PRICE ANALYSIS, AND ALTERNATIVE METHODS OF MARKETING PLUMS IN MICHIGAN

A RESEARCH PAPER

BY

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SUBMITTED TO MICHIGAN STATE UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

(UNDER PLAN B)

FOR THE DEGREE OF MASTER OF SCIENCE

DEPARTMENT OF AGRICULTURAL ECONOMICS

1970

ACKNOWLEDGEMENTS

The author wishes to express sincere thanks and gratitude to all those who contributed to the compilation of this report. Special thanks is due to Dr. Donald Ricks, who supervised and gave valuable assistance in the form of literature and related information during the course of this study.

Thanks is also due to Dr. Lester Manderscheid, my major professor, who planned my program of study and contributed significantly to the compilation of this study. The author is also thankful to Mr. Robert Anderson, Ph.D student, who from time to time made useful suggestions as to the structuring of this paper, and who unselfishly shared important sources of information.

Finally, I wish to thank my family for the understanding and encouragement afforded me during the course of my studies. Specifically I want to thank my wife Thelma, who spent long hours typing several drafts of this manuscript, and for her sustained encouragement and understanding over the period.

The author assumes full responsibility for any omissions or errors that my be present in this paper.

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INTRODUCTION TO STUDY

Plum production is steadily becoming big business in Michigan. The literature shows that the industry contributes a total value of more than one million dollars annually to Michigan growers. The industry is relatively young, but so far it has demonstrated an ability for substantial growth. Its growing importance plus a lack of economic information indicates that economic research is needed for this industry.

This study seeks to examine a number of factor relative to the industry. First the present state of the industry will be examined along with a comparison with the other competing areas, specifically Washington, Oregon and Idaho. Production costs for Michigan and Oregon will be examined and compared. A short insight will be given into the California plum industry, mostly because of its potential as a source of future competition.

A second objective of this study is an attempt to analyze the Michigan plum price situation and to develop a forecast equation for Michigan plum price.

The third objective is to examine the market potential of the Michigan plum industry. In this context an attempt will be made to suggest various ways in which the market may be expanded and made more responsive to the needs of producers and consumers alike.

Finally, an attempt will be made to examine the past performance of the industry, to see what factors, if any might have impeded performance in the past. The performance criteria to be used are:

(a) efficiency, (b) product suitability, (c) number of processing plants, (d) innovativeness of the participants, (e) ease of entry and exit. In the case of efficiency both operational and pricing efficiency will be looked at.

The method of approach will be both analytical and descriptive. An attempt will be made to suggest solutions to problems where these solutions seem feasible. Admittedly all the problems cannot be dealt with here, as indeed all the problems are not known. It is hoped however, that where solutions cannot be suggested, at least relevant questions will be raised to provide food for thought, or to present areas of interest for future research work.

PLUMS AND PRUNES DEFINED

There is some confusion, chiefly among non-farm people as to the distinction between a plum and a prune. The result is that in the Michigan industry the terms plum and prunes are used synonymously when referring to plums grown in Michigan.

The term plum specifies a variety grown primarily for use other than drying, mainly for fresh consumption for canning, freezing, crushing and jam and jelly making. Prunes on the other hand designates a variety which can be and normally is dried without removal of the pit. The term refers to both the fruit in its fresh state and to the dried product. In recent years the Northwest industry has endeavored to gain widespread use of "purple plums" as a more appropriate designation.

OVERVIEW OF THE PLUM INDUSTRY

During the period 1955-1959 average plum production in the state, primarily of the Stanley variety, averaged about 6,400 tons. This was approximately 7.1% of the total production of the four major producing states of Idaho, Washington, Oregon and Michigan, during this period. At that time Oregon was the major producing state with an average production of 41,860 tons, Idaho was next with an average of 22,280 tons and Washington third with average production being approximately 18,900 tons (Table 1).

The steady growth of the Michigan industry continued, so that, during the period 1960-64 Michigan increased its production to the point where it was producing 14.8% of the four state total production. This did not represent a doubling of Michigan production, but instead was a result of poor production in the other three states simultaneously.

The year 1968 was an especially good year for the State's plum producers, since production was fairly large and producers received a high price. A short crop in the N.W. states* resulted in Michigan producing 29.5% of the total for the four major producing states. The shortage of prunes in the N.W. states also resulted in high prices for Michigan industry. In spite of intermittent poor crop years, the trend has been towards a steady increase in production and in the state's share of the total plum production, due largely to new plantings starting in the 1960's. While this increase in production may be regarded as

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*Washington, Idaho and Oregon are regarded as the Northwestern competing States.

desirable as far as a growing industry is concerned, the situation might be viewed in a different perspective at the national level. This is because production is also increasing in the competing states of Washington, Idaho and Oregon, due primarily to increase plantings. As such oversupply situations appear likely. This will in all probability lead to lower prices.

