mechanical harvester of either the limb or trunk type. As a result, a large percentage of plums sold directly for processing in Michigan are mechanically harvested, and a small but growing percent of plums for the fresh market are mechanically harvested. This mechanical harvesting has increased the limb and trash content that must be removed before the plums can be used. Some growers have indicated that mechanical harvesting may be removing too many spurs, thus decreasing future production. Both problems may diminish as growers become more experienced at shaking trees, and orchards are mechanically harvested on a continual basis. Growers and extension people believe that for the first two or three years of mechanical harvesting, old branches and spurs not removed during pruning will have accumulated and drop during mechanical harvesting.

Successful mechanical harvesting of fresh market plums is more difficult than harvesting plums for processing. Less severe shaking, stronger trash blowers and more labor are required in fresh mechanical harvesting. Consumers will not buy bruised or marked fresh plums. Because they are such a tender fruit, plums may be bruised when they land on each other or when they strike limbs during harvest and from their own weight while in storage. Better trash removal reduces the chance of spurs or twigs damaging the plum surface in storage and in transit to packers. Extra labor is needed to

remove the plums from the harvester before they pile up and crush one another. The shakers now in use, unless cautiously run, cause most of the plums to drop at one shake. This may cause bruising as they fall on each other. Additional research appears necessary to improve the mechanical harvester for fresh harvesting.

Because mechanical harvesting usually makes possible lower container, transport and storage costs than are usually encountered in hand picking, it is particularly important that an improved mechanical harvester be developed. In addition to lowering these three costs an improved harvester may cut back the grading costs which have been higher for mechanically picked plums than for hand picked plums. These savings possibilities will encourage further improvements, however, a producer supported research effort might lead to speedier results.

Development of a mechanical harvester to satisfactorily harvest plums for the fresh market may be aided by the development of a chemical that will retard plum dropping. At present Michigan State horticultural department has such a chemical but cost makes its use prohibitive. Once an economically priced chemical becomes available, mechanical harvester use may become even more widespread.

Unfortunately, fresh and process-type plums are not usually ready to harvest at the same time or it might be efficient to harvest them all together and sort out the large, firm, unmarked plums for the fresh market. Fresh plums are picked at a lower level of maturity to ensure a longer storage

and shelf life. Besides, most processors want plums to be fairly ripe before they are picked for canning.

Michigan Costs

Investment in new plum trees usually occurs when the grower feels that the returns from such an investment will at least equal the returns from the next best opportunity. Once a grower has committed himself to growing plums, he incurs some fixed costs. For example, the trees are a cost once the grower buys them. As a result, if a grower can obtain any return to his fixed costs, he will continue to grow plums. A low or negative salvage value is a characteristic of most tree fruit crops and accounts for some of the reluctance of growers to stop producing a fruit when returns do not cover total costs. Hence in the short run, most growers try to at least cover the variable costs.

Cost data is important information necessary to explain grower response to falling prices. Growers may continue to produce, not only when returns do not cover total costs, but even when they are not covering current variable costs because of the negative salvage value of their orchards or an expectation of better prices in the future. If returns were to fall below variable costs and growers continued their production, emphasis would have to be placed on the future expectations concerning the market and returns. Growers may expect the demand for plums to increase and/or other growers to go out of business. Both of these expectations may keep

growers in the plum business longer than returns warrant. Grower expectations are difficult to determine and almost impossible to quantify. However, costs in relation to prices received will influence grower behavior.

Estimated production costs for the Michigan purple plum industry have been provided in a recent M.S.U. publication.[3] Several tables have been reproduced here from that publication showing variable growing costs, variable harvest costs, and the effect of varying yields on costs per harvested bushel. The cost data referred to in this section were collected from producers attending special meetings for this purpose. As a result, these costs may reflect lower than average plum production costs.

In compiling these costs per bushel, an average yield of 250 bushels or 7.5 tons per acre was assumed. This yield is above the average recorded yield per acre for Michigan and may indicate that the growers present at these meetings were above average. If this is the case, the costs may be low and the yield higher than that experienced by many Michigan growers. Since costs will differ from grower to grower, and according to orchard maturity, a set of costs such as these will only serve as an indication of the actual cost situation and should not be considered as completely representative of all growers.

Growers reported in 1970 that the total cost of producing 7.5 tons of purple plums was approximately $60.00 per ton.

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[3]Stephen B. Harsh, Myron P. Kelsey, and Glen Antle, Economics of Plum Production in Western Michigan, Agricultural Economics Report No. 162, Michigan State University, May 1970.

This total cost includes a $40.00 variable and $20.00 fixed cost (Table 20). With these costs, growers would require at least $60.00 per ton or 3 cents per pound to at least meet all costs.

Prices received by growers in Michigan have been below $60.00 per ton for processed plums for only four years since 1944 and in only one year for fresh plums (Table 14). This indicates that these Michigan growers experiencing the yield and costs mentioned above have received a profit in most years. In the short run, prices as low as $40.00 per ton would allow them to cover variable costs.

If these are above average growers, they may not represent the situation experienced by many growers. Consider a grower with a yield of only 4.5 tons per acre or approximately 150 bushels. Under these conditions the estimated total cost rose to $83.00 per ton of which approximately $50.00 was variable. Since 1964, the price received for plums sold to processors has been lower than $83,000 per ton, except for 1968 when yields were very low in the U.S. This means that these growers have not been covering total costs. In 1964, they barely covered their variable costs when the price for processing plums dropped to $50.00 per ton.

These growers not covering total costs may be expecting their position to change, either with a yield or price increase, or they may have no alternative available for their resources that would return them more than they are now receiving. If the latter is the case, they are more or less trapped in their situation. If they want to make a change to

Table 20. Effect of Varying Yields on Costs Per Harvested Bushel for Plums, Western Michigan 1970.

Harvest yield per acre	Variable growing	Variable harvest*	Total Variable growing & harvesting	Fixed growing & harvesting	Total growing & harvesting
150 bu.	$.72	$0.76	$1.48	$1.04	$2.52
200 bu.	.54	0.76	1.30	0.78	2.02
250 bu.	.43	0.76	1.19	0.63	1.82
300 bu.	.36	0.76	1.12	0.53	1.64
350 bu.	.32	0.76	1.08	0.45	1.53

*The variable cost per bushel is assumed for study purposes to be constant for different yields. However, in reality, the cost per bushel will most likely increase somewhat for yields less than 250 bushels per acre and decrease somewhat for yields over 250 bushels per acre.

Source: Stephen B. Harsh, Myron P. Kelsey, and Glen Antle, Economics of Plum Production in Western Michigan, Agricultural Economics Report No. 162, Michigan State University, May 1970.

some other crop, there is a cost for removing the trees and starting up a new crop, with no assurance that the other crop will have higher returns. In their present situation, they at least cover some of their fixed costs and can hope for a year when prices will once more exceed total costs.

When growers are unsure of the returns from plums a drop in new plantings would be expected. If a grower did not expect to cover total cost and make some profit, he would not likely plant new trees. This should eventually remove the less efficient producers as they would likely discontinue planting first.

Grower decisions on planting and removing trees depends upon market conditions at the time of the decision. When a grower has fruit land available for planting, he considers the alternatives available and the returns to each. He bases his decision on the market conditions prevailing at that time. If total costs are covered and the profit is above that available from the next best opportunity, then he will plant plums. Later, if market conditions change, the grower will make a new decision. If he expects prices to increase he may try to reduce variable costs or not harvest for a season, but if he expects prices to be low for some time, he may consider removing the orchard. His removal decision will depend upon whether he expects returns over the remaining life of the orchard to be below variable costs including the cost of orchard removal.

Industry response to a price reduction often takes the form, as suggested above, of cost reduction. In plums,

one method of reducing costs is to reduce cultural practices (Table 21). By not trimming, removing brush or spraying herbicides, growers may save as much as $40.00 per acre or $5.35 per ton. Of course, such action may lower yields. If yield decreases below 7.5 tons per acre, the saving per acre from reduced cultural practices may be much less than the loss from a lower yield. While supplies would decline from these changes in production practices, it is not suggested as a reasonable approach to the problem of excess supply and low prices. Instead, such a practice is a potential hazard or side effect of low prices. Growers who reduce their cultural practices could easily experience very low yields and permanently reduce the potential of their orchard.

A question arises as to what is the minimum price below which growers will not harvest plums? In general, growers will not harvest if the cost of harvesting per ton was above the grower price of plums. For a 7.5 ton or 250 bushel yield, this means the price must be at least $25.08 per ton based upon the cost estimates of Kelsey and Harsh (Table 22). The harvest cost is often higher than $25.08 per ton for lower yields and would require a higher price to cover this additional cost if they were to be harvested.[4]

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[4]Unfortunately, no data is available on harvest costs for low yields. Individual growers should calculate their harvest cost per acre, then estimate the expected yield from the orchard. If the price of plums is so low that the returns do not cover harvest cost, he should not harvest. This is especially important in young orchards that have not reached their mature production level.

Table 21. Variable Cost of Growing One Acre of Plums Western Michigan 1970 (Average yield of 7.5 tons).

Operation	Labor	Machinery	Material	Total
Trimming	26.10	3.54	--	29.64
Brush removal	2.24	.83	--	3.07
Fertilization	1.12	.45	8.70	10.27
Herbicides	1.34	.40	3.32	5.07
Spraying	6.05	6.99	37.29	50.33
Mowing	1.57	.83	--	2.40
Other	--	--	--	6.85
Total variable Growing costs	38.42	13.05	49.31	107.63

Source: Economics of Plum Production in Western Michigan, Agricultural Economics Report No. 162, Stephen Harsh, Myron P. Kelsey, Glen Antle, Michigan State University, May 1970.

Table 22. Variable Cost of Harvesting 250 Bushels of Plums (1 Acre), Western Michigan, 1970.

Type	Amount	Wage rate	Costs	Equip. used	Hours of use	Cost/ unit use	Cost
Full time labor	12 hrs.	$2.24	$ 26.80	3 plow tractor	4	$.95	$3.80
Piece work with crew boss	250 bu.	$0.606 /bu.	$151.50	Lift	4	.24	.96
				2 plow tractor	4	.68	2.72
				Truck	32 mi.	.08	2.56
				Ladders	1 acre		.22
				Boxes	1 acre		.98
Total labor cost			178.30	Total			11.24
Total variable cost to harvest 250 bu.			$189.54	Variable cost per bushel			$0.76

Source: Economics of Plum Production in Western Michigan, Agricultural Economics Report No. 162, Stephen Harsh, Myron P. Kelsey, Glen Antle, Michigan State University.

To date, the lowest processing price has been $47.90 per ton meaning that the plum crop would be harvested every year and that all of the variable costs have been covered every year.

The recent reduction, but continual planting of plums, reflects an assessment of costs and prices by growers. Heavy plantings in the 1963-1966 period are partially explained by the above average plum prices in the preceding years, lower returns in other crops and the advent of mechanical harvesters. Mechanical harvesting substantially lowered the cost of growing plums which, when combined with higher prices, led to the expected increase in plantings. Plantings since 1966 have tapered off from the high of 100,000 per year in the 1963-1966 period, but have remained above that number needed to just replace the existing orchard.

Fresh market plums have a marketing cost which is usually encountered by growers. Some grade and pack their own, some sell through packing firms on a packed fruit price minus costs basis, while others sell directly to a packer for a price based upon orchard run fruit. Those growers who pack their own will have grading and container costs plus a transportation cost to the place of sale which in many cases will be the Benton Harbor market. Many of these growers do not cool, store or chemically treat their plums. As a result, their market costs are likely to be lower than those of a packing house.

If a grower delivers to a packer who performs all of the above actions, the total marketing cost from the grower to the retail store has been approximately $45.00 per ton or $1.36 per bushel (Table 23). This $45.00 marketing cost raises

Table 23. Some Average Estimated Marketing Costs for Plums Per 1000 Bushel Harvested (Grade Equals 85 percent #1) Southwestern Michigan, 1970.

Item		Cost
Grading Charge @	$.42/bu.	$420.00
Hydro Cooling @	.20/bu.	$200.00
1/2 Bushel Container @ .30	.60/bu.	$600.00
Storage	.20/bu.	$200.00
6 percent Commission on Sales @	.18/bu.	$180.00
	Total cost[b]	$1600.00

Cost per bushel packed out -- $1.60

Cost per harvested bushel at 85 percent #1[a] -- $1.36

[a]The remaining 15 percent are grade-outs and are usually discarded.

[b]Does not include transportation costs to retail outlets.

Source: Economics of Plum Production in Western Michigan, Agricultural Economics Report No. 162, Stephen Harsh, Myron P. Kelsey, Glen Antle, Michigan State University, May 1970.

the total cost from $60.00 to $105.00 per ton or approximately $3.20 per bushel of orchard run fruit. Meanwhile, prices at the grower level have, with the exception of 1964, been over $105.00 per ton for every year since 1958. The average price for Michigan fresh plums has been $130.50 per ton for the period 1958-1969. As a result, a fresh grower with a production and marketing cost of $105.00 per ton has been making money in the fresh market. According to this cost schedule, fresh plum growers require slightly more than 5¢ per pound to cover total costs. If the marketing costs are added as variable costs, total variable cost amounts to $85.00 per ton or 4.25 cents per pound.[5]

Michigan fresh prices have exceeded this price in every year but two since 1944 (Table 14). This indicates that growers can profitably market fresh plums on a long term basis at a price of $105.00 or more per ton and on a short term basis at a price of $85.00 or more per ton if costs don't change. The difference between costs and returns in the fresh market suggests that it may be to growers advantage to lower market prices, increasing the volume of plums sold. Total revenue would be increased if demand is price elastic. If the total revenue in the fresh market expands with a lower price, the problem of expanding demand to provide a profitable market for the increased supplies will be much less difficult.

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[5]In the marketing costs, the 6% commission on Sales may normally be called a fixed cost, but if a grower does not market any plums he does not usually pay for the upkeep of the packing facilities.

Regional Costs of Production

It is most difficult to make meaningful comparisons of production costs between Washington, Oregon, and Michigan because of the different methods used to determine costs. The cost comparison is further complicated since Washington growers irrigate and prop their trees. Several adjustments have been made to make these costs comparable.

Although Michigan has a lower variable cost for cultural operations and a cost for harvesting similar to that of the other states, their fixed costs are much higher resulting in a total production cost higher than either Washington or Oregon (Table 24). The high fixed cost for Michigan is accentuated by the lower average yield per acre. Washington has a higher yield per acre over which to spread fixed costs. While Oregon has a lower yield per acre, their total fixed costs per acre are much lower than those for Michigan.

According to the variable costs reported here, Michigan growers are very competitive. Their variable costs are approximately $3.50 per ton less than Oregon's and approximately $5.80 per ton less than Washington costs. With these cost differences, Michigan growers are in a position to try to increase their average yield through additional cultural practices, such as irrigation, more prunning or heavier fertilization. It may be possible for Michigan growers to raise their average yield per acre by these practices for a small increase in the variable cost level. If the increase in

Table 24. State by State Cost Comparison--Michigan, Washington, Oregon

Part A. Variable Cost of Cultural Operations (dollars per acre)

Operation	Michigan	Washington	Oregon
Labor (cultural)[a]	38.42	124.40[c]	32.40
Fertilizer (materials)	8.70	12.00	6.50
Spray (materials)	40.62	20.50	18.05
Machinery (Repair, fuel, oil, upkeep)	13.05	64.40[b]	31.10
Cover-crop Seed	--	--	1.50
Irrigation	--	18.00	--
Other	6.85	3.00	--
Total cost/acre	107.64	242.30	89.55
Total cost/ton	14.35[d]	20.19[e]	17.91[f]

[a]Michigan uses a labor cost of $2.24/hour for full time, $1.74 for hourly and $.606/hour for piece work. Washington and Oregon use a labor cost of $3.00/hour for the operator and $2.55/hour for hired labor.

[b]Authors report this may be lowered in final report.

[c]Includes irrigating, and propping activities not included in other state labor costs.

[d]Assumed an average yield of 7.5 tons per acre.

[e]Used an average yield of 12 tons per acre.

[f]Used a yield of 5 tons per acre.

Table 24 Continued

Part B. Variable Cost of Harvesting 8 Tons of Plums

Operation	Michigan	Washington	Oregon
Harvest Labor (includes piece work with Boss, Picking, Hauling, etc.)	$188.36[a]	$191.40[b]	$169.60[c]
Harvest Equipment costs and extras	11.24	32.60	12.25
Total cost	199.60	224.00	181.85
Cost per ton	24.95	28.00	22.73

[a]Estimated from a reported 7.5 tons per acre harvest cost.

[b]Estimated from a reported 12 ton per acre harvest cost.

[c]Assumes a picking cost of $20.00/ton and a hauling cost of $1.20 per ton.

Table 24 Continued

Part C. Fixed and Total Costs Per Acre

Item	Michigan	Washington	Oregon
Taxes	$ 10.00	$ 15.00[a]	$ 6.00
Interest (on investment)	42.00	116.25[b]	59.50
Depreciation	104.64	--	3.70[c]
Total Fixed Cost	156.64	131.25	69.20
Fixed Cost per ton	20.88	10.93	13.84
Total production cost/acre	463.88	597.55	340.60
Cost per ton	60.18	59.12	54.48

[a]Includes personal and real property.

[b]Includes interest, overhead and depreciation.

[c]Small charge for overhead only.

Source: (1) Stephen B. Harsh, Myron P. Kelsey, and Glen Antle, Economics of Plum Production in Western Michigan, Agricultural Economics Report No. 162, Michigan State University, May 1970.

(2) Ken Brown and Jim Ballard, "Preliminary Italian Prune Enterprise Data Sheet," (Unpublished, Yakima Valley, Washington, April 1971).

(3) Ken Brown, "Preliminary Prune Enterprise Data Sheet," (Unpublished, Willamette Valley, Oregon State University, Cooperative Extension Service, 1971).

(4) Idaho data not available.

variable cost is less than the decrease in fixed cost, resulting from an increase in yield, then Michigan producers would become even more competitive as their total cost per unit declines.

Harvest costs in the three areas are very similar varying only slightly, according to the cost of labor and mechanical harvesters in each state. At present, the cost to hand pick is very similar to that of mechanical harvesting because of the high cost of machinery.

Summary

In spite of a number of cultural problems, particularly those of disease and the need for pollinizing varieties, purple plum growers in Michigan are competitive with those in other states.

Purple plums in Michigan have produced consistent yields on low damp soils and appear to be more resistant to weather conditions than other Michigan fruit crops. More recent plantings on higher locations are expected to lead to higher yields.

Brown rot and the Black Knot diseases threaten the quality of the fruit and the life expectancy of the orchard respectively. Without improved chemicals it is doubtful whether growers can completely control brown rot. Substantial improvement in brown rot control can be made, however, with presently available technology. Black Knot can be reduced to economic insignificance with present technology.

Plum size, pollinizing varieties and ova abortion in Stanley plums are additional grower problems. Many Michigan plums are excluded from the fresh market by virtue of their size. This size may be improved through increased fertilization and prunning or by irrigation. Both of the major varieties require pollinating plum varieties to be grown with them. These other varieties do not ripen at the same time, reducing mechanical harvesting efficiency and except for Stanley and Blufre varieties, encounter a low demand. Ova abortion in Stanley plums, while a minor problem,is important in short crop years when a lot of the fruit drop before maturing.

Plums sold for processing have been mechanically harvested for some time, but mechanical harvesting of fresh market plums is just in the early stages of development. Plum damage, loss of tree spurs and excess trash are problems confronted by fresh mechanical harvesters.

Above average growers, with yields of approximately 7.5 tons per acre, have been experiencing profits while growers with yields of 4.5 tons per acre have not been covering total costs, nor in some years even covering variable costs. Despite not covering variable costs, these growers are not encouraged to reduce cultural practices because of the adverse effect expected on yields. For the above average producer average variable costs were found to be $40.00 per ton to grow and harvest the crop. Fresh marketing required an additional $45.00 per ton to cover storage, packing, grading and cooling.

The cost of producing plums in Michigan, while slightly above that in Washington and Oregon, was found to be competitive.

CHAPTER V

VIEWS AND PROBLEMS OF PROCESSORS

Processing firms buy approximately 70 percent of Michigan's purple plums. About 75 percent of these are canned whole, and about 25 percent made into baby food and preserves. If the supply continues to grow, as all signs indicate, canners and baby food producers will have to process and market roughly 60 percent of the increase. To determine whether the present firms in the field can handle the anticipated increase, this study interviewed all Michigan firms that hot pack whole plums or make baby food. The survey had two objectives: (1) to obtain detailed information on the industry's problems and (2) to determine alternative ways in which the firms might handle the expected increase while keeping or improving their economic viability.

Produce Quality

For canning of high quality, plums must be of uniform size and good color, and must be mature and free of disease. For several reasons, most processors prefer plums with a diameter of 1 1/8 inches to 1 1/2 inches. First, they keep within this range because they want to pack a certain number in each can, since the number dictates the number of individual servings. In a #10, for instance, although they may pack from 50 to 90 plums, they prefer to pack 70-90; similarly,

although they sometimes pack from 12 to 23 in a #2 1/2 can, they prefer 14 to 17. Second, uniformly sized plums are more appealing than a mixture of large and small plums, because, according to processors, the small plums suggest a lower quality fruit.

Other problems are brown rot, immature plums, and lack of color. If processing is delayed, brown rot may attack an entire shipment. Immature plums can reduce sales because they are tough-skinned, difficult to eat and often have a poor flavor. Color is important chiefly because government regulations require a strong purple for top grades. Several processors suggested the idea of trying to persuade the government to change the regulations on color because, according to taste panels, Michigan plums are at least as tasty as the better colored Northwestern plums.

Besides these problems, the industry admits that the physical characteristics of the plum itself cause difficulties. Even the minimum sized plum is a mouthful, and its tough skin makes it hard to cut. Moreover, since all canned plums have pits, the consumer must either chew the meat off the pit or try to cut the meat off. On the other hand, several processors claim that cooking the plum with the pit provides more flavor and prevents the fruit from breaking down. In any case, in as much as no present machine can remove the pit without mashing the plum, the processors have no choice in this matter.

Although several new plum products have been suggested recently, such as plum pie and plum nectar, none have been

successful to date.[1] The consequent lack of variety in products makes it necessary for the industry either to cooperate in finding new products or to concentrate on improving its efficiency with its present products.

Location of Growers and Processors

Most processors buy their plums from a number of different growers, large and small. The following five counties, each with a substantial number of growers, supply five or more processors: Leelanau, Mason, Grand Traverse, Kent and Oceania (Figure 3). Since plums can be transported long distances, some growers sell to firms outside their county, a few to processors as far away as 250 miles. Most growers, however, ship to processors no more than 50 miles away.

Processors consistently buy from a large number of growers, apparently to minimize the risk of a crop failure. For instance, three of the 15 large firms buy from 100 or more growers, and nine buy from 50 or more. Most of their growers, however, sell only small quantities. One firm buys approximately 2/3 of its supply from five growers and the remaining 1/3 from approximately 95 others. Two firms obtained over half their supply from five growers. For some firms their top five growers produced between 200 and 400 tons.

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[1]Glen G. Antle, and W. Smith Greig, The Potentials for Plum Pie, Agricultural Economics Report No. 146, Department of Agricultural Economics, Michigan State University, August 1969.

All processors deal with growers on an informal basis, omitting the use of formal written contracts. They reacted to the suggestion of written contracts by saying that quantities and prices would have to be negotiated each year, which makes long term quantity and price determined contracts unavailable. Even though arrangements are informal, processors support market information groups that provide all sides of the marketing picture because these groups acquaint growers and processors with market conditions for each year.

Processor reactions to the first plum market information program were mixed. While this program, started by MACMA in 1970, had not reached a number of processors, they did respond by indicating how other MACMA fruit programs have worked. Their comments indicated that while MACMA's programs provide factual, informative material that aids in providing a stable uniform market, their apparently uncompromisable statements, unrealistic price demands, lack of awareness of the implications of their predictions, insufficient market research and failure to always consider other market conditions make them ineffective in establishing price.

Responses to questions on contracts, custom processing, and joint ownership agreements with growers show that processors are reluctant to contract under a price formula but will, in some cases, custom process or enter into joint ownership programs (Table 25). Contracts with grower associations would have to include delivery specifications,

Table 25. Processor Responses to Grower Relation Type Questions.

Question	No. Responding Yes	No. Responding No	No Response
1. Would you be willing to offer a contract to growers for several years which included a specified price formula?	1	13	0
2. Have you ever contracted for plums?	6	8	0
3. Would you sign a contract with a growers association?	8	3	3
4. Would you be willing to custom process plums for growers?	8	6	0
5. Would you be interested in processing plums on a joint venture basis with growers?	5	9	0

quality criteria, quantity and a price negotiating arrangement. Those five firms willing to enter a joint ownership arrangement will only do so on a cost plus basis meaning that processors are reluctant to share the risk with growers, preferring instead to own the plums outright or custom process. One processor has started a joint ownership venture, but was reluctant to provide details until there is some indication as to its possible success.

Processor Market

Michigan's canned plums compete for a share of the U.S. canned whole plum market. Although two of Michigan's processors have national brands, they do not necessarily sell Michigan produced plums in all parts of the U.S., as they have processing plants in the Northwest as well. Michigan canned plums compete mainly in the Midwestern and Eastern sections of the U.S. market. Sales have been reported in Detroit, Philadelphia, New York, Chicago and Nashville as well as in the states of Nebraska, Florida and Texas. These same processors indicate that the Eastern market is the largest regional market in the U.S. for plums.

Canning

The canning of whole purple plums involves equipment similar to that in canning other fruits such as sorting and grading facilities, syrup tanks, and closing machines. Plums do require a stemmer which in many cases is a bean destemmer,

especially since mechanical harvesting has raised the incidence of stems.

Canning purple plums represents less than 2 percent of business and for the most part involves the #2 1/2 and #10 size cans (Table 26). In addition to canning these plums, all firms process tart cherries and many process other crops especially sweet cherries, apples, blueberries, and asparagus. With the plum season between that of tart cherries and apples, many firms have their equipment available for processing which provides a means of spreading overhead. If a firm has a hot pack line for any products, they can use it for purple plums even if they have never processed plums before. The ease with which firms may undertake the canning of plums and the responses of those already in the business reveal that the physical capacity exists with which to handle the increase in supply. Ten of the 14 firms have maintained or increased the quantity of plums processed over the past ten years. Two firms quit altogether because of low returns and the loss of a market for their canned whole plums.

Pricing

According to processors, the supply of plums in the Northwest, competing fruit, and total available carryin of canned plums all affect the price received by processors for canned plums. If the Northwest has a big supply, baby food and whole plum processors with plants in Michigan and the Northwest will process plums out there, lowering the demand

Table 26. Number of Firms Packing Specific Can Sizes, Percentage of Business Represented by Plums, and Other Crops Processed.

1. Number of firms packing each size and the percent of the total processed by these firms	can size	8 oz.	# 303	# 2 1/2	# 10	
	No. of firms	1	2	6	10	
	Percent of Volume in 1970	1	4.6	41.4	53.6	
2. Percent of total business represented by plums	Percent	0-2%	2+-9%		10-20%	
	No. of firms	10	0		4	

3. Other major fruit and vegetable crops processed by these firms

Crop:	Tart cherries	Sweet cherries	Apples	Blueberries	Peaches	Strawberries
No. of firms	14	11	10	8	3	3

Crop:	Pears	Other fruit	Asparagus	Tomatoes	Other vegetables
No. of firms:	1	4	8	4	3

and price for Michigan's plums. In addition, if Northwestern firms have a cheap supply of plums they will be able to transport canned plums east and compete with Michigan processors at lower prices. Theoretically, all competing fruit such as pears, peaches, applesauce, apricots and fruit cocktail are potential but not perfect substitutes for whole plums in consumer purchases. And finally, the other factor most frequently mentioned as influencing plum prices was that of canned whole plum carryin. Because canned plums may be stored for up to two years, unsold quantities, as of the first of June, constitute part of the available supply for the next season. If carryin quantity is high, processors would expect a lower price for new canned plums.

To obtain their desired supply of fruit at competitive prices, processors establish some grower-processor loyalty as well as offer prices similar to those offered by other processors. If a grower sells to a processor in short supply years, that processor will purchase from him in big crop years and in some big crop years increase the average quantity purchased. With big crop years becoming more frequent, processors are experiencing a degree of oligopsony bargaining power. This means that if growers are unhappy with a particular processor's price, they may have no alternative market available. In addition to dealing primarily with growers on a regular basis, processors offer very similar prices. The maximum price differences per pound reported

by processors on an individual basis for the three years 1968-1970 were as follows: 2 cents in 1968, 1.25 cents in 1969 and .25 cents in 1970. These variations depend in part on whether the grower must deliver their own plums or whether the firm will pick up the plums.

Advertising and Promotion

Processors do very little advertising or product promotion for canned purple plums. Although seven of fourteen firms favor advertising, only two firms reported spending funds on specific advertising of plums. However, several others, marketing under a national brand label, indicated some indirect promotion through brand advertising. This lack of interest in advertising is attributed to the unimportance of purple plums to most processing firms, the low sales volume and high cost of advertising.

If an advertising program for the industry is undertaken, half of the processors favor a strictly Michigan program and half favor a combined Northwest-Michigan program. Eight of the fourteen firms felt that processors should contribute if an industry wide advertising program is established. Contributions, according to ten of the fourteen processors, would have to be mandatory for such a program to be properly financed.

None of the fourteen processors mentioned using merchandising agents at present for purple plum promotion, but eight firms were in favor of using this means of promotion in an industry sponsored program. Merchandising agents would

call on chain stores and institutional buyers in an attempt to get wider acceptance, greater distribution, and more shelf space for plums.

The suggestion of using a central sales agency as a means of promotion and a way of increasing returns to the industry encountered a mixed reaction. Five firms thought the idea had merit, four thought it to be completely infeasible, four others were undecided while one processor would make no comment. While it may be found to be illegal for processors to collude and sell as one, growers could farm a cooperative, retaining ownership of the plums, and sell through a central agency.

Under a central sales agency, whether run by processors or producers, all brands of a similar quality would sell for the same price and all sales would be handled by the agency, removing special processor quantity or price deals and in effect creating a monopoly. Operating as a monopoly, the agency would be in a position to set wholesale prices to retailers. These prices would depend upon the same variables now affecting processor prices of Northwest supply, carryin, and Michigan supply but it would remove the inter-processor price competition by Michigan firms.

Processing Costs

Variations in the cost of processing depend upon how heavy a syrup is used, container quality, labor efficiency, and total overhead. While not all firms provided cost figures

for the survey, over half did, providing a range of costs and a means of determining the importance of such inputs as sugar, labor, containers, and overhead.

By looking at the average costs per case, we can see that sugar, container, and overhead costs are substantial (Table 27). Since a case of #2 1/2 plums requires 30 pounds of raw fruit, which at $60.00 per ton or 3 cents per pound would cost $.90, these costs per case are each greater than or almost equal to the raw product cost per case. A similar situation exists for the size ten cases. Sugar costs, while slightly below the raw product cost in this illustration, vary and may be above or below the raw product cost at 3 cents per pound.

On a percentage basis, with a raw product cost of 3 cents per pound added to the average cost of $4.17 per #2 1/2 case, the cans represent 30 percent of this total cost while the raw fruit accounts for approximately 18 percent. Overhead costs, likewise, exceed raw product cost per case. And a similar situation exists for a #10 case. This cost structure points out the fact that the raw product represents only a small part of the final product. Consequently a change in grower price of one cent from 3 to 4 cents, per pound, which represents a 33 percent increase in price at the grower level, means a change from $5.07 per case of #2 1/2 plums to $5.37 per case or a 6 percent change in price at the processor level. The implication is that since raw product cost is not a major part of the final cost and where a large percentage change

Table 27. Pounds of Raw Fruit Required and Costs Involved in Canning Purple Plums.

Part A: Quantity of raw fruit necessary to produce one case of fruit.

	Can size			
	8 oz.	#303	#2 1/2	#10
No. of Pounds of Raw Plums[a]	7-9	16.5-19	29-31	26.5-30

[a]Processors reported that the quantity varies with the sugar used and condition of the plums.

Part B: Costs Involved in Canning Purple Plums (Excluding Raw Product Cost)[b].

	Cost Range per case of 24, #2 1/2	Average cost/case of 24,#2 1/2	Cost Range per case of 6, #10's	Average Cost per case of 6, #10's
	dollars per case			
Sugar	.76-1.00	.842	.68-.99	.786
Cans	1.44-1.63	1.52	.91-1.20	1.035
Carton	.115-.125	.121	.097-.130	.12
Labor	.31-.605	.448	.25-.50	.344
Overhead[c]	1.165-1.30	1.239	1.23-1.40	1.345
Total	3.79-4.55	4.17	3.17-3.91	3.63

[b]Eight firms replied with cost figures for #10 containers while four reported costs for the #2 1/2 can size. Only six firms provided overhead costs.

[c]Overhead costs were not reported separately but are the differences between the total cost reported and the first four costs listed.

at the grower level results in a relatively small change at the retail level, it may be possible to obtain higher prices at the grower level. An increase in price at the grower level would not occur without strong representation on the grower's behalf.

Although it may appear that a price increase at the grower level, with its limited effect on retail prices, could be passed on to consumers, processors are reluctant to increase the price paid to producers. Unlike the situation in cans and sugar, where reduced purchases by individual processors do not affect the prices, a cut back in purchases by individual processors directly affects raw product price in the area. In years of average or above average production, many growers are looking for a market for their plums. If their local processor won't buy them, they are forced to sell to another area usually causing a downward pressure on prices in that area. As a result, processors can favorably affect the price of the raw product.

Despite the lack of control over can costs and the high cost of cans, processors indicated very little interest in jointly or individually owning a can making company. According to processors, the high volume necessary for a profitable container company and the variety of containers needed in the processing industry makes a container company unprofitable.

Labor costs represent approximately 10 percent of the processors' cost excluding the raw product cost or less than 9 percent if the raw product cost is included for a

case of #2 1/2 size cans. Labor costs vary from firm to firm according to the technology employed and the efficiency of the operation. This difference from firm to firm is illustrated by the wide range of labor costs reported.

Financial Situation

Indebtedness and credit availability were two means of providing an indication of the financial soundness of the processing industry. To measure indebtedness processors were asked to indicate what percent of their operating capital was borrowed on an annual basis. Unfortunately individual firms defined operating capital in a number of different ways making the responses very rough indications of money borrowed. They reported borrowing from 33 to 75 percent of their total operating requirements. Although these rough estimates reveal a wide range in the percentage of capital borrowed, they do support the responses on credit availability.

Firm responses to the question of whether less costly and better financing arrangements would encourage them to pack more plums or expand their operations indicated, with one exception, that financing costs did not affect pack size. And only two firms, one of which also mentioned credit availability as a factor in determining pack size, reported financial cost as a reason for not expanding plum pack. One other firm reported that credit availability affected pack size. According to these replies

the cost and availability of credit are not important limiting factors affecting the size of plum pack.

Closely related to the problem of credit availability is that of firm financing. Survey responses to the question of whether underfinanced firms presented a problem to the industry indicate that while underfinanced firms might cut prices there appeared to be no firms in this position at present.

As an indication of the profitability of plums, processors were asked to indicate whether average net return differed from their other processing enterprise. With one exception plum returns were reported as either just covering their total costs or yielding returns similar to the average returns experienced by other products. One firm reported losing money on plums. According to processors, plums are a small part of most enterprises and contribute to keeping down overhead costs by making use of idle equipment during a period when other products are not available for processing. All but one processor said they plan to continue plum processing if returns continue as they are.

Excess Supply

The Michigan purple plum industry's ability to handle an increase in supply is critical if the industry is to economically handle the 21-39,000 tons of plums produced annually in the seventies. Since approximately 70 percent of the crop has been processed, processors' analysis of the industry's ability to handle a supply increase is considered very important.

Under present conditions, processors believe that additional supplies would have to be left unharvested. These processors say that even with lower priced raw fruit the change in

retail price of the product would be so small that only a small increase in sales is likely. This means that growers would receive less for their crop and still not find a market for the entire crop. As a result, they might be better to just harvest a portion of the crop and keep prices from falling to the harvest cost level.

Supply management, through acreage control or harvest restrictions, was proposed in the survey as one method of handling excess supply. Processor reaction to this idea was less than enthusiastic. Unsuccessful use of supply management in other areas made processors pessimistic about its success here. For supply management to work, other plum growing regions would have to be included as well. In addition, the existence of substitutes would be a limiting factor on the returns that could be expected from controlling supply. While each of these conditions could be overcome they do indicate that supply management would not be an easy method to use in overcoming the supply problem.

Not all processors believed that excess supply would be detrimental to the industry. They suggested marketing only the highest quality plums and in so doing expand demand for more of the product. Availability of only high quality plums would encourage consumers to increase their consumption by having better tasting plums and fewer experiences with low quality products. An additional advantage from marketing only high quality plums would be realized from a general advertising program. In most situations, industry wide advertising is not recommended where consumers encounter a high degree of quality variation. With an increase in supply the industry could be more selective in quality

Although excess supplies can be detrimental to an industry, the quantity marketed does affect total returns to the industry. This effect depends upon the elasticity of demand. To determine what effect an increase in supply will have upon returns this elasticity of demand must be determined. A later chapter attempts to determine this elasticity. Once processors are aware of how an increase in supply will affect returns under present conditions, they may adjust their processing accordingly or alter the demand situation through a promotional type of program.

When industry supply increases, processors indicated they would not increase their processing unless returns per case were maintained at or near current levels. As this supply increase approaches the expected range of 21-39,000 tons, processors expect lower raw product prices, possibly as low as, or lower than, 2 cents per pound. This price is above the grower harvest cost of $1.25 per pound mentioned in Chapter IV.

Processors suggested that growers might reduce the supply by removing some trees, planting fewer trees and not marketing the entire crop. Tree removal would likely involve inefficient, low yielding and possibly diseased orchards. Indications are that fewer trees have been planted in the last few years. However, as long as growers receive returns that more than cover harvest costs, they have marketed all of their crop. If some of the crop is to be left unmarketed, a marketing regulation of some type will have to be used or the price will have to drop below the harvest cost.

When asked whether retail prices would respond to decreases in prices at the grower and processor level, resulting from an increase in supply, processors were pessimistic, indicating that in their opinion retail prices have always been slow to move. This is understandable as we saw earlier where a one cent change in raw product price was a very significant price change at the grower level but quite insignificant at the wholesale level and even more insignificant at the retail level. The fact that the raw product cost in the final product is such a small percent of the total cost explains why many agricultural based products do not fluctuate in prices at the retail level to the same degree as the price fluctuates at the producer level.

All processors were asked to indicate, from a list provided, what activities they believed would be effective in increasing demand. While quality was not mentioned in the list, there was an opportunity for an activity involving quality to be added. However only one firm did so (Table 28). Their responses suggest that advertising and promotion combined with new products provide the greatest opportunity for expanding the demand for canned whole plums.

Even though processors, on an individual basis, may not have a ready solution to the supply problem, they represent a positive force that if combined with producer efforts may effectively alter the market situation. Cooperation between these two groups at the very minimum can reduce costs and improve the efficiency of the industry.

Table 28. Support for Methods of Expanding Demand for Canned Purple Plums.

Method	Number[a]
Lower prices	3
Advertising & promotion	7
New products	6
Stabilize supplies	4
Central selling	3
Exports	2
Additional promotion to institutions (Hospitals, Colleges, etc.)	4
Other (Quality improvement)	1

[a]Processors were provided with a list of methods and asked to indicate what methods they thought would best expand demand.

Industry Problems

Although a number of problems were covered with earlier sections of the questionnaire, the final question asked each processor to mention any and all industry problems that, in their opinions, require industry attention. Many of these problems were discussed earlier in this chapter but are listed here as an indication of the range of problems confronting industry participants, particularly processors. The first three problems listed below were mentioned by at least two processors. The list is as follows:

(a) Quality is a problem at both the grower and processor level.

(b) Prices at the retail level do not change by as much nor as often as prices at the grower level.

(c) Industry organization and cooperation is insufficient to handle the industry's problems.

(d) Processors feel the Government could help in surplus years by buying more plums but appears reluctant to do so.

(e) Expanding the demand for purple plums is and will continue to be a problem because the product form (canned whole plums) has a number of undesirable characteristics.

(f) Some processors apparently bid at below cost for some government contracts creating hardship for other processors.

(g) Committee buying, rather than having one buyer as in the past, at the retail level has created a problem because these committees are less responsive to market changes and less knowledgeable of market conditions.

(h) The government color regulation discriminates against Michigan plums.

(i) A heavy syrup pack has become more difficult to sell to a calorie conscious public.

(j) The wide variation in plum count of #10 cans is a problem to consumers who require a specific number of servings per can.

(k) The average consumer is unfamiliar with canned plums.

(l) There is a lack of Michigan plum promotion.

(m) There is a fluctuating supply.

(n) Can prices are too high.

(o) Plums may be a luxury item and therefore more susceptible to economic changes.

Summary

Michigan's processing industry, handling approximately 70 percent of the state's purple plum supply, must overcome a number of problems if they are to economically handle the increase in supply. Many of these problems such as low quality, high input costs, and oversupply are common among other industry participants. However, such problems

as advertising or promotion, pricing policy, and market expansion involve the processors more directly than other participants.

Plum quality and size, determined in part by diseases and growing conditions, are a major problem to processors as well as to growers because of their affect on final product quality and sale of that product. The following contribute to the quality problem: brown rot, a disease causing a breakdown of the plum, immaturity, a joint producer-processor harvesting problem and unevenly ripened fruit caused by diseased trees. Even though size, unlike raw plum quality, does not affect the final product quality it does influence sales in two ways. First, many consumers require a certain number of uniformly sized plums per container to provide them with a constant number of individual servings. For example, institutional consumers prefer the #10 can to have between 70 and 90 plums per can. And second, size is a problem to sales even when the plums are small. For example, the minimum size plum, with a diameter of 1 1/8 inch, is a mouthful and requires cutting prior to being eaten. This cutting requirement is often made difficult by immature, tough skinned and under-cooked plums. As a result, canned whole plums meet with a degree of consumer sales resistance because of size problems.

All industry participants have input cost problems and processors are no exception. Of particular importance is the can cost. This cost represents approximately 30 percent of the total cost of a case of #2 1/2 plums when the

raw product cost is 3 cents per pound. In this particular cost situation, processors have no control over the input cost. Running a canning company to lower this cost in processors' opinion, would however, not be economical for processors alone because of the volume needed for a profitable container company and the variety of can sizes needed by processors. Another cost, over which processors have little effect, is sugar which is approximately equal to raw product cost at 3 cents per pound. The raw product cost at 3 cents per pound represents 18 percent of the total cost.

Physically handling the increase in supply is no problem, but marketing the additional volume of final product is. Although an increase in supply will lower raw product prices, the effect on retail prices will be minor. So sales will not likely increase significantly due to price changes at the grower level. Without additional promotion, new products or some other action to increase demand, processors predict that the current market cannot use all of the increase in supply. This means some of the crop will have to be left unharvested.

Even though processors are in a position to benefit from additional sales of processed plums, they carry out very little advertising or promotion. Much of this disinterest is credited to the small volume of their sales represented by plums and the high cost of advertising. No firms use merchandising agents for promotion and the suggestion of a central sales agency met with a mixed reaction ranging from full support to no support.

While processing and promotion costs affect their pricing policy, processors indicate that grower prices depend, for the most part, on the supply of plums in Michigan and the Northwest, competing fruit and total available carryin. Northwestern supply is of particular importance as it accounts for approximately 75 percent of the total U.S. purple plum industry. Competing fruit, although imperfect substitutes, affect the sale of plums, by virtue of their prices and availability. A big carryin, the supply of canned whole plums remaining from the previous year, results in lower raw product prices.

Closely related to the promotion aspect is that of market expansion into cities and states not now receiving Michigan canned whole plums. At present, sales have been reported in Detroit, Philadelphia, New York, Chicago, and Nashville as well as the states of Nebraska, Florida and Texas. Indications are that the Eastern market in the U.S. represents the largest regional market.

In their relations with growers, processors deal on an informal basis with many growers both large and small. By dealing with many growers they minimize the risk of a crop failure affecting their total supply. Contractual agreements, with the exception of one joint ownership agreement, are on an informal basis.

CHAPTER VI

VIEWS AND PROBLEMS OF RETAILERS, FRESH PACKERS, HANDLERS AND BROKERS

In order to gain an understanding of the industry and problems as perceived by a number of important participants in the subsector, interviews were conducted with retailers, fresh packers, handlers and brokers. These were not structured surveys, rather a series of open-ended questions were used during each interview to encourage a full discussion of individual problems and how those problems were related to the industry as a whole. The firms were selected to provide a range of situations and viewpoints. However, no attempt was made at systematic random sampling. The following sections report the findings and implications of these interviews.

Retailing Canned Whole Plums

To learn more about the sale of canned plums and the problems of increasing sales, eight major food chains, with stores in Michigan, were interviewed. Each food chain had a canned fruit buyer handling the purchase and promotion of plums. This was the individual interviewed.

All buyers indicated that, in Michigan, whole plums are one of the slowest moving canned fruit regularly handled.

One buyer indicated that for every can of plums sold in the chain, four cans of the next least popular fruit and forty cans of the most popular fruit were sold. They indicated that the low volume may be partially explained by low priced competing products such as peaches and consumer eating habits which seldom include whole canned plums.

These people were then asked how price affected their stocking the product and the volume sold. Responses indicated that volume would drop off even more if prices increased. Any further reduction in volume would cause three chains to discontinue selling plums altogether. Retailers use volume as a basic criteria in allotting display space, although not necessarily location of facings, as plums were displayed alongside other more popular fruit.

Despite the low volume of sales, four firms carry two or more brands, with two of the other four firms interviewed occasionally featuring a second brand. Two firms sell only Northwestern plums while one firm sells only Michigan plums. The others usually keep at least one brand from each area in stock.

Because of their low volume, whole plums are seldom featured by chain stores in their attempts to attract customers. One buyer indicated that, with most canned fruit, any extra volume left over from a feature moves quickly at regular prices, but such is not the case for plums. He also observed that consumer purchases of plums, after a feature, do not increase as much as do purchases of other fruits after a feature. This might indicate that a plum feature does not

attract new consumers but rather effects regular buyer inventories. Consequently, retail chains tend not to feature whole plums, although they will feature plums if processors give the retail chain a special deal such as a lower price.

Retailers price plums according to some combination of competition and profit. A large, store to store, variation in retail price was observed in the Lansing area where during February and March, prices ranged from 28 to 45 cents per #2 1/2 can. Most of the stores observed were charging between 29 and 33 cents per can. The buyer for the chain charging 45 cents said that, according to his costs, 45 cents per can was not out of order. He did indicate that sales were very low.

Retail buyers believe that quality and price are the major factors to be considered in expanding demand. At the processor level, plums are sold under the quality classifications of "fancy" or "choice" with "fancy" being of higher quality. However, this distinction is not carried through to the consumer, although a few brands indicate that their plums are "grade A," others give no indication of quality. Even though retailers pay less for "choice" plums, some of their pricing is such that a choice can of plums in one chain may cost more than a can of fancy plums in another chain. As a result, consumers cannot depend on price alone to indicate quality.

In selecting some product brands, unless they have their own brand which is automatically carried, retailers sometimes use a consumer taste panel to determine which

brand has the best quality. Although none of the buyers had used a panel to select their plum brands, possibly because of the low volume, several buyers believe the Northwest has better quality, while others feel that Michigan has as good or better quality. They base their quality judgments on the number of complaints they receive about under-cooked, tough skinned and poorly flavored plums.

Buyers point out that, with the variation in quality, advertising of whole plums as a consumer food item is risky, especially if consumers buy or receive a low quality plum. Most buyers thought that improving quality and making it uniform throughout the industry were requirements for demand expansion.

Once the quality problem is solved, retailers mention consumer education as the next required step. Most retailers felt that consumers lacked knowledge of how and when to serve canned purple plums. This outlook was their personal view concerning consumer response to purple plums. They also indicated that, with many homes not serving canned plums, much of the next generation will not be familiar with the product. One buyer, having had experience in New York State, indicated that consumers there bought plums on a regular basis, not on impulse as seems to be the case in Michigan.

Even if quality and consumer education are improved, the price of the product must be kept in line with other canned fruit such as peaches, pears, fruit cocktail, and apricots. One buyer suggested selling plums in a smaller can but raise the price per ounce to allow for more returns to the

industry. He also suggested that with a smaller can they could feature plums at four cans for a dollar.

Finally, retailers pointed out that there are many products competing for their shelf space. A product without sufficient demand or volume will be replaced by some other product. In the past, some products have been carried to provide the consumer with a complete line, but with the increase in product numbers and cost of space, retailers indicate that more low volume products will have to be dropped unless they have a very high markup. From these comments it is clear that retailers will not be promoting plum sales.

Retailing Fresh Purple Plums

Retail produce buyers were, for the most part, more optimistic about expanding their market than their canned fruit counterparts. Six produce buyers from Michigan food chain stores provided information on the sale of fresh purple plums. Five of the six firms sell Northwestern purple plums prior to the start of Michigan's season in early September, but transfer to Michigan plums as soon as they become available.

Two retail buyers indicated that Northwestern plums are bigger, more uniformly sized and better graded. This uniformity may be explained by the existence of a federal marketing order that controls quality and size in the Northwest. Also, fruit which is shipped for long distances is usually better graded. Two other buyers said that Michigan, because of their market proximity, can allow their plums to

tree ripen more than growers in the Northwest, who must transport their plums a longer distance to the market. Thus Michigan growers are able to provide consumers with a better tasting plum than can Northwestern growers.

Despite Michigan's lack of regulated quality control and the distance travelled by Northwestern plums, retail buyers said they have no problems handling purple plums except for isolated cases of fruit breakdown. They did mention such quality problems as scars, fruit breakdown (internal browning or brown rot) and maturity which affect sales but not necessarily the physical handling of plums. Maturity and scar problems could be removed with improved picking schedules and grading, while breakdown may be impeded through adequate cooling procedures.

In addition to preventing breakdown, buyers mentioned that cooling increases the shelf life of plums. Although hydro-cooling of fresh plums is a fairly recent practice, all buyers were familiar with this method. Those buyers receiving hydro-cooled plums appeared to assume that proper hydro-cooling techniques were being followed in every situation which, according to some growers and packers, is not the case. Apparently some firms using hydro-coolers do not keep the temperature as low as required. However, retailers, by dealing with reputable firms, may avoid encountering this particular problem. Hydro-cooling as a technique is only better than other methods if properly conducted. These retail buyers indicated a demand for quality requiring hydro-cooling.

This means that small growers in the future will most likely have to enlarge their operation to pay for a hydro-cooling system or sell through a packer who has the equipment.

Buyers were questioned concerning their experience with breakdown in Michigan's Stanley and Blufre purple plums. Industry sources had indicated some problems of this nature with Blufre. Two buyers indicated that Blufre's better size and taste overcame any problems the variety might have with breakdown. The other two buyers favored Stanley's for their staying qualities and uniform appearance. Based on these replies neither variety would seem to have a clear advantage in the fresh market.

Buyers were asked whether an increase in stems would create any marketing problems for them. Although three buyers indicated that they prefer fewer rather than more stems, none of the buyers said they would reject a load of plums because of the number of stems present. However, one buyer cautioned that an increase in the number of stems might result in more skin breakage and bruising.

Consumer packaging changes, according to retail buyers, have been the most recent fresh purple plum marketing improvement. Half of the retail chains interviewed had switched from bulk sales to 1, 2, 3 or 10 pound, pre-wrapped consumer packages. With each firm usually featuring one size, consumers are provided with alternative sizes similar to packages offered by other fruits such as apples.

Benefits from pre-wrapped, consumer packaging were reported to be a decrease in store handling costs, a speed up

of consumer shopping, and less fruit bruising by consumers. This sales method requires uniform, high quality plums to gain the confidence of consumers. Buyers also mentioned that consumers appear reluctant to buy packages of plums containing a wide variation in individual plum size.

To date, most of the chains have done their own packaging, but indicated their interest in buying the service from packers. Other firms, not now selling in these overwrap packages, were interested in switching from the bulk to overwrap, but lack packaging facilities. One firm reported overwrapping Michigan plums but not Northwestern because the added packaging cost on Northwestern plums makes them too expensive. This implies that pre-wrapped packaging could be a feature of Michigan's plums and not available in Northwestern plums. One buyer suggested that fruit packing firms in the state which are not now packing plums might do so, as the crop comes when many packing facilities are not busy with other fruit. Packers and retailers have been able to agree on who pays for the packaging of apples and through negotiation could come to some agreement on plum overwrapping.

Produce buyers had several suggestions as to how sales might be increased. To begin with, they thought that as supply increases, the lower prices would increase sales. Two buyers added that if quality were maintained with the lower prices, the sales increase might be fairly significant. According to buyers, plum sales drop off near the end of Michigan's season possibly because of a drop in

quality and possibly because consumers are becoming tired of fresh plums. To overcome this weakening of consumer demand, buyers suggest some consumer education and point of sale advertising. They point out that the Northwest has point of sale materials, although more materials could be used each year if available.

One buyer suggested a promotion program centered around a Michigan plum week. He had no idea of how effective this would be nor of how to run it, but suggested a pattern similar to that run by other fruit programs.

Another area where more consumer education appears appropriate is that of consumer handling after purchase. Three firms advertise that plums keep longer if kept in a cool place, but should be allowed to sit at room temperature for best taste results. One chain provides store managers with a circular entitled "facts on plums" for in-store education.

Featuring a medium or small size plum was mentioned by one buyer as a means of increasing sales. This chain would carry a large size all the time but run a feature on medium or small size plums. This would require that packers size their plums, but should be investigated by packers and retailers to determine its potential profitability.

Although chemical residues have not been a problem in fresh plum sales, retailers warn of the potential reaction of consumers. Recent consumer awareness of the dangers from various chemicals make consumers reluctant to purchase a

product showing any evidence of residue deposit. If residue evidence were not present at all, buyers believe that sales might increase slightly.

Fresh Packing

Fresh packing is an important feature in the marketing of approximately 30 percent of Michigan's total purple plum production. Nine of approximately 18 fresh packing firms were interviewed to obtain a description of this segment of the industry.

Fresh packers, through the use of fieldmen, keep abreast of crop size and maturity. Their knowledge of crop size is used in establishing the price paid to producers and maturity information is used to anticipate harvesting dates. Because fresh plums are often stored for at least a short period of time, the maturity at harvest time is particularly important. Overripe plums will not have a sufficiently long shelf life and a plum picked too early will have insufficient sugar and flavor. Either situation is detrimental to sales.

By scheduling or being aware of harvest dates, packers may be able to reduce the time between the harvesting and cooling of plums. If harvested plums are left uncooled, they will continue to ripen causing them to become soft and possibly unsalable. This heat may be removed with ice water, regular refrigeration or hydro-cooling. Recently, hydro-cooling has increased in popularity as a means of cooling.

Since packers deal with growers on an informal basis, growers often have several different company fieldmen visit them each year. Most growers apparently deal with the same packers from year to year depending in part on location of the packer and in part on returns obtained in the previous year. However, these fieldmen by helping growers with production problems may convince them to sell through their packing firms in any given year. The distance between grower and packer is particularly important as it affects the time between harvesting and cooling unless the grower has cooling facilities and uses them before transporting the plums.

Occasionally packers will not sell for a particular grower, especially if a fieldman finds the grower picking immature plums, continually overfilling containers or in some cases mechanically harvesting. A grower that habitually picks immature plums forces the packer to jeopardize future sales by trying to sell these immature plums. Overfilling requires additional grading to remove damaged fruit which increases costs. And mechanical harvesting in many cases increases damage to the plums resulting in a higher grading cost.

Packing requires equipment similar to that used with other fruit. This includes chemicals for the control of brown rot, half-bushel containers and labor.

Major fresh plum markets for Michigan packers are the cities of Chicago and Detroit. A few are sold to other major cities in the east as well as to the provinces of Ontario and Manitoba in Canada.

Fresh packers encounter several product problems of which Brown rot is the most serious. If Brown rot is not detected before the plums are received and sprayed with chemical controls, the fruit may become unsalable. These chemicals leave a residue on the plums and containers which may lower consumer acceptance at the retail level. As mentioned in the previous section, retailers fear that, if the residues are noticed by the public, fresh fruit sales will decline. Without chemical treatment, Brown rot will likely ruin the fruit.

Two other problems encountered by packers are fruit size and breakdown. To compete with Northwestern plums on a size basis, Michigan plums must have a minimum diameter of 1 1/8 inch. This size is difficult to attain, particularly in Northern Michigan. The problem of breakdown was mentioned by several packers as occurring more often in the Blufre variety causing some sales resistance to that variety. Although retailers indicated above that breakdown in Blufre is not particularly serious.

Packers suggest that the following will be very important if the demand for fresh plums is to be expanded: A more uniform sizing of plums, strict regulations on maturity, a change in consumer packaging, better grading of plums and avoidance of marketing overripe fruit. As the supply increases, size, quality and maturity standards are expected to become more strict. Some packers believe that sales could increase using different packaging and stricter standards while others believe the increase, if any, would be very slight.

Packers, as a group or individually, might increase Michigan plum sales through the establishment of a set of quality standards. The success of this idea would depend not on complete adherence by all packers, but rather the establishment and promotion of reasonable standards for improved quality so that retail units would buy from packers adhering to the standards. This standard might include such areas as chemical treatment, sizing and maturity. Of course, any packer supplying poor quality fresh plums affects the future demand for plums and would still be a problem in this attempt to improve sales.

Handling

Handlers assemble plums from growers and transfer them to canners, handling about 11 percent of the plums purchased by canning and baby food processors in the last few years. Approximately ten firms operate as handlers in the state, three of which were questioned concerning their problems and industry outlook.

While they have the physical capacity with which to handle the increase in supply, handlers, based on past experience, were pessimistic about processors accepting more plums as the supply increases. Their experience has shown that processors will buy a few more plums in big supply years if these big supply years do not occur very close together. Thus a prolonged period of increased supplies, in their opinions, will not be met by increased processor purchases.

Brown rot and plum size are problems faced by handlers as well as other industry participants. Brown rot becomes a problem if a handler has to hold the plums several days before the processor will accept shipment. Some handlers apply chemicals if Brown rot threatens but try to avoid this extra expense by delivering before treatment becomes necessary. Plum size is a problem in big crop years when plums are usually smaller and processors are reluctant to accept small plums. In this situation growers pressure handlers to accept small plums while processors sometimes reject a load of small plums from handlers leaving the handler in the difficult position of telling the producer his plums have been rejected.

Trash, caused by mechanical harvesting, is a problem for handlers. As with the size problem, processors sometimes reject plums with too much trash present, forcing the handler to relate this news to the producer. Thus handlers are forced to turn down a grower's plums or risk incurring transportation costs and the possibility that a processor may stop taking any plums from that particular handler. It is hoped that improved harvesting techniques may decrease the trash content and remove this particular problem.

Handlers complain that processors have two sets of quality criteria. In short crop years, processors apparently accept almost anything, but in big crop years become very particular. As a result, growers deliver according to their own interpretation of quality requirements and are shocked to find their plums rejected in some years while in other years

very low quality plums are accepted. Consequently, handlers strongly recommended a set of quality standards to be applied at their level.

Finally, handlers suggest that processors could decrease their plum losses by scheduling harvest and delivery dates. At present, many processors have large quantities of plums delivered to their factories at one time. Usually, this results in fruit decay and a financial loss to the processor, who will likely pass the extra cost on to growers by reducing the price. The advent of mechanical harvestors, allowing growers to harvest all their plums in a very short period of time, is likely to compound this problem. Handlers suggest that processors keep in close touch with handlers and major growers prior to harvest to schedule harvest and delivery of plums. For this to work, processors will require some information concerning quantities available or expected from each source. This is usually available from their own fieldmen. If a large quantity of plums had to be harvested at one time and the processors' facilities could not handle them, storage facilities could be arranged for the oversupply. The ultimate result should be a lower loss in fruit from spoilage and a higher quality processed product resulting from a better quality raw product.

Brokerage

Brokers coordinate movement of the product between processor or packer and wholesalers and sometimes between wholesalers and retailers. By outlining the merits of a

product and how the retailer may benefit from it, a broker is, in fact, a type of merchandising agent. Without brokers, wholesalers would have to find their own retailers while brokers, by dealing with many retailers, provide wholesalers with a number of market outlets.

By combining fresh fruit with vegetables, brokers selling fresh plums are exposed to a number of retailers which puts them in a position to promote additional sales of fresh plums. Some of these fresh brokers have expanded their operations by doing their own packing. They apparently started packing and cooling plums when it became apparent that uncooled Benton Harbor plums were becoming more difficult to sell. They still handle plums for other packers as well as their own plums. Their biggest problem is determining whether the plums they buy will keep until resold by retailers.

Since canned plums are a small volume product, canned product brokers put very little emphasis on their movement. In fact, some processors by-pass these brokers by selling directly to retail outlets. Canned product brokers showed little interest in expanding their efforts on plums.

Summary

This survey of retailers, fresh packers, handlers, and brokers reveals that industry participants believe consistent product quality is essential if a demand expansion program is to be successful. Retailers of canned plums point to the variation in quality from can to can and lack of

quality distinction at the consumer level as handicaps to any demand expansion program. Fresh plum retailers say that even though Michigan's plums are tree-ripened and sweet tasting, the well graded, top quality, and uniformly sized Northwestern plum is easier to promote and sell. This charge against Michigan plums, of inconsistent quality, is further supported by packers and handlers who complain of maturity and disease problems.

Other problems include a low volume of canned sales compared with other retail fruit sales, adequate cooling, and fruit damage during harvesting. According to retail merchandisers of canned products, plums are the slowest moving fruit, with one retailer reporting that for every case of plums sold, the chain sells four cases of the next least popular fruit and 25 cases of the most popular fruit. If volume continues to remain low or declines while others increase, indications are that plums might be discontinued by some chains.

Fresh retail buyers are familiar with and favor hydro-cooling of plums, however industry sources indicate that not all firms using hydro-cooling are using it properly, meaning that some plums are reaching the market with a below average shelf-life expectancy. Fruit damage from mechanical harvesting and overloading of containers was reported by packers as contributing to higher packing costs.

Two suggestions for industry improvement included that of improved scheduling of deliveries of raw plums to processors and increased use of pre-wrapped containers in

the sale of fresh plums. Handlers believe that fruit spoilage may be reduced and canned plum quality improved if processors, through storage or delivery limitation, reduce the time between delivery and processing. At present, delivered plums remain in uncooled storage areas. Retailers indicate that use of the pre-wrapped package can decrease store handling costs, lower consumer shopping time and result in less consumer bruising of the product.

CHAPTER VII

ECONOMIC RELATIONSHIPS IN THE PURPLE PLUM SUBSECTOR

The objective of this Chapter is to quantify, where possible, the relationships among market factors in the purple plum subsector. Included in this quantification is a measurement of the influence of such key factors as plum supply, personal income, population and supply of competing fruit on prices received by growers and processors. Price elasticity of demand values are also estimated for fresh and processed plums. Ordinary and two stage least square regression models are used in quantifying these relationships. Results from this quantification are then used in Chapter VIII along with the earlier descriptive information, to provide an analysis of selected alternatives to various problems facing the subsector.

Canned Plum Consumption

Industry sources have indicated that the largest consumers of canned whole plums are elderly and of Jewish culture, while young married couples buy few plums. One retail source, having had experience in New York State, suggested that the large Jewish community in New York State accounts, in part, for New York State's canned plum sales exceeding those of

Michigan. Evidence of low Michigan sales is also provided by a study for the period 1952-58 in which less than 2 percent of the families responding to a consumer survey, representative of a Michigan city, bought canned plums in any one year.[1] Even though age and cultural background appear to affect demand for canned plums, adequate data quantifying these relationships are not available.

Retailers report that retail programs promoting fruit through increased advertising or price reductions usually attract a number of new consumers to the featured product, both during and after the feature, but not in the case of canned plums. If regular buyers just stocked up on plums during the sale, volume would decline after the sale because no new buyers were introduced to the product and the regular buyers would have an adequate supply on hand. For a product to interest new consumers during a price feature, the product must be attractive to the consumer. If it is price elastic, a drop in prices will result in a greater number of sales and an increase in total returns to the industry. If industry sources are correct in reporting that canned plum sales do not increase appreciably with a decrease in price, then it is expected that the price elasticity of demand for canned plums will be relatively inelastic.

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[1] James D. Shaffer, Consumer Purchase Patterns for Individual Fresh, Frozen and Canned Fruits and Vegetables. M.S.U. Consumer Panel 1952-1958, Michigan State University, Department of Agricultural Economics, p. 27.

The method used to estimate price elasticity of demand involves the use of a two stage least squares (2SLS) model. A 2SLS model is used because this type of model allows for interaction between the fresh and canned markets. For example, when fresh sales are low, fresh prices will be high attracting plums normally sold for processing and thus forcing the price of plums sold for processing to increase.

Although the full model is described below, only the results for the canned whole plums are reported here. Results for fresh sales appear in the next section.

A number of variables are included in the model, however, only the results from equations A and B with prices as the key variables are reported here. The quantity of fresh plums demanded is affected by the price paid to growers for fresh plums directly and by the price paid to growers for plums sold for processing. These two prices are both used because a given portion of every year's crop is too small for the fresh market, thus creating a separate market and price. If the price for these processing plums is sufficiently high, then plums that could go into the fresh market may be attracted to the processing market. And if fresh plum prices were high and process plum price were low, fresh plum consumers might buy some of the plums that could go to either market. Income is expected to be positively related to the demand for fresh plums. The higher the income the higher the demand for fresh plums. In equation B a similar explanation holds for the inclusion of both prices as variables. Equation C introduces wages as a factor affecting the supply of plums. As wages

increase, the supply of plums is expected to decrease. Prices in equation C are expected to inversely affect the supply. Equations D, E and F are identities.

The prices paid to growers for fresh and process type plums are distinct for that portion of the production that cannot enter the fresh market. Some very large plums are not well suited to processing as processors strive for a given number of plums per container, hence a distinct portion of the production is suited for the fresh market only. Plums sold on the fresh market are usually hand picked and chemically treated which raises the cost. Thus the two prices over the entire season are related but never the same.

The model used is as follows:

(A) Fresh Qd* = f (Price F*, Income, Price P*)

(B) Process Qd* = F (Price P*, Income, Price F*)

(C) F Quantity S* = F (Price F*, Wage, Price P*)

(D) P Quantity S* = Total Prod. - F. Quantity S*)

(E) F Quantity S* = Fresh Qd*

(F) P Quantity S* = Process Qd*

* = endogenous variables.

Where:

Fresh Qd = Total U.S. supply per capita of fresh purple plums from the four major states (tons) (Table 30, col. 2).

Price F = Average price, in 1969 dollars, paid to growers for purple plums sold on the fresh market in the U.S. (dollars per ton) (Table 30, col. 3).

Income = Disposable personal income per capital in current prices (expressed in dollars) (Table 30, col. 1).

Price P = Average price, in 1969 dollars, received by growers for purple plums sold to processing (dollars per ton) (Table 12, col. 6).

Process Qd = Total U.S. supply per capita of purple plums sold for canning (tons) (Table 7, col. 6).

Wage = Michigan Farm wage rate per hour, without room and board (Table 29, col. 1).

The data in log farm yielded a lower standard error of the estimate and a higher R^2 than did the data in non-log form. Consequently only the log results are reported for equations A and B below.

Process-type plum demand results are as follows:

Equation A

Log process Qd=0.087 - 0.722 log Price P + 0.430 log Income
(1.277) (0.381) (0.445)

0.435 log Price F
(0.607)

R^2 = .5946 R^2 = 0.4933 Std. Error of Estimate = 0.1333

d = 2.795

d = Durbin-Watson Statistic

Parenthesis contain the standard errors.

Degrees of freedom 15

The estimated price elasticity of demand for process-type plums is -.722. This indicates an inelastic price

Table 29. Wage Rate, U.S. Per Capita Supply of Process Type Purple Plums, Total U.S. Supply of Purple Plums, and Average Price Paid to Growers for Process Type Plums.

Marketing year June-May	Wage current $'s	Total per capita supply of purple plums sold for processing (Mich., Idaho, Ore., Wash.)	Total U.S. Supply of Purple Plums (all uses) fresh and process	Average U.S. Price received by growers for process type plums current dollars
	dollars	lbs.	tons	dollars/tons
1954	.783	.400	60770	36.33
1955	.798	.375	82250	31.71
1956	.830	.430	81000	35.08
1957	.838	.217	59960	29.20
1958	.830	.212	54270	67.97
1959	.838	.307	73300	31.16
1960	.838	.081	30175	101.01
1961	.858	.293	62435	60.53
1962	.861	.381	71580	30.93
1963	.877	.212	48990	62.49
1964	.885	.294	63019	34.53
1965	.940	.311	63939	46.28
1966	1.034	.256	55470	46.28
1967	1.104	.321	61982	52.46
1968	1.190	.157	38395	63.76
1969	1.292	.423	78880	42.12

Source: Col. 1 Michigan Crop Report Service: Michigan Agricultural Statistics, Annual Reports.
Col. 2 and 3: Fruits Non-Citrus by States; Production, Use, Value: Annual Reports. (Total process supply divided by U.S. population Table 32, Col. 4).
Col. 4 Table 12, Col. 5, deflated to 1969 dollars by a value of 127.7.

Table 30. Per Capita Income, U.S. Per Capita Fresh Supply of Purple Plums, and Average Price Paid to Growers for Fresh Plums, 1954-1969.

Marketing year June--May	Per Capita disposable income current $'s	Total U.S. Per Capita supply of fresh purple plums (Mich., Idaho, Ore., Wash.)	Average price received by growers for fresh purple plums U.S.
	dollars	lbs.	dollars/ton
1954	1,582	.366	115.89
1955	1,660	.619	60.76
1956	1,741	.536	93.18
1957	1,803	.481	94.75
1958	1,825	.404	116.67
1959	1,904	.517	87.70
1960	1,937	.249	173.84
1961	1,983	.389	123.72
1962	2,064	.389	91.62
1963	2,136	.304	117.46
1964	2,280	.364	95.53
1965	2,432	.355	106.49
1966	2,599	.317	138.60
1967	2,744	.321	123.72
1968	2,939	.231	148.78
1969	3,108	.375	121.37

Source: Col.1 Current issue, The Handbook of Basic Economic Statistics (by the Economic Statistics Bureau)

Col.2 Fruits Noncitrus by States, Production, Use Value: Annual Reports (total fresh supply divided by U.S. population, Table 32, col. 4).

Col.3 Noncitrus Fruit Prices, by States and United States Crop Report Board, SRS, USDA (deflated to 1969 dollars using a value of 127.7).

elasticity of demand meaning that a price increase typically results in an increase in total revenue. The extent of the price increase possible before returns would decline depends upon the price and quantity range covered by the time series used to develop the elasticities.

Low values for each of the coefficients indicates that the cross-elasticity values, although not necessarily zero, are low.

These results imply that sales will not be significantly increased through a policy of price reduction. Without an alternative program to expand demand, the industry can expect to experience very little growth.

Fresh Plum Consumption

Industry sources believe that no one segment of the population predominates in the consumption of fresh plums. Although all segments apparently consume fresh plums, consumption per capita is not very high as one survey shows that less than 2.5 percent of the families responding to a Michigan consumer survey bought fresh plums in any one year.[2]

Although a number of fresh fruits are available in plum season, peaches and apples are available in the largest quantities and are believed to be the major competition. If peaches and apples are major substitutes for plums, then

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[2]James D. Shaffer, Consumer Purchase Patterns for Individual Fresh, Frozen and Canned Fruits and Vegetables, M.S.U. Consumer Panel 1952-1958, Michigan State University, Department of Agricultural Economics, p. 27.

consumers will have to be attracted to plums and away from these products. One method of doing this might be a reduction in plum prices. This idea was supported by one retailer who believes that smaller plums could be featured at low prices and result in a substantial increase in sales. This same retailer would keep regular sized plums on hand but use the smaller, low priced plums as a feature to attract consumers away from other fruit.

Fresh plum demand results are as follows:

Equation B

Log Fresh Qd = 2.226 - 0.692 log Price F - 0.315 log Income -
(0.516) (0.245) (0.180)

0.115 log Price P.
(0.154)

R^2 = .8251 $\bar{R}^2$ = .7813 Std. Error of Estimate 0.0539

d = 1.689

d = Durbin-Watson Statistic

Parenthesis contain the standard error

Degree of freedom 15.

These results indicate that the price elasticity of demand for fresh whole plums is -.692. This degree of inelasticity resembles very closely that found above for process-type plums and contradicts the belief of one retailer who believed that lower prices would result in an increase in total returns to the industry.

As was the case for the process-type plum results, the cross elasticities are irrelevant.

According to the degree of price inelasticity, a policy including a slight increase in prices should increase total returns to the industry. However, such a policy would result in a reduced volume of sales.

Factors Affecting F.O.B. Prices of Northwestern Canned Purple Plums

An analysis of factors affecting f.o.b. prices of Northwestern canned plums is made here because the Michigan price is believed to be closely related to that of the Northwest's and data on Michigan prices are not available.[3] Retailers indicate that the delivered price of Michigan canned plums to Michigan retail stores is only slightly less than the delivered price of Northwestern canned plums. Realizing that Northwestern plums encounter a high transportation cost, it is likely that Michigan's f.o.b. price for canned plums is slightly above the Northwestern f.o.b. price. It is also believed that an explanation of the variables causing price variations in Northwestern plums will also explain much of the variation in Michigan canned plum prices. This analysis then, attempts to aid Michigan processors by selecting from all the variables that have been mentioned those variables that significantly affect the price.

The supply of plums available for canning depends upon a number of characteristics. To begin with, the total U.S.

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[3]The smallness of Michigan's canned plums industry in the past is perhaps part of the reason for Michigan prices not being recorded.

supply of plums is usually fixed in any one year just prior to harvest. Even if prices were to increase to several times the original price, no more plums could be grown that year. Fertilizer, irrigation and prunning practices could increase the supply in the year following a price increase but new trees would take five years to start bearing and approximately ten years to approach maturity. Although the total supply of plums available in any one year is usually fixed, not all purple plums go into processing. The fresh market handles between 50 and 70 percent of the supply depending upon the production level in any one year. However, total annual production is expected to be one major variable as it provides an upper limit to the available supply.

Another measure of plum supply is the total U.S. pack of canned purple plums. It is this measure that reports exactly what quantity of the total supply has been canned in any one year. When the values for this variable become available, it is too late to make any changes in the supply of canned whole plums. Because this variable is a measure of supply it was tested to determine how important it is in explaining price variations. As total pack and total production are closely correlated only one variable will eventually be used, however it is important that the most significant variable be used.

Because this analysis involves Northwestern f.o.b. prices, the total U.S. supply variable was divided into a Northwestern supply variable and a Michigan supply variable. It was thought that Northwestern plum production, by itself,

might explain more of the variation in price than if Michigan's production was included as is the case with the total U.S. supply variable. If the Northwestern variable is more significant than the total U.S. supply variable, it would indicate that historically Michigan production has not been an important variable in determining Northwestern plum prices.

Carryin of canned plums is, according to processors, also a supply variable affecting the price of plums. Carryin, the quantity of canned plums in storage when the new crop is about to be packed, becomes part of the available supply and is expected to be inversely related to the price.

Income, in the form of real disposable and as a disposable income index, was checked as a variable that may explain some of the variation in price. Price is expected to vary directly with income.

Population is a variable affecting the demand for plums and hence the price of plums. As population increases, assuming per capita consumption remains constant, the demand for purple plums and hence the price is likely to increase. Thus the relationship is expected to be positive.

And finally, industry sources mentioned that competing fruits such as peaches, pears, apricots, apples and fruit cocktail have an ffect on the price of canned plums. Each of the competing fruits was tested individually be using the quantity packed during the year and their combined effect was tested by constructing a weighted price index.

The variables of supply, income, population and competing fruit, described above, represent the quantifiable variables

which are believed accountable for much of the variation in the price of Northwestern canned purple plums. The extent of their accountability was estimated using ordinary least squares regression. Results from these estimates are reported below in three equations which numerically relate the more significant variables.

Equation (1)

$$(\log Pf) = .4654 - \underset{(0.465)}{0.2676}\ (\log N) - \underset{(0.033)}{0.0786}\ (\log C) + \underset{(0.017)}{0.3919}\ (\log U \quad \underset{(0.199)}{}$$

$R^2 = .9010 \quad \bar{R}^2 = .8774$ Std. Error of Estimate = 0.0214

$d = 1.55$

Equation (2)

$$(\log Pf) = 1.1418 - \underset{(0.147)}{0.2707}\ (\log N) - \underset{(0.033)}{0.0801}\ (\log C) + \underset{(0.017)}{0.0952}\ (\log \quad \underset{(0.049)}{}$$

$R^2 = .9017 \quad \bar{R}^2 = .8774$ Std. Error of Estimate = 0.0214

$d = 1.55$

Equation (3)

$$Pf = 0.3454 - \underset{(1.420)}{0.0019}C - \underset{(0.000)}{0.0012}T + \underset{(0.000)}{0.0376}U \quad \underset{(0.008)}{}$$

$R^2 = .8929 \quad \bar{R}^2 = .8571$ Std. Error of Estimate = 0.2549

$d = 1.997$

d = Durbin-Watson Statistic

Standard errors are set out in parentheses.

Where:

Pf = price in dollars per case of 24 #2 1/2 cans of choice N.W. canned purple plums (f.o.b. Northwestern processing plants) Table 31, Col. 1.

Table 31. Actual and Estimated F.O.B. Prices and Their Differences for Canned Choice N.W. Purple Plums in Cases of 24, No. 2 1/2 Cans. (1954-1969 for Equation 1 and 2, 1957-1969 for Equation 3).

Mktg. year June-May	Actual(a) Price	Est.Price(b) Equa. 1	Diff.(b) actual-est. 1	Est. Price(c) Equa. 2	Diff. actual minus Est. 2(c)	Est. Price Equa. 3(d)	Diff. actual minus Est. 3(d)
			---dollars per case---				
1954	4.20	4.38	-.18	4.41	-.21		
1955	4.08	3.89	.19	3.91	.17		
1956	3.93	3.88	.05	3.89	.04		
1957	4.03	4.15	-.12	4.16	-.13	4.11	-.08
1958	5.03	5.08	-.05	5.09	-.06	5.08	-.05
1959	4.52	4.34	.18	4.32	.20	4.55	-.03
1960	6.20	6.12	.08	6.11	.09	6.24	-.04
1961	5.39	5.50	-.11	5.48	-.09	5.26	.13
1962	4.18	4.32	-.14	4.28	-.10	4.22	-.04
1963	5.37	5.02	.35	4.98	.39	4.74	.63
1964	4.65	4.45	.20	4.42	.23	4.75	-.10
1965	4.34	4.64	-.30	4.63	-.29	4.57	-.23
1966	4.49	4.77	-.28	4.77	-.28	4.63	-.14
1967	4.62	4.82	-.20	4.83	-.21	4.77	-.15
1968	6.00	5.91	.09	5.95	.05	6.11	-.11
1969	5.10	4.79	.31	4.83	.27	4.89	.21

Source: (a) Canning trade, simple 12 month, June-May average of 1st report of each month[a] (except 1955 where the monthly price for Sept., Nov., Dec., Jan., Feb., Mar., Apr., and May is the price for N.W. fancy in 2 1/2 cans minus 50 cents per case. The same applies for June, July, and Aug. of 1956. The monthly price used for Sept. and Oct. of 1956 was the mean price of that reported).

(b) Estimates and differences using Equation 1.

(c) Estimates and differences using Equation 2.

(d) Estimates and differences using Equation 3.

[a]To determine whether weighing by shipment would improve on f.o.b. prices, the years 1961-1969 were weighed for the shipping periods of June 1-Nov. 1, Nov. 1-Jan. 1, Jan. 1-Apr. 1, Apr. 1-June 1, using a simple average of the monthly prices in each period times the shipments per period. The difference between the wt'd. and unweighed prices for eight of the years was less than 2 cents per case. The other year had a 9 cent difference. Since it is difficult to obtain shipments for the years prior to 1961, this analysis has used the simple unweighed averages.

C = Carryin stocks (June 1) of all canned purple plums converted to #2 1/2 basis in terms of cases of 24 (000's of cases). Table 32, Col. 1.

N = Total Northwest purple plum production (000's of tons) Table 32, Col. 2.

U = U.S. population as reported on January 1st, The Handbook of Basic Economic Statistics (by the Economic Statistics Bureau) millions, Table 32, Col. 4.

D = U.S. disposable personal income (1947-48 - 1949-50 = 100). Table 32, Col. 5.

T = Total annual U.S. purple plum pack of all sizes converted to a #2 1/2 basis (000's of cases of 24) Table 32, Col. 3.

Usually only one equation would be needed to report the findings, but in this case the available data did not yield consistent results when slight changes were made in the data. Equations one and two, although equally efficient in explaining canned plum price variation, were made necessary by the fact that the variables of population and income were both found to be significant variables but incompatible (highly correlated) in the same equation. Their inclusion in one equation resulted in very high variances and covariances of the $\hat{B}$'S ($\hat{B}$=estimated regression coefficient). Equation three differs from equations one and two in that it uses only the last thirteen years from 1957-1969. This shorter period was used because the data for the years 1955 and 1956 had to be adjusted as described in Table 31. Equation three might still

Table 32. F.O.B. Prices of Northwestern Canned Purple Plums

Marketing year	Total carryover of canned purple plums, June 1 choice, #2 1/2 basis	Total N.W. purple plum production	Total U.S. purple plum pack, all sizes (#2 1/2 basis)	Total U.S. population on Jan. 1 of next year	Index U.S. disposable personal income
	000's of cases	000's of T	000's of cases	millions	index
1954	330	70.3	1706	164.6	140.4
1955	501	99.8	1698	167.5	151.1
1956	525	102.0	2330	170.6	160.0
1957	783	72.0	1077	173.5	165.8
1958	197	52.3	1271	176.4	174.7
1959	260	89.1	1701	179.4	182.6
1960	276	24.7	374	182.3	188.2
1961	38	67.7	1637	185.3	199.5
1962	382	86.3	2060	188.2	208.9
1963	736	41.6	1170	190.9	222.9
1964	568	71.6	1497	193.5	240.5
1965	562	62.7	1729	195.8	262.4
1966	733	53.2	1488	198.0	280.8
1967	462	59.7	1858	200.2	301.4
1968	518	27.3	731	202.3	322.7
1969	251	75.0	2209	204.4	350.2

Footnotes: or Sources:

Col. 1 National Canners Association Monthly Reports (1954-57 from Canner Packer)

Col. 2 Fruits noncitrus by States, Production, Use, Value: Annual Reports

Col. 3 Same as Col. 1

Col. 4 Current issue, the Handbook of Basic Economic Statistics (by the Economic Statistics Bureau)

Col. 5 Based on income data reported in the current issues of Economic Indicators, (Council of Economic Advisors) expressed as percentages with 1947-48 to 1949-50 = 100. (Billions of dollars).

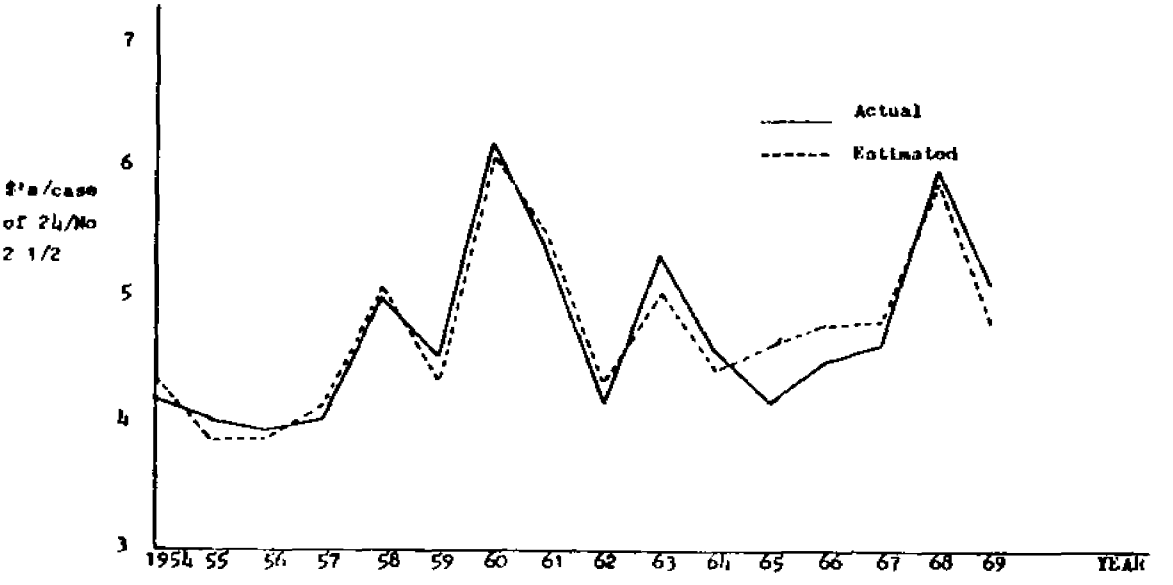
not have been necessary had it yielded the same variables as equations one and two. However, the significant supply variable in equation three differs from that in equations one and two. The fact that equation one analyzes a more recent period in which improved transportation and Michigan production became significant, may account for the appearance of a different supply variable.

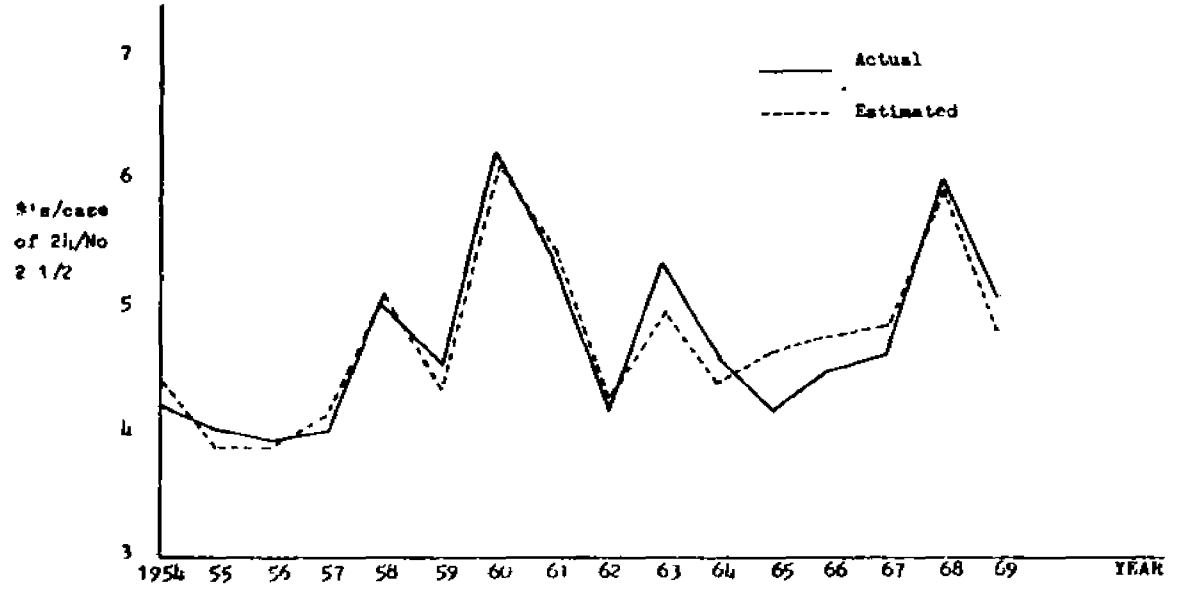
All equations were run using data in the log and non-log form. Only the most significant results are reported below. These results indicate that all three equations are approximately equally adept at explaining approximately 90 percent of the variation in Northwestern f.o.b. price of canned purple plums. For example, equation one has an R^2 of .893 indicating that the three variables of carryin, total pack and population together account for 89.3 percent of the variation in the annual average price of canned plums. Because of their high intercorrelation, the variables of population and disposable income appear to be interchangeable without any explanatory loss. Actual f.o.b. prices and the estimated prices using these equations are presented in Table 31 (p. 147).

The accuracy of these equations may be seen by observing the actual and estimated values plotted in graphical form (Figures 8, 9, 10). The fact that the estimated values follow the actual values very closely for each equation illustrates the accuracy referred to above.

Figure 8. No. 2 1/2 heavy syrup pack purple plums: Actua
and estimated f.o.b. processor prices (N.W.) by
years 1954-1969 Equation 1.

Figure 9. No. 2 1/2 heavy syrup pack purple plums: Actua
and estimated f.o.b. processor prices (N.W.) by
years 1954-1969 Equation 2.


$'s/case
of 24/No
2 1/2
7
6
5
4
3
Actual
Estimated
1954 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69
YEAR


$'s/case
of 24/No
2 1/2
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Actual
Estimated
1954 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69
YEAR

Figures 8, 9

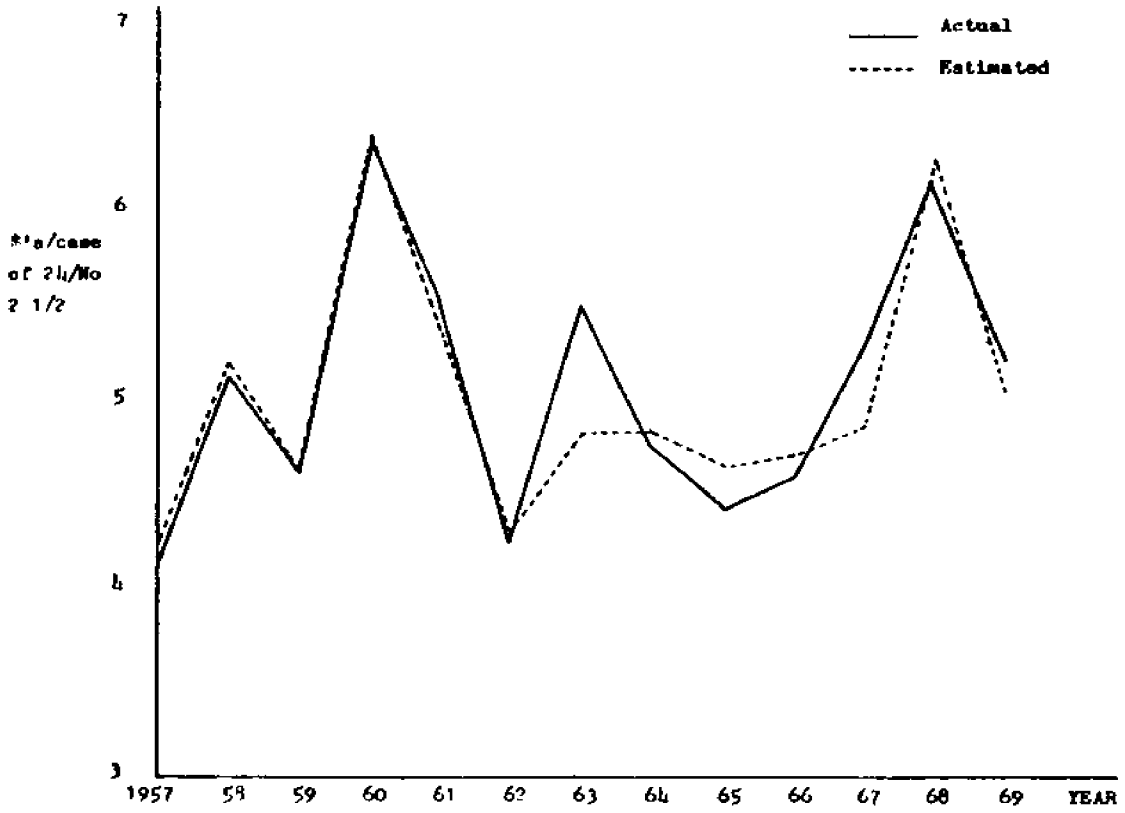

Figure 10. No. 2 1/2 heavy syrup pack purple plums: Actual and estimated f.o.b. processor prices (N.W.) by years 1957-1969 Equation 3.

Only one variable, carryin, appears as a significant variable in all three equations. This is expected as carryin represents a previous commitment by processors. As expected, carryin varies inversely with the price--higher stocks associated with lower prices and lower stocks with higher prices.

Total Northwestern plum production and total U.S. plum pack proved to be the significant variables representing the current supply of purple plums. Total Northwestern production was the significant variable for the equations representing the earlier data. This is logical in view of the fact that Michigan's production was not very important in the years of 1954, 1955 and 1956, and when these years were added to the data they weighed the data in favor of the earlier period. However, with Michigan's production becoming increasingly significant, and with the three earlier years being dropped, total U.S. pack became the significant supply variable in Equation 3.

Although industry sources mentioned competing fruit as a significant market variable affecting price, the regression results did not support this hypothesis. None of the competing fruits tested proved to be significant in explaining variations in the f.o.b. price of canned plums. One reason for this unexpected result may be that consumers treat plums as a specialty product, buying it occasionally, regardless of the availability or price of other fruits.

An example, using current values of the independent, price-determining variables will best illustrate the use of

these equations to predict the price of plums for a given year. Values for 1970 have become available including the actual f.o.b. price of choice Northwestern canned purple plums. The actual f.o.b. price is $5.46 per case of 24 No. 2 1/2 size cans. The total carryover as of June 1 for the marketing year 1970 was 917,000 cases. This value was available prior to the 1970 processing season from the National Canners Association bulletin. While the actual value for total Northwest production in 1970, of 36,850 tons is used in this example, estimates may be obtained from the U.S. Department of Agriculture crop estimates and used in the equations to provide an estimate of the future price. Total U.S. purple plum pack data is not available prior to the processing season, thus making Equation 3 less useful as a predictive indicator prior to processing commitments, but is available soon after the end of the season providing processors with a means of estimating what they can expect to receive as an average price for their product over the entire marketing season. In this example the total pack of 840,000 cases for 1970 is available for use. A population value of 206 million people and an income index value of 372.1 are available prior to processing and are used here.

Remembering that the actual average price in the 1970 marketing year was $5.46 the three equations yielded the following results:

Equation 1

Price= .4654 - 0.2676 (log 36.85) - 0.0786 (log 917) + 0.3919 (log 206.0)

= .4654 - 0.2676 (1.56644) - 0.0786 (2.96237) + 0.3919 (2.31175)

= .4654 - .41917 - .23284 + .90597

= .71936

= $5.24

Equation 2

Price= 1.1418 - 0.2707 (log 36.85) - 0.0801 (log 917) + .0952 (log 372.1)

= 1.1418 - 0.2707 (1.56644) - 0.0801 (2.96237) + .0952 (2.57066)

= 1.1418 - .42403 - .23728 + .24472

= .72521

= $5.31

Equation 3

Price= 0.3454 - 0.0019C - 0.0012T + 0.0376U

= 0.3454 - 0.0019(917) - 0.0012(840) + 0.0376(206)

= 0.3454 - 1.7423 - 1.0080 + 7.7456

= $5.34

As was expected, all three equations estimated a price very close to that actually realized (which was $5.46). Equation 3, although not of use prior to processing commitments, provided the nearest estimate. However, all three estimates are within an acceptable range and would be of value to processors as an estimate of future income.

By using new data for each year, as it becomes available, processors may use these equations to help them decide on pack size and/or to estimate gross income from the product

already packed. Naturally these equations cannot be expected to estimate the price exactly, as some variables may be excluded. These excluded variables in normal years might have very little effect on prices but occasionally they may force an adjustment. For example, if quality were extremely poor in a particular year, people using the equation would have to make adjustments without the help of the equation as quality is not a separate variable in the equations.

Factors Affecting Purple Plum Marketing at the Grower Level

Some debate exists as to whether Michigan growers are confronted by a single market or by two separate markets. Those fresh packers and processors supporting the single market theory say that growers may sell to either the fresh or processing market depending upon the quality and size of a growers crop at harvest. However many fresh packers argue that growers wishing to sell in the fresh market must commit themselves early in the season, have adequate size, follow a detailed spraying schedule and pick at a specific maturity. Some processors also argue that plums picked for the fresh market do not make top quality canned whole plums.

One study by Canute A. McLean attempted to explain the variation in average prices received for all plum sales with the following equation.[4]

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[4]Canute A. McLean, Price Analysis, and Alternative Methods of Marketing Plums in Michigan (unpublished M.S. paper, Michigan State University, 1970).

$P_f = 111.82480 - 4.27542\ A - 0.34877\ B + 0.94039\ C$

$R^2 = .83$

where:

P_f = Michigan growers price of plums for all sales at the farm level in dollars per ton.

A = Michigan plum production in 1000 tons.

B = Plum production of the Northwestern states plus canners carryover stock expressed as fresh equivalent (1000 tons).

C = U.S. apple growers price for canning and freezing sales, expressed in dollars per ton.

McLean found that the variables of Michigan plum production, U.S. apple growers price for canning and freezing apples, and Northwestern purple plum production combined with canners carryover stock expressed in fresh equivalents, accounted for approximately 83 percent of the variation in the average price received by Michigan growers for all plum sales. Using this equation, McLean indicated that if the Northwest production plus carryover reaches 68,200 tons when Michigan production is 21,900 tons and the U.S. apple price is $47.00 per ton, the average price received by Michigan growers for all plum sales would reach a low of $38.61.[5] Although his equation does not account for inflation, such a price is lower than any price

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[5]Canute A. McLean, Price Analysis, and Alternative Methods of Marketing Plums in Michigan (unpublished M.S. paper, Michigan State University, 1970), p. 34.

experienced by growers in the past. Because this price would be significantly below the cost of growing a ton of plums as reported in Chapter IV, and mean that many growers would lose large sums of money, it is very important that the estimate be as exact as possible. For this reason and because a number of industry people expressed the belief that two markets exist, an attempt is made at explaining the variation in prices encountered in both the fresh and processed markets using separate equations.

Since demand at the grower level is derived demand, the same factors apply as were tested in the previous section dealing with the f.o.b. price of canned whole plums. For this analysis the supply variable was tested in the form used in the last section as well as being broken into two separate variables of fresh and processing supply. Competing fruit were tested using the price paid to growers. As was the case in previous sections, equations were run using log and non-log data with only the most significant equation reported herein.

Fresh Plums

According to Equation 4, grower prices for fresh plums are determined to a large degree by the total Northwest fresh supply of purple plums, Michigan total purple plum production, U.S. population and the price paid to U.S. apple growers for canning and freezing sales. Relationships were estimated for the years 1957-1969.

Equation 4

$$P_f = -140.7191 - 1.6683X_2 - 8.3193X_3 + 1.8071X_4 + 1.2144X_5$$
$$\quad (82.729) \quad (0.000) \quad (1.529) \quad (0.561) \quad (0.321)$$

$R^2 = .9492$ $\bar{R}^2 = 0.9237$ Std. Error of Estimate= 6.6146 d=2

d = Durbin-Watson statistic

Standard errors are set out in parentheses

Where:

P_f = price in dollars per ton received by growers for purple plums sold on the fresh market. (Table 34, Col. 1)

X_2 = total Northwest fresh supply of purple plums (000's of tons) (Table 33, Col. 2).

X_3 = Michigan total purple plum production (000's of tons). (Table 33, Col. 3).

X_4 = U.S. population as reported on January 1st by the Council of Economic Advisors (millions) (Table 33, Col. 4).

X_5 = U.S. apple growers price for canning and freezing sales (dollars per ton) (Table 33, Col. 5).

Results from Equation 4 show the extent of the influence of each of the significant variables. As might be expected, Michigan's total production has the greatest influence, as a one thousand ton increase in production will result in a reduction in grower price of $8.14 per ton. Although of less significance, the Northwest supply of fresh plums, likewise, adversely affects grower prices to the extent that a one thousand ton increase in this supply variable is associated with a price reduction of $1.70 per ton. Each of the other two variables, population and U.S. apple growers price, were positively related to grower

Table 33. Data for Grower Price Analysis, 1957-1969.

Marketing year June-May	Total N.W. Purple Plum Production (000's of tons)	Total N.W. Fresh Plum Supply (000's of tons)	Total Michigan Purple Plum Production (000's of tons)	Total U.S. Population on Jan 1 of Next Year (millions)	Grower's Price for Canning and Freezing Apples U.S. Average (dollars/ton)
1957	72.0	37.9	7.3	173.5	44.50
1958	52.3	31.7	7.8	176.4	35.80
1959	89.1	42.3	6.8	179.4	42.80
1960	24.7	19.3	8.0	182.3	57.40
1961	67.7	31.7	9.0	185.3	44.00
1962	86.3	34.3	8.0	188.2	49.20
1963	41.6	25.4	10.5	190.9	56.00
1964	71.6	29.6	14.5	193.5	43.40
1965	62.7	30.7	11.5	195.8	54.80
1966	53.2	26.5	13.0	198.0	57.60
1967	59.7	27.6	15.0	200.0	70.40
1968	27.3	20.4	13.0	202.3	75.30
1969	75.0	33.2	14.5	204.4	58.30

Source: Col. 1 Fruits Noncitrus by States Production, Use, Value: Annual Reports.
Col. 2 " " " " " " " " .
Col. 3 " " " " " " " " .
Col. 4 Current Issues, The Handbook of Basic Economics Statistics (by the Economic Statistics Bureau).
Col. 5 Season Average Price for Canning and Freezing Apples, United States, SRS, USDA.

Table 34. Actual and Estimated Prices Paid to Growers for Purple Plums Sold Fresh and Sold for Processing (dollars per ton).

Marketing Year June-May	Michigan Grower Fresh Price	Estimated Grower Fresh Price	Difference Actual Minus Estimated (Fresh)	Michigan Grower Process Price	Estimated Grower Process Price	Difference Actual Minus Estimated Process
1957	98.00	102.91	-4.91	65.00	71.94	-6.94
1958	105.00	103.69	1.31	63.00	69.94	-6.94
1959	110.00	108.39	1.61	82.00	80.04	1.96
1960	155.00	159.69	-4.69	119.00	110.85	8.15
1961	124.00	119.78	4.22	81.00	71.67	9.33
1962	134.00	135.30	-1.30	81.00	83.74	-2.74
1963	145.00	142.57	2.43	99.00	83.68	15.32
1964	92.00	91.73	0.27	50.00	48.97	1.03
1965	143.00	132.82	10.18	75.00	73.60	1.40
1966	130.00	134.74	-4.74	68.00	71.37	-3.37
1967	142.00	135.80	6.20	71.00	67.25	3.75
1968	174.00	174.12	-0.12	87.00	100.84	-13.84
1969	113.00	123.47	-10.47	62.00	64.81	-2.81

Source: Col. 1 Noncitrus Fruit Prices, By States and United States.
Col. 2 Estimated from Equation 4.
Col. 3 Column one minus column two.
Col. 4 Noncitrus Fruit Prices, By States and United States.
Col. 5 Estimated using Equation 5.
Col. 6 Column four minus column five.

prices--an increase in population of one million is associated with a $1.81 per ton increase in growers price and a $1.00 per ton increase in apple growers price is associated with a $1.21 per ton increase in plum prices.

The appearance of U.S. apple grower price as a significant variable in Equation 4 requires further explanation. Apples are marketed in Michigan at about the same time as purple plums providing direct competition for the consumers fresh fruit dollar and the fresh packer's space. Applesauce also competes with canned purple plums. This is the logic used to explain the appearance of apple grower price as a significant variable in explaining the price received by growers for plums sold to the fresh or to the processing market.

Population as a variable in this equation includes some income and time effects. Because income and population are closely correlated, both could not be included. As for time trend, when tested as a separate variable it was not significant, but what little effect it has will be lumped in with the population coefficient.

An R^2 (coefficient of multiple determination) of .949 indicates that the four independent variables of total Northwest supply of fresh plums, total Michigan production, U.S. population, and the U.S. apple growers price for canning and freezing sales explain 94.9 percent of the variation in the dependent variable, which in this case is the grower price of fresh plums. This R^2 value of .949 indicates a high degree of accuracy which may be observed by comparing the actual values

with those estimated using Equation 4. This comparison is illustrated in Figure 11 and reported in Table 34. As can be seen in Figure 11 the estimated prices are very close to the real prices experienced in the market.

An equation with as high an R^2 as that found in Equation 4 could be expected to be particularly effective in predicting future prices if the same relationships between the independent and dependent variables continue to hold. Using 1970 data, which has just become available, it is possible to determine how reliable Equation 4 would have been for 1970. Then using production projections for 1975 and estimates for the other variables it is possible to predict what growers can expect in the way of prices in 1975 if present market relationships continue.

1970 Estimate:

The following values were used for the independent variables in Equation 4. Total Northwest fresh production of 21.3 thousand tons, total Michigan production of 10,000 tons, a population value of 206 million and a U.S. apple growers price of $48.80 per ton. These are all actual values. Most predictions would use estimates as will be the case for the 1975 example.

$$\text{Price Fresh} = -140.7191 - 1.6683X_2 - 8.3193X_3 + 1.8071X_4 + 1.2144X_5$$

$$= -140.7191 - 1.6683\ (21.3) - 8.3193\ (10) + 1.8071\ (206) + 1.2144\ (48.80)$$

$$= -140.7191 - 35.5348 - 83.193 + 372.26 + 59.26$$

$$= \$172.07$$

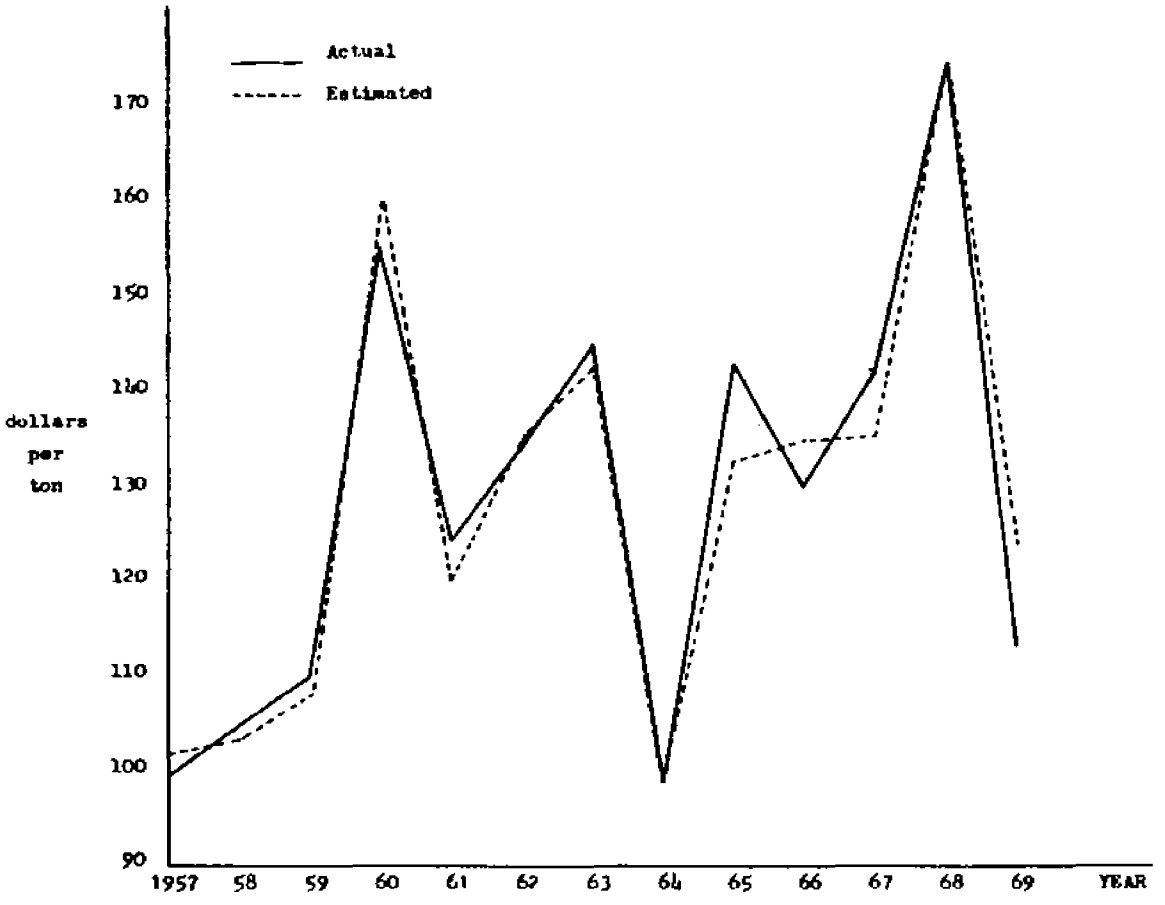

Figure 11. Fresh Market Plums: Actual and estimated price received by growers 1957-1969.

According to Equation 4, the estimated price could be $172.07 per ton when in fact the actual price for 1970 was $150.00 per ton. This difference may be partially explained by the unusual year. In 1970 there was an extremely short supply of plums accompanied by a very big supply of apples. As a result, the U.S. apple growers price was very low, providing some incentive for consumers to switch to apples in preference to expensive plums.

Results using 1970 data indicate the importance of considering factors other than those included in the equation. In this case, other factors included an unusually low supply coupled with an unusually low apple price and the fact that Michigan producers will require a larger share of the market if they are to market all they produce in the next few years.

1975 Estimate:

Equation 4 may be used to predict what the price of plums might be in 1975 if present market conditions hold. The 1975 price using Equation 4 is as follows: Using a projected production level for the Northwest of 71,000 tons (Chapter III) and assuming that, as in the past, half the crop will be sold fresh, then the value for the variable X_2 will be 35.5 thousand tons. Michigan's total production according to Table 18 is expected to be approximately 39,000 tons which is the value used for favorable X_3. The population in 1975, if it continues to gain at approximately 2 million per year, will be approximatel 216 million. And according to Tomek[6] an apple price of $68.00

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[6]William G. Tomek, Apples in the U.S.: Farm Prices and Uses, 1947-1975, Cornell University Agricultural Experiment Station, New York, State College of Agriculture, N.Y., July 1968.

per ton will prevail. Using these values and Equation 4 the estimated 1975 price is a negative $51.48 as shown below:

$$\text{Price Fresh} = 140.7191 - 1.6683X_2 - 8.3193X_3 + 1.8071X_4 + 1.2144$$

$$= 140.7191 - 1.6683(35.5) - 8.3193(39) + 1.8071(216) + 1.2144(68)$$

$$= 140.7191 - 59.2246 - 324.4453 : 390.3336 : 82.5792$$

$$= -\$51.48$$

A negative price for purple plums is unrealistic and will not occur. However, what this example illustrates is that under current market conditions not all of Michigan's supply can be marketed at realistic prices. This means that the quantity marketed will have to be reduced until the price reaches $25.08 which was established in Chapter IV as the harvesting cost per ton for an average producer, and/or programs to expand the demand will have to be effective.

Supply restriction and other alternatives to this problem are discussed in Chapter VIII.

Plums Sold for Processing

Total Northwest purple plum production, Michigan purple plum production, U.S. population and the U.S. apple growers price for canning and freezing sales account for 83 percent of the variation in prices received by Michigan growers for plums sold for processing (Equation 5). Relationships were estimated for the year 1957-1969.

Equation 5

$$(\log p_p) = \underset{(4.0143)}{-4.3656} - \underset{(0.1073)}{0.2512}\ (\log x_1) - \underset{(0.2937)}{1.0369}\ (\log x_3)$$
$$+\underset{(2.0667)}{3.0797}\ (\log x_4) + \underset{(0.3289)}{0.4173}\ (\log x_5)$$

$R^2 = 0.8305$ $\bar{R}^2 = 0.7457$ Std. Error of Estimate = 0.0488

d = 1.73

d = Durbin-Watson statistic

Standard errors are set out in parentheses

Where:

P_p = price in dollars per ton paid to growers for purple plums sold for processing (Table 34, Col. 4).

X_1 = total Northwest purple plum production (000's of tons). (Table 33, Col. 1).

X_3 = Michigan total purple plum production (000's of tons) (Table 33, Col. 3).

X_4 = U.S. population as reported on January 1st by the Council of Economic Advisors (millions) (Table 33, Col. 4).

X_5 = U.S. apple growers price for canning and freezing sales (dollars per ton) (Table 33, Col. 5).

With the exception of total Northwest production, which replaces total Northwest fresh supply of purple plums, Equations 4 and 5 are similar with respect to the variables included. Substitution of total Northwest production for total Northwest fresh supply is a logical change as processing represents a

residual market where supply depends on the entire supply and not just that portion suitable for the fresh market. If the fresh market wasn't available, growers could pick their plums later and sell them for processing. A similar explanation to that provided for the variables in Equation 4 holds for the variables in this equation.

Results from Equation 5 appear in Table 34 and are illustrated in Figure 12. Both the Table and the Figure show that Equation 5 was able to explain less of the price variation in grower price for processing than did Equation 4 in explaining the grower price for fresh plums. Despite being less efficient, the variables in Equation 5 account for 83 percent of the variation in price.

As was the case with Equation 4, Equation 5 may be used to predict future prices, assuming that current market conditions hold. Hence, Equation 5 will be used with actual data to indicate what the price would have been in 1970, then estimates will be used to indicate the price for 1975. Similar data sources and data are applicable from the examples using Equation 4. The results for these two examples are as follows:
1970 Estimate:

The values used are 36.8 thousand tons for total Northwest production, 10.0 thousand tons for Michigan production, a population of 206 million and an apple price of $48.80.

$$\log P_p = -4.3656 - 0.2512 (\log x_1) - 1.0369 (\log x_3) + 3.0797 (\log x_4) + 0.4173 (\log x_5)$$

$$= -4.3656 - 0.2512 (\log 36.8) - 1.0369 (\log 10) + 3.0797 (\log 206) + 0.4173 (\log 48.80)$$

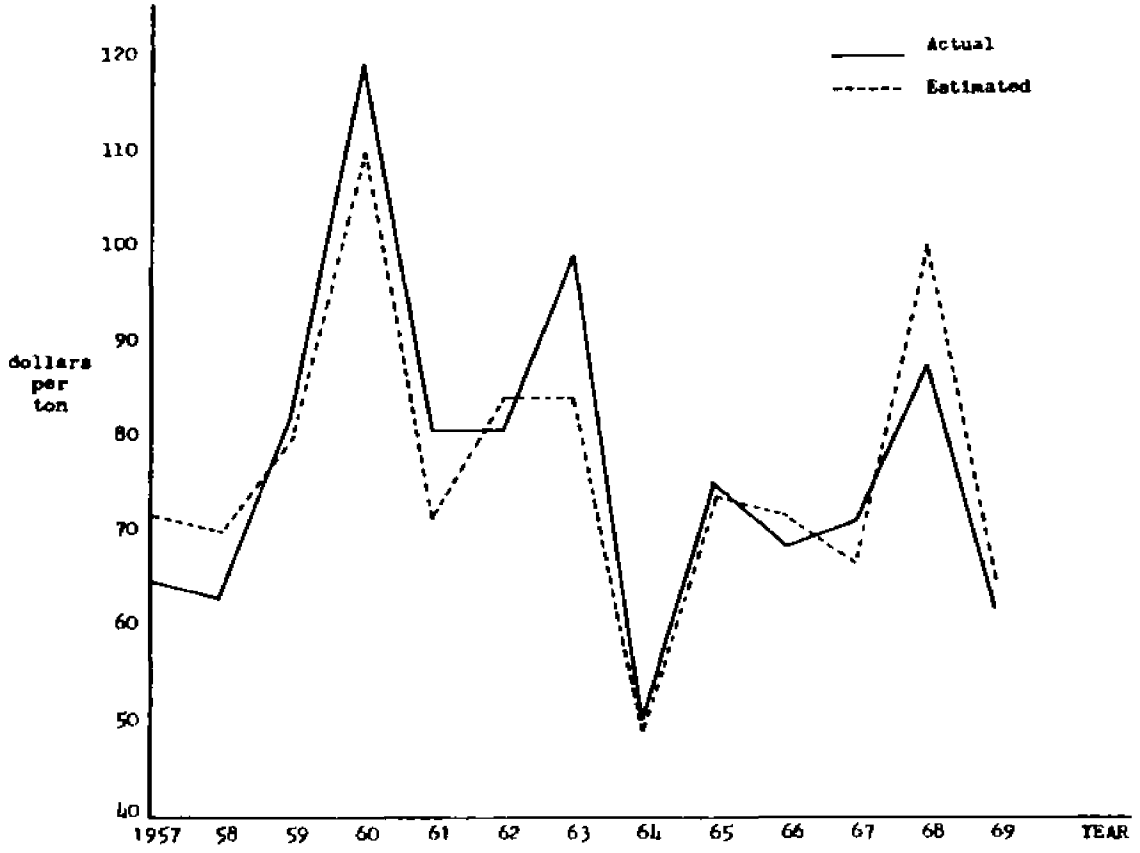

Figure 12. Processing Market Plums: Actual and Estimated price received by growers 1957-1969.

$$= -4.3656 - 0.2512\ (1.5658) - 1.0369\ (1.0000) + 3.0797\ (2.3139) + 0.4173\ (1.6812)$$

$$= -4.3656 - .3933 - 1.0369 + 7.1257 + .7016$$

$\log P_p = 2.0315$

Price = $107.50

According to Equation 5, the grower price should be $107.50 per ton when, in fact, it was $104.00 per ton. This estimate for the 1970 grower price for processing is much closer to the actual price than was the 1970 fresh price estimate in the previous section. The result is in spite of the fact that Equation 4 historically explained more of the variation in prices than did Equation 5. Consequently, the reader is advised to keep in mind that a higher R^2 does not always result in a better estimate. In this particular situation the four variables included had a greater than usual effect on processing price, hence the estimate was very close to the actual.

1975 Estimate:

Values used for this estimate include 71 thousand tons for total Northwest production, 39 thousand tons for Michigan production, a population value of 216 million and an apple price of 68 dollars per ton.

$$\log P_p = -4.3656 - 0.2512\ (\log 71) - 1.0369\ (\log 39) + 3.0797\ (\log 216) + 0.4173\ (\log 68)$$

$$= -4.3656 - 0.2512\ (1.85126) - 1.0369\ (1.59106) + 3.0797\ (2.33445) + 0.4173\ (1.8325)$$

$$= -4.3656 - 0.4684 - 1.6498 + 7.1894 + 0.7647$$

$\log P_p = 1.47030$

Price = $29.50

According to Equation 5, prices for plums sold for processing will be $29.50 per ton if present market conditions continue as they are and the estimated values for each variable materialize. If the price offered for fresh plums declines below $29.50, many fresh growers will likely direct their plums to the processing market, thus the price may drop below $29.50 per ton. It is noted here that the two market theory analyzes a historical period in which the percent sold on the fresh market remained fairly constant. If low fresh prices resulted in large quantities, that could normally be marketed on the fresh market, entering the process market, this equation would likely be much less accurate. This may occur under the supply conditions predicted for 1975, thus making this estimate of $29.50 inappropriate.

Summary

Results from using a two Stage Least Squares (2SLS) regression model on the demand for fresh and process type fruit indicate that both forms of purple plums are relatively price inelastic. The price elasticity of demand for process type plums was found to be -.722 while the value for fresh plums was -.692. These values show that sales of purple plums in either fresh or processed form respond very little to price changes.

Total Northwest production, total U.S. pack, carryin, population and disposable income were all found to be significant variables in explaining the f.o.b. price of Northwestern canned purple plums. Not all of these variables appear in the same explanatory equation because of their high intercorrelation. When the variables of total Northwest production and carryin were combined with either population or income, but not both, they accounted for slightly more than 90 percent of the variation in price. Substituting total U.S. pack for total Northwest production in combination with the variables of carryin and population explained approximately 89 percent of the variation in price.

Although this study is mainly concerned with Michigan f.o.b. prices, the lack of price data made a similar analysis impossible for Michigan. Analysis of the Northwestern f.o.b. price is justified on the assumption that those variables affecting the Northwestern f.o.b. price would be similar if not the same as the variables affecting Michigan prices.

Despite a belief to the contrary by industry processors, the price or supply of competing fruit was not found to be a significant variable affecting the f.o.b. price of canned whole Northwestern purple plums at the wholesale level.

One final area of price analysis was at the Michigan grower level where two market theories exist. One theory assumes that the fresh and process market are equally available to growers while the other hypothesis supports the idea of two markets recognizing that fresh market growers could delay

harvest and enter the process market. This second hypothesis suggests that the fresh market is not usually available to process type growers.

Price analysis of each theory found variables that explained 83 percent of the variation in Michigan grower price received for all plums, which represents the one market hypothesis, and variables that explained approximately 95 percent of the fresh price and 83 percent of the process price in the second hypothesis. Michigan plum production, Northwestern plum production plus carryover expressed as fresh equivalents and the U.S. apple growers price for canning and freezing sales were the variables found to be significant in explaining 83 percent of the "one market" price. Michigan production, total Northwest fresh supply, population and the U.S. apple growers price for canning and freezing sales were the significant variables accounting for 94.9 percent of the variation in the grower price of fresh plums while total Northwest production, Michigan production, population and the U.S. apple growers price for canning and freezing sales were the significant variables accounting for 83.0 percent of the variation in grower process prices. Based on the amount of the variation explained using the two market hypothesis, it would appear to be beneficial to use the two market theory.

Assuming that present market conditions hold and using estimates for each of the variables, these two equations from the two market hypothesis indicate that the fresh price in 1975 would be negative if the entire Michigan crop is marketed and that the price for process type plums would drop to

approximately $30.00 per ton. Naturally the fresh price will not become negative as growers would not harvest for less than $25.00 per ton; with a higher and positive process price they would sell on the process market. These predictions infer that not all of Michigan's anticipated production can be marketed at a profitable price under present market conditions.

CHAPTER VIII

ALTERNATIVE APPROACHES TO INDUSTRY PROBLEMS

The Oversupply Problem

Industry participants, as a group, express concern over what affect the impending increase in supply of Michigan plums will have on the industry. While confident that existing facilities can physically handle the increase, they have expressed doubt over the markets' ability to absorb the increase and the resulting effect on prices and returns. They say that the industry has had some difficulty, as evidenced by sharply reduced prices, in marketing large crops in the past when a large crop was between 13,000 and 15,000 tons. With the expected increase in the crop to 21,000 tons or more, they anticipate even greater marketing problems.

The impact of this increase in supply may be illustrated by looking at the effect on grower prices. By assuming a value approximately equivalent to current market conditions for each of the variables in equations four and five of Chapter VII, this impact can be seen. The values used include a population of 210 million, total Northwestern plum production of 60,000 tons, a Northwest fresh plum supply

of 30,000 tons and a U.S. apple grower's price of $50.00 per ton. Three separate production levels will be used for Michigan plum production, which is the other independent variable included in each equation, to provide an estimation of how different levels of production would affect prices. One example is worked out in full detail and the results of the other two production levels are summarized. They are as follows:

A. Where:

P_f = Price to fresh growers

(4) $P_f = -140.7191 - 1.6683X_2 - 8.3193X_3 + 1.8071X_4 + 1.2144X_5$

(1) Where Michigan production equals 18,000 tons

$P_f = -140.72 - 1.6683(30) - 8.3193(18) + 1.807(210) + 1.2144(50)$

$= -140.72 - 50.05 - 149.75 + 379.49 + 60.72$

$= \$98.69$ per ton

(2) Where Michigan production equals 20,000 tons, the price to growers for fresh plums would be $82.05 per ton.

(3) Where Michigan production equals 22,000 tons, the price to growers was found to be $65.42 per ton.

B. Where:

P_p = Price received by growers selling for processing.

(5) $P_p = -4.3656 - 0.2512 \ln X_1 - 1.0369 \ln X_3 + 3.0797 \ln X_4 + 0.4173 \ln X_5$

(1) Where Michigan production is 18,000 tons

$P_p = -4.3656 - 0.2512 \ln(60) - 1.0369 \ln(18) + 3.0797 \ln(210) + 0.4173$

$= -4.3656 - 0.2512(1.7782) - 1.0369(1.2553) + 3.0797(2.3222) + 0.4173(1.6990)$

$= -4.3656 - .44668 - 1.3016 + 7.1517 + .70899$

$= 1.7468 = \$55.82$ per ton

(2) Where Michigan production is 20,000 tons, the price to growers selling process-type plums was found to be $50.05 per ton.

(3) Where Michigan production is 22,000 tons, the price was found to be $45.34.

Growers selling for processing would have their harvest and growing variable costs ($40.00) covered at $45.34 per ton but fresh plum growers could not cover their variable costs, which are $85.00, at the low price of $65.47 per ton (Chapter IV). In this situation some fresh growers might divert their plums to the processing market by allowing them to mature and be mechanically harvested. This would lower prices in the processing market until net returns were equal in each market. In the short run, growers will continue to grow plums as long as there appears to be some chance of prices increasing if variable costs can be covered. However, supply projections indicate that the level of supply under

assumed orchard removal rates will continue at or above these levels for a number of years. According to this cost and price situation, growers could not remain economically viable in the long run.

Indications are that some impact from the increase in supply could be felt in 1971. Tree plantings indicate that large numbers of trees were planted in the period of 1963-1966, which will be reaching maturity in the early 1970's. Meanwhile, supply has been increasing at a fairly steady pace since the early 1960's. Most recent tree surveys indicate that no substantial number of trees have been removed in Michigan because of disease or other reasons. This further substantiates the fact that a significant increase in supply is forthcoming. This increase could easily have occurred in 1970, but weather conditions caused a somewhat lower yield than expected. If the weather permits, the tree numbers and maturity are such that purple plum production in Michigan could reach approximately 21,000 tons in the early 1970's.

There are a number of ways in which the industry might handle this supply. One approach is to do nothing. In this event, prices would fall to a level where some higher cost growers would not only fail to cover their fixed costs but some of their variable costs would not be covered as well. However, because of high fixed costs, the cost of removal and the fluctuating nature of supplies and prices, few growers would likely remove orchards in the short run. Their actions would also depend upon the opportunity costs

involved in leaving the orchard in. A number of growers, for whom the plum enterprise is small and who do not depend on purple plums for a major part of their income, might continue to grow them. However, the producers who rely upon plums as a major part of their operation, unless they were extremely efficient, would be forced out of the plum business as prices dropped to where they could not cover total variable costs in the long run. This approach could force the industry into a cyclical situation where a big supply would drive prices down forcing growers out of the industry. Fewer growers would result in lower supplies and higher prices which in turn might encourage growers to re-enter the industry. A few growers might make a profit from this situation but many growers would incur financial losses. Such an economically unstable industry is not beneficial to the growers nor to the other participants. Two alternative ways of handling the supply problem are analyzed in depth in the following sections.

Supply Management Via Marketing Quotas

The excess supply may be handled with a Michigan or National marketing limitation program which would maintain minimum industry price, increase gross income and reduce price instability. The program would involve controlling the amount of plums marketed so that the market price would not go below a minimum price level. This minimum price would be set by a marketing committee that would consider the cost of production, competition from the Northwest, the

threat of substitutes and other related factors. After the minimum price is set, a quota system, using marketing certificates, could be implemented to control the volume allowed on the market. If a producer did not receive a certificate for a certain portion of his production, he could not market that portion of his production which would usually be left unharvested. This program requires an industry or government agency to police the delivery of purple plums by growers.

Under this type of program, the market price would be paid only for the production allowed on the market. A marketing committee would establish a quota system and set the quantity each year. The committee could alter the quantities right up until harvest time depending upon market and supply conditions.

Market response to the program will vary according to the actions taken. If the minimum price established by the Michigan program is sufficiently high so that growers in other areas can more than cover the transportation costs of moving plums to Michigan, they will do so, raising the available supply in Michigan. This increase in supply will mean lower quotas for Michigan growers or lower prices. Not only would high prices encourage additional supplies, but if passed on to consumers, could, despite an inelastic price elasticity, result in slightly reduced sales of purple plums at the retail level. The threat of an increase in supply from other states and a decrease in sales will serve to keep the program from setting prices that force purple plums to lose

their market. Hence, it is more economically sound to consider a program including Oregon, Washington, Idaho, New York and Michigan.

A program including the five above mentioned states would require organization in each state. At present, only the three Northwestern states are organized with marketing orders. Once Michigan and New York become organized, it would be possible to have all five states work on such a program. One problem of a national program would be market share for each state.

The relationships illustrated in Chapter VII are used here to indicate how price and quantity could be established to maximize total returns to growers. Prices that would cover average total costs according to Chapter IV, in the long run, were used as minimum prices. Equations four and five from Chapter VII were then used to determine what volume of plums could be sold and still maintain prices of $105.00 per ton for fresh and $60.00 per ton for processed plums. These two equations were also used to determine at what production level total returns would be maximized. The total returns were determined by assuming that 40 percent of Michigan's production would be sold on the fresh market and 60 percent at processing prices.[1] The independent variables of the equation were assumed to have the following values: U.S. apple growers price of $50.00 per ton, population of

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[1]These percentages are very close to the average percentages of Michigan's total crop that has gone to each market over the ten years from 1960-1969.

210 million, total Northwest production of 60,000 tons, and a total Northwest supply of fresh plums of 30,000 tons. Results using equations four and five indicate that, under present market conditions, 17,000 tons of Michigan plums would result in a fresh price of $107.06 per ton and a price to growers for process type plums of $59.24 per ton. The results further indicate that gross returns to growers would be maximized at 15,000 tons which would mean a fresh price of $123.70 per ton and a price of $67.44 per ton for processing plums.[2]

Even though a production level of 15,000 tons maximizes revenue, it may not be the best quantity at which to limit marketing. A price of $123.70 per ton for fresh plums and a price of $67.44 per ton for process type plums may encourage supplies from other states or encourage additional plantings within Michigan. On the other hand, marketing 17,000 tons covers the average total cost and returns only a normal profit to growers.

This same program might include a two price system and a quality improvement scheme. In situations where demand elasticities differ, the volume marketed could be adjusted to take advantage of differences in individual markets. At present, a two price system has limited possibilities as the price elasticity of demand for fresh and processed purple plums are

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[2]The difference in price paid for fresh and process type plums is accounted for by the additional cost of $45.00 per ton for marketing fresh plums and the fact that some plums cannot be sold in the fresh market because of their size.

similar. As for quality improvement, once a program is established to limit deliveries, only minor changes are needed to have plums delivered according to a quality criteria. For example, a grower might be allowed to deliver beyond his quota tonnage, all of which would be graded, possibly into several grades, with only the top grades being accepted. Market demand and supply conditions would determine what minimum grade was acceptable.

A program of this type might include a number of stipulations that would discourage growers from continually overproducing. For example, if quotas had to be enforced, the quantity allowed on the market could be set so that the price received per ton only covered slightly more than the average variable cost of harvesting. This stipulation means that growers would not be assured of profits for the plums harvested regardless of the supply. Otherwise, if the quota always guaranteed a profitable return for that quantity marketed, and the possibility of higher returns in other years, it might pay more growers to start producing plums. Covering only the average variable cost of harvest would not be a goal of the program, but rather a preventative position in the event that supplies increase and lead to continual use of the quotas. The goal would be to cover average total costs. Even covering average total costs may result in attracting new plantings especially if other enterprises return less than a normal profit. These factors indicate the difficulty in arbitrarily establishing a market price.

New or expanding growers might be discouraged from planting new orchards by stipulating that quotas may only be filled from mature orchards or orchards planted before a certain date. The definition of a mature orchard could vary depending upon the supply needed and the age of the State's bearing trees. The program could specify that all growers register new plantings. This would keep the program up to date on production possibilities and serve as an indication of when some action might be necessary to limit supply.

In addition to maximizing total short run returns to growers and reducing price instability, this program has a number of other benefits. By allowing growers to produce as many as they wish, it provides a reserve which may be drawn upon until harvest time. This reserve might be used in years when Northwestern production was initially predicted as being high, but resulted in a short supply. Since Michigan harvests later than the Northwest, quotas could be adjusted. The program would also remove the necessity of incurring harvest costs for those plums not covered by market certificates.

Before producers would purposely produce above their quotas, they would have to have some indication that quotas could reasonably be expected to change in mid-season fairly frequently. If quotas rarely changed in mid-season, the added cost of producing, but not harvesting extra fruit would be very unlikely to be covered. A grower would also have to have an orchard that produced good sized fruit in years when

some marginal areas had small sized fruit. The returns to such a program would have to be worked out by individual growers.

A shortcoming of the program is that it does not provide reserves to handle short supply situations. Under this type of program there is no carry-over available for short crop years as there would be with a storage type program. In view of the benefits described above and the fact that the crop has only been in limited supply for two of the last sixteen years, this shortcoming does not appear to be serious.

By including the Northwest and New York, this program could be expanded from the Michigan to the federal level. The major benefit of this expansion is that it would have a greater control over supplies entering the market. Similar problems would arise with respect to new planting and substitutes. Supplies from other regions would be less of a problem under the federal approach.

Legislation drafted and expected to be introduced in the Michigan Legislature and the National Congress, if passed, will authorize the creation of a producers association that can deal with most, if not all, producer problems discussed above. According to this legislation, once a producer organization has the support of a specified percent of the producers or of a specified percent of the total production, it may be recognized as an accredited producer association. An accredited association will have the authority

to manage the supply of that commodity. Such management will include bargaining for prices, terms of sale, quality, quantity and transactions involving products and services utilized by one party and provided to the other party.

One of the major problems removed by this legislation will be that of the free rider problem. At present all commodity organizations with the exception of marketing orders, are voluntary, meaning that an improvement in product price, brought about by an individual group effort, benefits members and nonmembers alike, with the nonmembers bearing none of the costs. Free-riders or nonmenbers also place supply management and quality control programs in jeopardy. Under the new legislation, all producers will be forced to adhere to quality restrictions and supply management programs once established by the organization.

Supply Management Via Storage

One method of handling fluctuating supplies is a storage program where excess supplies are canned and stored until years when supplies are limited. Processors and growers together or growers alone would arrange to have plums processed and stored in processor or private warehouses. In short crop years when prices more than covered the additional cost of such a program, these plums would be sold on the market. Having a consistent supply would also enable the industry to maintain its market in short supply years.

The purpose of such a program would be to reduce the fluctuation in supply and make prices more stable. By reducing

the fluctuation in supply, a storage program would assure the industry of a steady supply upon which to build demand. Such a program might force market prices up in big crop years through storage of part of the crop and keep prices from going extremely high in short crop years by selling the stored product. More stable prices may encourage continual and greater usage of canned whole plums.

One important factor to examine in determining the feasibility of such a program is the storability of the product. According to processors, the storage life of canned purple plums depends upon the quality of the can. Most cans are good for eighteen months of storage; a higher quality can could extend the storage period to approximately three years. The plums themselves when packed in heavy syrup, as most are, will usually retain their quality for at least three years.

To ensure that the stored plums are rotated into the market each year, an agreement would have to be made with processors to move the stored plums each year. This is necessary to keep the plums in storage less than eighteen months old. A cost to move the old fruit out and the new in plus some compensation to processors for selling the older fruit would be necessary. This means a two cent per case cost annually, above the one cent per case per month for storage discussed below.[3]

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[3]Storage and "in and out" cost estimates were obtained from commercial warehouses and represent 1970 costs.

Even though a product may be stored it may not be economically sound to do so. Processors indicate that canning the raw plums cost approximately $4.17 per case. Assuming a 10 percent profit margin for processors, a raw product cost of 90 cents per case (based upon a grower price of $60.00 per ton), an interest cost of 6 percent and total storage plus removal costs of approximately 10 cents per case per eight month storage period, the total cost approaches $5.62 per case (Table 35). If raw product cost is based upon what it would cost to harvest the plums, the average cost would drop to approximately $5.09.

While most of these costs occur during normal processing, a few are increased or created as a result of the storage program. With no storage program a processor has processing and raw product costs. If a grower group hired this work done, these costs would occur, although the raw product cost might be lower if growers agreed to accept a minimum price equal to average variable harvest costs. Growers might only accept the lower price if they had an agreement whereby they could share in the profits of a storage program. By hiring a processing firm to can the plums, the grower organization would pay a profit margin to processors. This profit margin becomes a cost of the storage program because processors would normally not receive a profit until after the sale and then it would depend upon the price they receive. Lower storage costs might be encountered by a regular processor making use of idle warehouse facilities, but a storage program would have to pay the

Table 35. Storage Program Cost Data

Item	Minimum cost	Average cost	Maximum cost
	dollars per case of 24 No. 2 1/2 size cans		
Cost of processing	3.790	4.170	4.550
Minimum raw product cost[a]	.375	.375	.375
Processor profit at 10% of processor cost	.379	.417	.455
Additional raw product cost[b]	.525	.525	.525
Interest at 6% on total cost	.031	.033	.035
Cost to put case into and remove from storage	.020	.020	.020
8 months storage at 1 cent/mo.[c]	.080	.080	.080
Total Cost	$5.200	$5.620	$6.040

[a]The price required by growers to cover harvest costs of $25.00 per ton (Table 22).

[b]The additional raw product price covers all costs including fixed costs for growers but does not cover harvest cost which is the minimum cost mentioned in footnote a.

[c]By looking at the monthly prices it was determined that if a short crop is predicted, canned prices begin to rise in June, meaning that storage would have to be for at least 8 months (October-May).

going rate for storage facilities. If the 10 percent processor profit margin is counted as a variable cost along with the interest and storage fee the approximate cost of the storage program is 50 cents per case.

Historically, an annual average U.S. pack of 1,450,000 cases with an average carryin of 450,000 cases would have yielded an average per case price of $5.70. This is above the $5.62 necessary to cover average total costs defined above. However, the past sixteen years also indicate that for each additional 100,000 cases packed, the price drops by 12 cents per case.[4] If the industry is confident that additional plums packed for storage will in fact end up in storage, the twelve cent reduction may not occur.[5] But, for each 100,000 cases of carryin, the price declines by 19 cents per case. And with additional carryin available in storage, the market may react by immediately offering lower prices. For example, if the storage program had 200,000 cases on hand, buyers on the market would be aware of the available supply and offer lower prices, unless the storage group offered assurance that this additional supply was not available until prices reached a certain level.

Only two of the past sixteen years had total pack and carryin conditions necessary to force the price above $5.62

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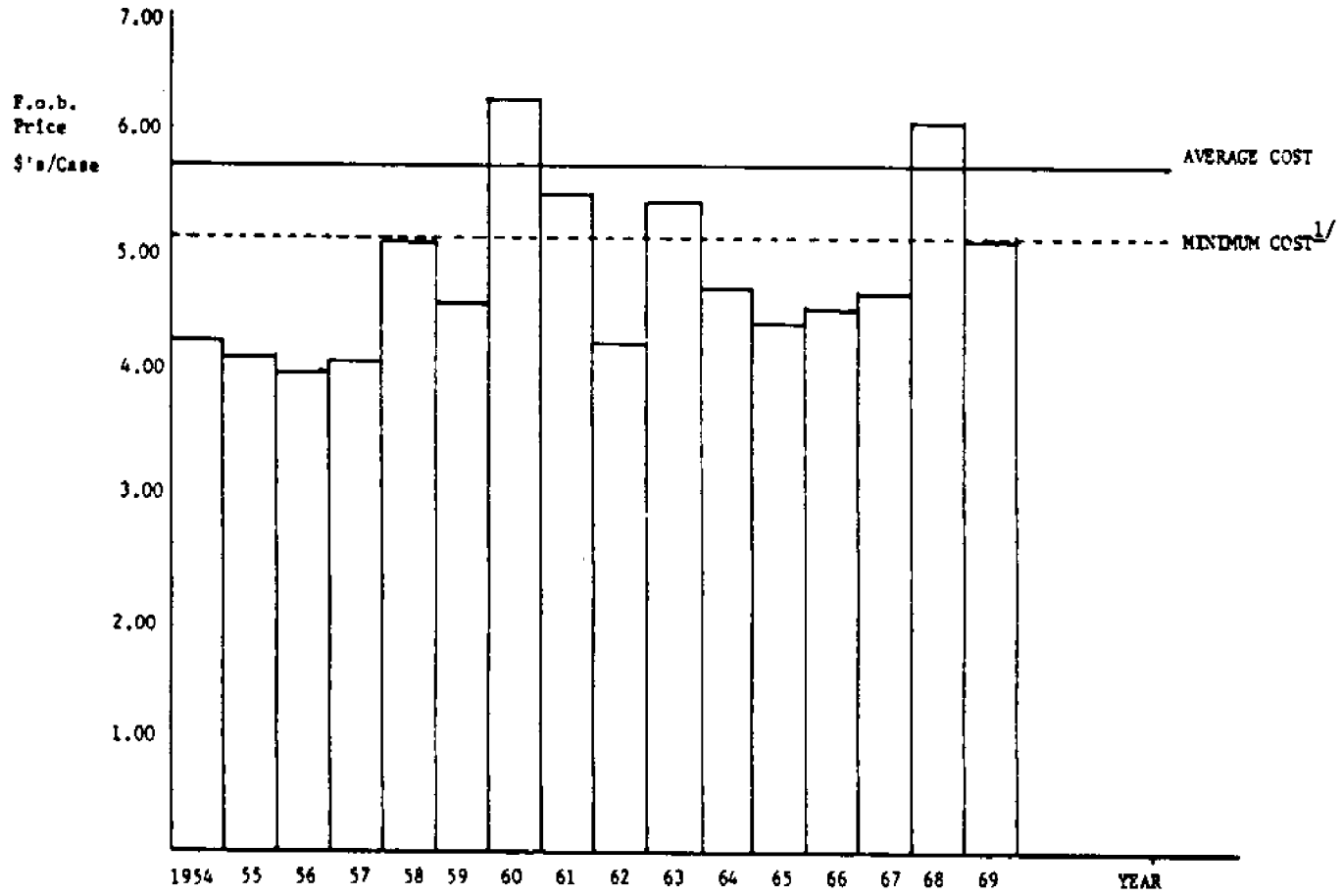
[4]See equation Three, Chapter VII.

[5]A marketing order could be used to assure that plums processed for storage would remain in storage until prices reached a predetermined level.

per case (Figure 13). This means that a storage program in most years would not have been able to cover costs.

For the two high price years of 1960 and 1968, stored supplies, beyond what was available at processors, of 300,000 and 200,000 cases respectively, would have brought the price back to $5.62. This assumes that price drops by 19 cents per 100,000 cases of carryin as mentioned earlier. Consequently a storage program with 300,000 cases would have been needed to ensure that prices did not exceed $5.62 in any one year of the past sixteen years and for the storage program to make money on a one year basis but not cover costs incurred in normal crop years.

Based on this analysis, a storage program of this type is not recommended at this time. In the first place overall supplies were only sufficiently short to force prices above the average cost of processing and storing a case for two of the sixteen years. Secondly, a storage cost of 14 cents per case per year plus a 3 cent per case interest charge and some compensation to processors for exchanging the plums annually would be necessary every year. Thus, it costs roughly 20 cents per case per year for a storage program that would have had only two payback periods in sixteen years. Even at the minimum case cost the price only exceeded it in four of the sixteen years (Figure 13). Finally, the payback at this price of $5.62 would only cover the cost of one years storage.



1/ Includes a minimum raw product cost for harvesting only.

Figure 13. Northwestern f.o.b. Processor Price for Canned Purple Plums and Storage Program Costs (per case of 24 No. 2 1/2 Cans).

Quality in Fresh Purple Plums

Industry sources have indicated that the uneven quality of Michigan's fresh plums places the state's industry at a competitive disadvantage vis-a-vis the Northwest. The Northwest uses a marketing order to improve the quality of the plums reaching the market. In Michigan, quality varies from packer to packer and encounters retailer criticism concerning variable size. Industry sources in New York indicate that Northwestern plums are well known for their quality while both Michigan and New York encounter problems of inconsistent quality. If quality were improved, consumers might be encouraged to buy more fresh Michigan plums. In addition, an advertising program could be used to promote the consumption of fresh plums if the industry could be reasonably sure that consumers attracted by promotion would get good plums. Two methods of improving quality are dealt with below.

Marketing Order for Fresh Quality Improvement

Quality improvement in the fresh market may be legally handled through a state marketing order. The major goal of this order would be to ensure that all Michigan purple plums reaching the market are of high quality and uniform size. This would be brought about by establishing a state marketing order to define and enforce a set of quality and size criteria.

The structure and criteria of the proposed marketing order could be similar to that used in the Washington-Oregon

prune marketing order. Regulations in the order would limit, during any period, the shipment of any particular size, quality, maturity or pack of purple plums. Criteria would also be included to regulate size, capacity, weight, dimensions and marketing of containers. Criteria would depend upon quality, size, market conditions and supply of the product as decided upon by a committee of industry people. A Federal or Federal-State Inspection Service could be the regulatory body which enforces these regulations.

One of the most important factors that could be improved under this program is size of fruit. By setting a minimum size limit, the order could improve the average size of Michigan plums being offered in the market. It may even be economically wise to set two size limits. One size would be a premium size, possibly for use in sales to other areas such as New York state, while a second size could be smaller and for use in local markets. It may not be possible to separate the markets, however, there may be advantages to having a premium size available for sale. For example, some individuals want size and are willing to pay a higher price. This would raise returns to the industry and not reduce sales. In addition, with increased supplies available, a size restriction would keep more plums out of the fresh market.

Benefits of such a program result from the establishment of a uniform, high quality product. By using inspection, to ensure that immature and diseased plums do not reach consumers, the program would create an improved reputation for

Michigan purple plums. Once consumers are confident that all Michigan purple plums are of top quality, sales might be expected to increase. Once the industry can assure the market that most plums reaching the market are of top quality, an advertising program would encourage consumers to try plums, only to find them, in some cases, of low quality. It is not possible to measure the benefits of more uniform quality, but chain store sources indicate that Northwestern plum quality is very high, and that the Northwest effectively uses a marketing order for quality improvement and promotional fund collection.

The importance of fruit quality in market expansion cannot be overemphasized. Consumers base their future consumption decisions on product quality while retail outlets try to handle only those products with a long shelf life. By introducing a quality program, Michigan may eventually attain a quality reputation similar to that enjoyed by the Northwest.

Fresh Quality Improvement By Individual Packers

An individual packer approach might be used as an alternative to a formal marketing order to bring about quality improvement. Similar criteria to that described for the quality marketing order would be followed by individual packers. Their purpose in establishing a quality criteria would be to benefit from an increase in sales to retailers. Retailers would benefit by having higher quality fruit and less spoilage.

Even though this alternative has fewer administrative and inspection enforcement problems, it has three major shortcomings. One major drawback is that since it is voluntary, not all packers will adopt the criteria. The result is that some low quality, immature plums will reach the market, adversely affecting future sales of all purple plums. Without the entire industry supporting the program or being forced to adhere to it, Michigan cannot establish a statewide reputation for high quality. And finally, the free rider problem encourages some packers to ignore quality yet enjoy higher prices. These three shortcomings make the individual approach unattractive for long run industry development.

Quality of Canned Whole Plums

Retailers and processors mentioned that variation in the quality of canned whole plums is detrimental to the expansion of demand. They indicated that tough skinned, undercooked, sour, and very small plums are encountered all too often by canned plum consumers. Processors are aware of occasions when their pack is below what would be considered fancy quality but do nothing about it. Processors also indicate that sometimes the pack is of a lower quality because the plums were immature or small. Retailers sometimes buy according to a processors quality reputation, and at other times they buy the least expensive plums available. The result is that consumers may have several brands of plums available at the retail outlets and, if not warned that some are

of inferior quality, could purchase the low quality product. Unfortunately price is not a clear indication of quality because some large chains sell top quality plums at prices charged by other stores for low quality plums. If this problem is not overcome, the expansion of demand for canned whole plums is likely to be very difficult.

Promotion of Two Quality Levels In Canned Whole Plums

The existence of at least two levels of quality in canned whole plums, which to date has been a detriment to the industry, may be used to increase sales and thus become beneficial to the industry. Two levels of quality are referred to as "choice" and "fancy" grades. Although only two levels are recognized, a wide variation exists within each of these two quality levels which suggests the possibility of additional quality levels. Even these two quality levels are not used on an industry wide basis as some processors do not differentiate on the label as to whether the contents are choice or fancy. In a year when plum supply and quality are high, much of the pack will be fancy, the upper quality level. In years of limited supply, processors accept nearly all available plums meaning that the average quality level is lower and thus more choice plums are packed. Lower quality would probably not be as detrimental to the industry if it met "choice" standards and was advertised as such. But often, processors do not indicate which quality level is being sold and the price in some cases is identical

for choice or fancy. In this situation, consumers have not received quality commensurate with price. Consequently new customers, paying top price for a lower quality, may not purchase plums again and regular consumers may reduce their purchases.

On the assumption that at least two quality levels are unavoidable, which appears likely according to historical variations in quality, it may be possible to promote two quality levels to the benefit of the industry. By clearly identifying all plums as fancy or choice and ensuring that predetermined quality standards are met for each, the industry may promote both qualities. The "fancy" quality would be higher priced and possibly used in specials where new consumers are expected to be trying plums for the first time. If a consumer is introduced to a high quality plum on their first test, they might be more likely to purchase additional plums. To regular consumers, the two quality levels would provide them with an opportunity to trade off between quality and price.

Success of such a program depends upon consumer preference for two grades, their response to promotion and their transfer from the lower to the higher quality product. All three reactions are very difficult to predict. Perhaps it would be possible to test the sale of two quality levels in several markets, in an effort to assess consumer response. If present consumers just switch from the one grade to the other very little will be gained by the industry. Prior to

undertaking such a program it may be necessary to develop an effective advertising and promotional design to get the message to consumers.

The major cost of this program would be for promotion. A processor would require an increase in the volume of plum sales and/or a higher price for his top quality plums if he hoped to make a profit from the venture.

Processors and the industry stand to benefit from such a program under the following conditions. Processors increase their profits if they sell more canned plums. The industry expands demand if new consumers are attracted by the promotion. If consumers simply switch from the lower quality to the higher quality plums and no new consumers enter the market then the consumers will receive most of the benefits of the program. If consumers start demanding higher quality and paying for it, then other processors will be forced to publicize the difference in the quality of their plums. Once the top quality brands have established their reputation, the industry may use this reputation in promoting increased consumption of purple plums. By advertising that new consumers should buy high quality plums, the industry might have a greater chance of these consumers developing a plum buying habit.

Fresh Market Expansion

Expansion of fresh plum sales might be used to solve part of the industry's excess supply problem. While sales

could be increased by means of increased advertising, improved quality, and lower prices, a change in consumer package also appears to have substantial possibilities for expanding fresh demand. This probably would need to be done at the individual packing firm level.

The suggested package change is aimed at overcoming the problems encountered in bulk selling, such as bruising by consumers, time required for consumer selection, individual weighing for each consumer, and lack of available quality for consumers. At present a number of retail firms still sell in what is defined as bulk, free choice form. For this sales system, consumers pick and choose individual plums from a counter containing a quantity of loose plums. As they decide upon what plums to choose, they squeeze and bruise others, take up counter space and leave the damaged fruit on top presenting a poor product appearance for the next consumer. Under the proposed package change, which is being used by a number of retail outlets, individual overwrapped trays of specified weights would be used. These would be stacked on a counter, have uniform quality throughout and be weighed prior to store placement. So all consumers do is see the plums on display through the see-through top, and select a tray. They may check a few trays but if they are assured of the quality within, they will not do this very often. An added advantage is that the trays carry easier in shopping containers.

The cost of packaging is greater for this method than for bulk packaging, but a number of savings are encountered when this method is used. Two packers who have wrapped three pound trays indicate that the additional packaging costs, including the extra labor, adds up to approximately four cents per pound or a range of $1.25 to $1.50 per carton of twelve, three pound trays. Even though some retailers use their own packing facilities now, they, and others who do not have facilities, indicate an interest in having packing firms do the packaging. Packers agreed that since they already have the plums on grading belts, additional handling would be avoided and savings available if they do the packaging. This method of packaging is expected to significantly reduce retail spoilage from bulk sales. An additional saving at the retail level is from the labor costs saved from reduced weighing by sales people. This assumes that weighing is less costly at the packer's where labor is often less expensive and more efficiently organized for this function.

Consumer acceptance of the overwrapped package is dependent, for the most part, upon the three factors of quality, size and price. They must be confident of receiving high quality plums especially when they are unable to handle them individually. Since small and large plums mixed together in one package meet with sales resistance (according to retail produce people) it appears advisable that each container have plums that are of similar size.

Finally, the higher price of packaged plums, despite the fact that plums are relatively price inelastic, will likely reduce sales if it is out of line with respect to prices of other fresh fruit.

Benefits of the new packaging technique may accrue to the industry as a whole, to packers, to retailers and to consumers. The industry benefits if more plums are sold which would expand the demand for fresh plums at the farm level. This increase in sales could help handle some of the supply increase in Michigan. Packers benefit in that they are paid to perform an additional service which will enlarge their operation. They would also benefit from increased volume. Retailers benefit by having consumers spend less time in the produce section which allows them to handle larger numbers of consumers. By using overwrap packages, retail produce departments cut down on labor costs as trays are usually easier to look after than bulk sales which require weighing and piling. Trays are easier to move into and out of storage if retail units should decide to refrigerate their plums. Consumers save on time and are likely to have a better chance of finding unbruised plums.

Promotion

While the Northwest has not led the way in consumer packaging changes, they have led the way in fresh plum promotional activity. Their program includes the use of news media such as newspapers, television and radio, employment

of seasonal dealer service people, distribution of point of sale materials, and a number of consumer surveys. The news media are used for advertisements during plum season to make consumers aware of the product. Dealer service men, hired for six to eight weeks during the fresh plum season, are used predominately in the Boston area. Point of sale materials, for in-store displays, are distributed to all retail outlets. Consumer surveys are used in large market areas such as New York city to determine what consumers like and dislike about fresh plums.

Their promotional program is financed by a mandatory tax on each ton of plums sold to the fresh market in each of the three Northwestern states. Combining their individual efforts into one program avoids duplication of administration costs and efforts as well as providing a larger financial base from which to work. Washington State taxes at the rate of $1.50 per ton, Idaho at the rate of $1.60 per ton and Oregon contributes a lump sum from their own state organization. The size of the annual budget varies but was reported to be $29,225 in 1967 and $41,964 in 1964.[6]

Michigan producers might consider joining the Northwestern program, starting a similar program on their own or join with other Eastern states, such as New York, in a program

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[6]Fred H. Westburg, "Comments on 1967 Fresh Northwest Purple Prune Plum Promotion," Trans 73rd Ann. Mtg., Idaho State Hort. Soc., pp. 54-56.

similar to that in the Northwest. Joining the Northwestern program or forming a group in the East would likely result in less promotional duplication, and provide more funds for the program. However, a joint program would not likely stress particular features of Michigan plums.

A joint promotion program may be a profitable alternative in handling the immediate problem of excess supply. Recognizing that producers have already invested in producing the trees, which have a negative salvage value, and that demand can be expanded by attracting new consumers and/or having old consumers increase consumption, a promotion program to attract new consumers warrants investigation. Before such a program can be recommended some information is required concerning how many consumers must be attracted, what would the cost of attracting them be and what returns can be expected from such a program.

Estimation of the number of new consumers required to consume the expected increase in supply, so that current prices continue at their present levels, is difficult. It was reported in Chapter VII that less than 2 percent of the population buy canned plums and less than 2.5 percent of the population buy fresh plums in any one year. According to these values, the average annual supply of plums to date of approximately 70-80,000 tons has been consumed by this small portion of the population. Assuming that each new consumer consumes slightly fewer plums per capita than do established consumers, the industry may require approximately 1.5 percent of the remaining population as new consumers. It may be

possible to sample some present plum consumers and divide them into recent and established consumers to determine whether the quantity consumed annually differs. Once the number of new consumers required is established the promotion industry can be consulted for estimates on the cost of the required promotion.

Returns that can be directly attributed to a promotional program depend, in part, upon what other market factors change. If the total increase in supply is marketed under present conditions the price of plums will decline significantly as indicated in Chapter VII. Now if a promotion program were introduced with none of the other market factors such as quality, acreage, and weather changing and if prices did not fall when the entire supply was marketed, then the difference between the recent average price for plums and the predicted price for plums would be the gross return to promotion. If the gross return exceeded the cost as determined from above, the program would be advisable. But as supply increases, it is unreasonable to expect that all other market factors will remain unchanged. However, it is reasonable to assume that for the next one or two years other market factors are not likely to have an immediate effect upon the supply and price situation. Consequently, if a promotion program can maintain the historical prices for the next one or two years at a cost of less than the expected price drop without the program, then the entire U.S. industry would be advised to adopt such a program.

Coordination

The lack of coordination among participants was reported as an industry problem by members of all groups. Survey reports indicated a number of situations where the lack of coordination adversely affected the performance of the industry. Handlers complained that processors, by not scheduling deliveries, cause a loss through fruit decay which makes the fruit unusable or lowers the quality of the final product. Processors complained that growers do not notify their fieldmen prior to harvesting and, in some cases, delivery. On the other hand, growers complain that packer and processor fieldmen are not sufficiently aware of the crop's maturity when they recommend harvest dates. Retailers indicate a desire to buy plums wrapped in specific package sizes but that packers have been slow to fulfill this desire. Packers, for their part, complain that retailers have not been willing to pay for the additional cost of overwrapping. These examples illustrate the existence of coordination problems.

A lower quality product and poorer performance are the result of this type of problem. Poor scheduling results in plums not being cooled immediately after being picked. As a result, disease spreads faster, and they may become overripe, causing a lower quality canned product. Any delay in removing heat or chemically treating harvested plums for disease will result in lower fresh quality and a shorter shelf life. Operation of wrapping equipment by retail units appears as a duplication of facilities and possibly unnecessary.

An information program that points out the areas where improved coordination could benefit participants might help the industry overcome this problem. A group, possibly including members from all parts of the industry, running a coordinating program might help the participants overcome the problems by suggesting ways to improve the situation or by helping the participants work together to reach an agreement.

Perhaps MACMA or a similar organization could serve the industry by coordinating deliveries from their members to processors. They could assure processor's quantities of plums at the exact times required, thus reducing spoilage and quality loss. If plums had to be harvested before processors were ready, MACMA could arrange for storage. Processors would not deal directly with growers, instead MACMA would be responsible for seeing that growers were compensated for the additional costs of storage and handling. They are particularly suited for handling this problem, because they represent many growers who sell directly to processors and already negotiate with processors on prices. Other organizations may already exist or need to be formed that can solve other parts of the coordination problem.

Use of the Term "Prune"

The decline in the popularity of dried prunes makes the use of the term "prune" by the purple plum industry questionable. The purple plum industry has called their product prunes or prune plums because the same type of plums in parts

of Oregon are made into prunes. However, the remainder of the purple plum producing areas cannot make quality prunes from their purple plums and hence the term may not apply. It might be beneficial to use the term if prunes were popular with consumers. However, industry sources indicate that consumers associate prunes with a laxative. At present, the prune industry, itself, is trying to overcome this image, thus it appears unwise for the purple plum industry to use the term prune with its adverse connotation. It is recommended that the industry use and promote the term "purple plum" when referring to its product.

New Uses for Plums

The continued availability of large, low cost supplies of purple plums could lead to the development of a number of new uses. Supplies are expected to continue at the new levels for some time, partly because of the trees already planted and partly because they are highly complementary with tart cherries. Using much of the same growing and harvesting equipment as they do for cherries, growers can make additional use of their labor, equipment and management resources during the plum season. By virtue of this complementarity and because plums are one of the easier fruits to grow, production can be expected to continue to increase. As labor continues to become a problem in the fruit industry, growers may switch from crops which cannot now be mechanized to the mechanized plum industry if they foresee any prospects of reasonable returns. Given that this

occurrence is already taking place, it appears likely that other uses for plums will be found. These could take the form of desserts, party snacks, special appetizing dishes, drinks and a number of other food products. With such a cheap source of input, any popular new products could be especially profitable to the developer and the industry.

Summary

This Chapter has reviewed a number of the problems confronting the industry and analyzed a few alternatives that might aid in dealing with the problems. The problems covered included supply, quality, demand expansion, coordination and terminology. Alternatives analyzed were a marketing quota, a storage program, a marketing order, packaging, promotion and organizations to improve coordination.

Promotion offers an immediate opportunity of expanding demand while the marketing board approach could provide a mechanism for supply management, quality improvement through coordination and grading plus a tax to provide new product research funds.

Recognizing that the industry has invested in new orchards, which have a negative salvage value, emphasis is placed on those programs that will increase demand in the immediate future. This includes promotion, packaging and quality control. It is in the immediate future when the new orchards are at peak production levels that the industry will lose the most if demand is not expanded and prices maintained.

CHAPTER IX

SUMMARY

Michigan's purple plum industry is now contributing over one million dollars annually to Michigan farmers and has increased its production from five to slightly over 20 percent of total U.S. purple plum production. In absolute terms, Michigan now produces between 10 and 15 thousand tons while the states of Washington, Oregon and Idaho produce approximately 50 to 60 thousand tons. Michigan's production is expected to continue increasing until at least 1975, reaching 39 thousand tons. Increasing at a slower rate, Northwestern production is expected to be 71 thousand tons by 1975. In years when Michigan production was 15 thousand tons, prices declined significantly indicating that if present market conditions continue, the additional supply expected by 1975 will result in even lower prices.

Two major varieties, both suitable for the fresh and processed markets, dominate U.S. purple plum production. In the Northwest, the Italian (Fellenberg) prune predominates while the Stanley prune plum accounts for approximately 75 percent of Michigan's production. Blufre, derived from the Stanley prune plum, is a recently developed variety that became popular in Michigan in the late 1960's.

Purple plums are marketed either as fresh fruit, or as processed products--canned whole plums, preserves or baby food. Idaho and Washington market over half of their plums on the fresh market while Michigan and Oregon dominate the processed market. In Michigan, 60 to 70 percent of the plums enter the processing market. The remaining 30 to 40 percent are sold as fresh plums through retail stores and roadside stands.

To date, Michigan plum sales have covered a limited area. Their processed plum sales have been mostly in the Midwest with a few in the Northeastern part of the U.S. Fresh sales have been centered in a few large cities of the Midwest and Northeast. A few fresh plums have been sold in Canada.

Those Michigan growers who obtain yields greater than 7.5 tons per acre, have been making a profit, while growers with yields of less than 4.5 tons per acre have not covered average variable costs of $40.00 tons in some years. Those growers experiencing yields of 7.5 tons per acre or more were found to be competitive on a cost basis with Washington and Oregon.

Fresh and final product quality, according to processors, retailers, fresh packers, handlers and brokers, is the major problem that must be overcome if the Michigan industry is to handle the increase in supply. In canned whole plums, tough skinned, immature or sour plums are a major problem requiring better control at the processing and harvesting level. Retailers say that even though Michigan's

fresh plums are tree ripened and have a sweet taste, the well graded, top quality, and uniformly sized Northwestern plum is easier to promote and sell. Improved quality control and responsibility for quality is necessary by all industry participants if the problem of poor quality in Michigan plums is to be overcome.

Price elasticities of demand for both fresh and processed products are relatively inelastic. A price elasticity of demand of -.722 for processed plums indicates a lack of response to price changes. This means that a price reduction will not significantly alter the problem of a huge supply. In the fresh market, a price elasticity of demand of -.692, slightly lower than that for the processed product, also indicates that lower prices will not solve the volume problem. These results imply that the increase in Michigan production cannot be handled by price reductions.

Recognizing that Michigan's canned whole plums compete with canned plums from the Northwest and that price data were not available for Michigan canned plums, a price analysis was carried out to determine which variables significantly affect the processors' f.o.b. price for Northwestern canned plums. Results indicate that total Northwestern production, total U.S. pack, carryin, population and disposable income are all significant variables. Population and income were closely correlated as were total Northwestern production and total U.S. pack. Combinations of these five variables explained approximately 90 percent of the variation in f.o.b. price. If current market conditions continue, Michigan

processors may use these equations and the historical difference existing between Northwestern and Michigan prices to estimate what price to expect for their plums.

A price analysis was performed on grower prices to determine the variables which produce most of the changes in grower prices. This analysis indicated that approximately 95 percent of the change in fresh plum prices could be accounted for by the variables of total Michigan production, total Northwest fresh supply, population and the U.S. canning and freezing apple prices. When "total Northwest fresh supply" was replaced by "total Northwestern production," these same variables explained 83 percent of the price variation for plums sold to processors. If present market conditions remain, growers may use these relationships to estimate plum prices prior to harvest. By estimating what prices they can expect to receive based on historical relationship, producers will have a realistic price level to strive for in negotiations with processors. They will also have some indication of the profitability of marketing the entire crop.

While confident that existing facilities can physically handle the increase in supply, industry participants are of the opinion that demand is currently insufficient to handle the supply without a significant drop in prices and lower returns per unit. Faced with this supply situation, the industry has a number of options. They could do nothing and force inefficient high cost growers out of the industry. Under this option, all growers will encounter low prices and low returns.

The second alternative involves the industry initiating a marketing quota scheme, allowing growers to market only that quantity which would attract a predetermined minimum price. All marketing would be controlled by a marketing agency which would assign quotas to each grower based on predetermined demand and supply conditions. This program would maximize short run returns, reduce price instability and provide a seasonal reserve from which only the highest quality plums would reach the market. Another alternative, if supply were to fluctuate according to a cycle, would be a storage program of the processed plums. Present supply fluctuations do not warrant such a program. Other alternatives which may help overcome the supply problem involve demand expansion through new products and promotion.

If a demand expansion program is to be successful, the quality problem must be solved. One means of improving quality would be by inspection under a marketing order similar to the one in the Northwest. By stressing that there are two levels of quality in canned plums, increased sales could result and part of the quality problem in the processing sector would be eliminated. Specific delivery schedules among growers, truckers and processors may also improve the quality of final products.

Improvement of existing products and the development of new products depends upon the research funds available. At present, industry participants indicate few, if any, funds available in this area. Perhaps if the industry organized itself in Michigan, some progress might be made in funding research.

Although many Michigan plum people use the term "prune" when referring to purple plums, this association with the prune industry may not be beneficial to the purple plum industry. An industry that requires expansion such as the purple plum industry, is not often well advised to link itself with an industry (such as the prune industry) that is experiencing a decline in sales. It may be advisable to discontinue the use of the term "prune" in the Michigan purple plum industry.

In summary, Michigan's purple plum industry faces a substantial supply increase in the near future. By expanding the demand for existing products, developing new products and actively organizing the industry, they may be able to withstand the pressures which this supply surge will create and ultimately become a better organized, profitable and growing industry.

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APPENDIX

APPENDIX A

PURPLE PLUM PROCESSING SURVEY

Company Name:

Address:

Name of Person Interviewed

Date:

Section 1

1. What percent of your total fruit and vegetable processing business is represented by plums?_____

2. What percent of your plums were processed into #10 cans _____ #303 cans_____ #2 1/2 cans_____? What other products did you make from purple plums and their percent?_____

3. How many lbs. of raw fruit are needed to produce one case of each of the following sizes? #10____lbs. #303_____lbs. #2 1/2 ___ lbs. Other (specify)_____lbs.

4. What range in plum sizes is best for plum canning?_____ Would you be willing to pay more for plums if they were sized before you bought them? Yes___ No ___.

5. What plum count do you strive for in each of the following can sizes? #10 _____ #303____ #2 1/2 ____.

6. What are the most serious problems in raw product plum quality for processing?_____
_____
_____

7. Do you have your own label or do you use private labels? your own____% private____%.

8. How do you sell your plum products? Brokers____% Direct sales____% Company staff____%.

9. Should the Michigan plum industry undertake an advertising and promotion program on an industry-wide basis? yes___ no___ no opinion____. If such a program were initiated should Michigan do it alone or in cooperation with the Northwest industry efforts? Michigan alone____ Michigan and Northwest____.

10. Does your firm make a specific expenditure for promotion and advertising of plums? Yes___ No___. If you have a total advertising and promotion budget, what part of it is for plums?_____?

11. Approximately how much did your firm spend on plum advertising during 1969_____ 1970_____?

12. What percent of this advertising budget did you use for promotional allowances? _____
television _____
radio _____
magazines _____
other _____

13. Do you favor the advertising and promotion of plums other than by brand? Yes____ No ____. With contributions by (a) Growers? Yes____ No ____ (b) Processors? Yes____ No____.

14. Should funds for processor sponsored programs be based on voluntary or mandatory contributions? Voluntary_____ Mandatory____. Would you contribute voluntarily? Yes___ No____. What percent of Michigan's plum processors would contribute?____%.

15. Of the funds collected for industry advertising and promotion, should any funds be spent for field merchandising men to call on chain stores and institutional buyers in an attempt to get wider acceptance, greater distribution, and more shelf space for plums? Yes___ No ___.

16. Should new product development in plums be the primary responsibility of individual processors for their own use or should there be an industry-wide approach to the problem? Individual processor____ Industry-wide____ Both ____.

17. If industry wide, who should finance it?

Growers_____
Processors_____
Others (specify)_____.

18. If an industry sponsored new product development project were started would your firm contribute money to support it? Yes___ No ___.

19. Do you have any funds budgeted specifically for new product development in plums? Yes___ No___. If yes, how much?_____. If no, was there some work as a part of your total product line development?_____

20. Would your firm be better off with many small plum processors or a few large processors? Many small firms____ Few large firms_____.

21. Do small and underfinanced processors result in undesirably low prices in the processed plum market? Yes____ No ___. If yes, have these processors been going out of business or merging with other firms? Yes___ No____.

22. Do you think a sales association or centralized sales firm would increase returns from canned purple plum products? Yes___ No ___ Unsure____.

23. Have you merged with or acquired other processing operations in the past five years? Merged with_____ Acquired _____. What merger or acquisition was involved?_____

_____.

24. Have you increased your plum processing capacity in the past five years? Yes___ No___. Have you increased the quantity of plums processed in the last five years? Yes___ No ___.

25. Does a large firm have a particular advantage over a small firm in plum processing? Yes___ No___. If yes, do the advantages lie in the area of (a) processing costs____ (b) procurement costs____ (c) marketing and sales advantages____. Does a large firm have disadvantages? Yes___ No___. If yes, what?_____

26. From your standpoint as a processor, what are the major advantages and disadvantages of a growers market information program?

Advantages_____

Disadvantages_____

27. How would you evaluate the Macma plum program?_____

_____

28. Would you be willing to offer a contract to growers for several years which included a specified price formula? Yes___ No___. If no, would a contract with an escape clause for unusual years encourage you to offer a contract to growers? Yes___ No___. Have you ever contracted for plums? Yes__No___. If yes, when and for what period of time?_____

_____

29. Would you sign a contract with a growers association for their plums? Yes___ No___. If yes, what conditions would you require in the contract?_____

_____

If no, why_____

_____

30. Would you be willing to custom process plums for growers? Yes___ No___.

31. Based on 1970 costs, how much per case would you have charged a grower coop to process 6500 cases of #2 1/2 size cans?_____

32. What other raw products do you process in your plant? Tart cherries___ Apples___Peaches___Strawberries___ Sweet cherries___Pears___Blueberries___Tomatoes___ Asparagus___Other fruit___Other vegetables_____

33. Approximately how many plums did you process in the following years? 1970___lbs. 1969____lbs. 1968____lbs. 1967____lbs. 1966____lbs.

34. What was the average price per pound paid by your firm for raw plums in the following years? 1970_____ 1969_____ 1968_____1967_____1966_____.

35. What are the important factors that determine what you receive for processed plums?_____

_____

36. How do you establish the price that you offer to producers?_____

_____

Section 2

37. Have you any equipment and facilities used exclusively for plums? Yes___ No___. If yes, what is it?_____ _____. If no, is there another crop which you could economically process at the same time of the year in place of plums?_____

_____

38. Are there any potential new uses for plums that processors need help in developing? Yes___ No ___ If yes, what?

_____

39. How long may canned plum products be stored without a significant loss in quality?_____

40. Does labor availability restrict your processing? Yes___ No___. How much additional temporary labor is needed for plum processing? _____ Have you introduced any labor saving technology recently in your plum processing enterprise? Yes___No___. If yes, what?_____

_____

41. Has there been any demand for a pitted canned purple plum? Yes___ No___. What are the advantages of pitted canned plums?_____

_____

What are the disadvantages?_____

_____

42. Do you have any plum pitters? Yes___ No___.

43. About what percent of your total operating capital does your firm usually borrow?_____?

44. Does credit availability or high interest rates limit the quantity of plums your firm packs? Yes___No___.

45. In what geographic area do you sell most of your plum products?_____

46. From what counties do you obtain most of your plums?

_____

_____

How far away is your most distant supplier?_____

What percent of your plums do you buy directly from growers?_____%

Who else do you buy from and how much?_____

_____

47. How many growers do you usually buy from (average for last three years you bought plums)?_____ How many tons do you receive from your five largest growers as a group?_____

48. If you did not can cherries would this affect your plum processing? Yes___No___. If yes, how_____

_____

49. What determines how many plums your firm processes in a given year? (a) available supply_____(b) your evaluation of market demand_____ (c) price of raw plums_____(d) government contracts____(e) financing___(f) quantities dictated by central office_____.

50. If (f) in question 49, how does the central office make this decision and what decision process is used to change it?_____

_____

51. If raw product supplies were more stable, would that encourage you to expand your average plum pack? Yes___ No___.

Section 3

52. What are your sugar costs per case? #10____ #303_____ #2 1/2 _____.

53. What do your containers cost? Cans: #10____ #2 1/2 ____ Carton: for packing_____. Would it be economical for a group of processors to own a container company? Yes___ No ___. If yes, would you be interested in taking part in such an enterprise? Yes____ No ____.

54. What are your direct labor costs per case of? #10's_____ #303's_____ #2 1/2's_____. Labor costs for other units_____.

55. What is your total cost per case excluding raw product cost? #10's_____ #303's_____ #2 1/2's_____ other sizes_____.

56. How profitable is the plum processing part of your industry? Above average_____average___break even____ losing_____.

Section 4

57. Do you think there is any potential for significant market expansion of plums? Yes___ No___ No opinion___. If yes, how can this best be exploited? (a) lower prices____ (b) advertising and promotion____ (c) new products____ (d) stabilize supplies____ (e) central selling of plum products____ (f)exports_____ (g) institutions____ (h) Other (specify)_____

_____.

58. In your opinion what market factors most seriously affect canned purple plum sales?_____

_____

_____

59. If more plums were available and market conditions warranted, could your plant physically process more plums? Yes___ No___. If yes, what is the maximum quantity you could process without altering your plant?_____.

60. Is the cost of expansion the only factor preventing you from expanding? Yes___ No___.

61. Would less costly and better financing arrangements encourage you to process more plum products? Yes____ No____.

62. If you processed more plums would you hire more labor or cut back your processing of other products? Hire more labor____ Cut back others____ Both_____.

63. Would you be interested in processing plums on a joint venture basis with growers? Yes___ No___. If yes, under what terms?_____

_____

If no, is there some special situation where you would?_____

64. If in the future growers produce an oversupply of plums when an adequate market doesn't exist for all the production, what should be done with the surplus?_____

_____

65. Would the entire plum industry be better off if producers limited their production through a supply management organization? Yes___ No_____ No opinion_____ Why?

_____

_____

Michigan statistical tree counts indicate that purple plum new tree plantings increased significantly between 1963 and 1967. If these trees are allowed to mature and the current level of tree removal remains constant, the supply of purple plums in Michigan is expected to double (and possibly triple). With favorable weather conditions the supply of purple plums can be expected to be in the 24-27,000 ton range by the mid 1970's, compared with the 12-15,000 ton range of the past five years.

Assume for these next few questions that it is the mid 1970's and that plum production has reached the 24-27,000 ton range and that production will continue at that level for several years. Northwestern statistics indicate that in the mid 1970's their plum production will be about 60,000 tons which is up from their average annual production of around 50,000 tons.

66. Under these conditions would your firm process more plums? Yes___ No___. Would your firm plan to process more plums annually over the next five years? Yes___ No___. Would your firm increase its plum marketing expenditures? Yes___ No___. Would your firm make plums a bigger part of its total operations? Yes___ No___. What other changes would your firm make?_____

_____

67. Based on this supply level what do you think the price of raw plums would be?_____, what would the selling price of plums be?_____. What effect would these prices have on processor returns?_____ _____. How would these factors (prices and large supplies) affect the number of processors processing plums?_____

_____.

What do you think the industry as a whole should do?

_____

_____.

What do you think growers should do?_____

_____

68. Faced with this level of supply should some means of supply management be set up? Yes___ No___. If yes, what and by who?_____

_____

If the farm price of raw plums declines should the government guarantee a minimum price to farmers? Yes___ No___.

69. From your experience are there any other problems or relationships among major groups of the plum industry that we should give consideration to?_____

_____

_____

_____

_____.