TABLE 1: PLUM AND PRUNE PRODUCTION, MICHIGAN AND COMPETING STATES

	MICHIGAN	IDAHO	WASH.	OREGON	MICHIGAN'S % OF 4-STATE TOTAL
	----------	----------	TONS	----------	
1955-59 Avg.	6,400	22,280	18,900	41,860	7.1
1960-64 "	10,000	18,060	18,000	21,340	14.8
1965-68 "	12,525	14,275	13,725	23,625	19.5
1964 "	14,500	23,500	23,300	23,300	17.2
1965 "	9,300	20,600	14,000	28,000	12.9
1966 "	13,000	11,000	17,200	25,200	19.6
1967 "	14,800	16,500	12,700	30,500	19.8
1968 "	13,000	9,000	11,000	11,000	29.5
1969 "	14,500	17,500	21,500	28,000	17.8

SOURCE: U.S. DEPARTMENT OF AGRICULTURE CROP REPORTING BOARD, AS REPORTED IN AGRICULTURAL ECONOMICS REPORT NO.162, MICHIGAN STATE UNIVERSITY, MAY 1970

The latest plum tree survey shows that the principal varieties of plums and prunes produced in Michigan are of the Stanley, Blufre, Damson and German Prune[1]. Of these the Stanley variety is by far the most popular. (Table 2) This variety accounts for 83 percent of the total trees planted

TABLE 2

NUMBER OF PLUM AND PRUNE TREES IN COMMERCIAL ORCHARD BY VARIETY, AND YEAR SET, DISTRICTS AND STATE, 1968

VARIETY	NUMBER OF TREES BY YEAR SET								
	1967	1965-66	1963-64	1960-62	1955-59	1950-54	1945-49	1944 AND EARLIER	TREES OF ALL AGES
				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
				NORTH WEST 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
				SOUTH-WEST 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: 1968 MICHIGAN FRUIT TREE SURVEY - MICHIGAN CROP REPORTING SERVICE AS REPORTED IN AGRICULTURAL ECONOMICS REPORT, NO. 162, MICHIGAN STATE UNIVERSITY, MAY, 1970

in 1962 and earlier, and 67 percent of the total from 1963-67. The second leading variety is Blufre with 5 percent of the total planted in 1962 and earlier and 27 percent of the total since 1962. One fourth of all prune-plum trees in Michigan orchards, as of 1968 were planted in the three year period, 1965-67 and one-half during the five year period 1963-67. Table 2, indicates that of the 839,982 prune-plum trees in the State during 1968 over 600,000 were of the Stanley variety and a little over 135,000 trees of the blufre variety. The table also indicates that the western part of the state is the area of major concentration as far as plum production in the state is concerned.

Data on non-bearing trees as a percentage of bearing trees indicate that Michigan has 85% whereas Oregon and Washington have 49 and 39 percent respectively in the non-bearing category. This would seem to indicate that Michigan can in the future hope to control an increasing share of the national market, but will receive lower price levels resulting from the substantial increases in U.S.supply. Although the expected increase in production from both Oregon and Washington is not expected to be as great as that of Michigan, the net effect seems to indicate a lowering of prices to producers in these areas also.

TABLE 3: PLUM TREE NUMBERS, MICHIGAN AND NORTHWESTERN STATES

		MICH.	OREGON	WASH.	IDAHO
		----------THOUSAND TREES----------			
BEARING TREES	1954	229	1290	435	299
	1959	237	1026	276	296
	1964	349	801	339	363
NON-BEARING TREES	1954	90	123	30	63
	1959	136	255	95	87
	1964	295	394	133	89
NON-BEARING TREES AS PERCENTAGE OF BEARING TREES					
	1954	39	10	6	21
	1959	57	25	24	29
	1964	85	49	39	24

SOURCE: U.S. CENSUS OF AGRICULTURE AS REPORTED IN AGRICULTURAL ECONOMICS REPORT, NO.162, MICHIGAN STATE UNIVERSITY, MAY 1970.

For the past decade fresh plum prices received by Michigan growers have shown an increasing trend, moving from an average price of $111.00 per ton between 1955-59 to $147.25 during the 1965-68 period. The period between 1965 and 1969 has been marked by fluctuations in prices, reaching a high of $174.00 per ton for fresh plums in 1968 and falling to $113.00 in 1969. This fluctuation in price has been due primarily to the effect of weather conditions and its effect on crop size both in Michigan and in competing states.

The processed prices are however the most important prices to local growers at least at this point in time. This is due to the fact that nearly 70 percent of all plums produced in Michigan is sold for processing. In this area price fluctuations have not been so violent as in the fresh sales.

Previously outlined data show that Michigan's plum industry is expanding at a faster rate than that of the major competitors. However, there are some implications that cannot be overlooked. Expected future increases in the industry's output, will inevitably cause prices to decrease. When prices fall producers will have less incentive to grow plums. They will likely switch to other crops or change occupations to non-farm industry. When prices fall producers' incomes decline and production will tend to decline after some time lag. This becomes more pronounced if producers are faced with low prices in consecutive market periods.

On the other hand, the argument could be made that some producers will react negligibly if at all to price changes. These producers have fixed cash commitments, so that when prices fall they will try to increase their production in order to meet their commitments. It is my view however, that this behavior is more likely in the traditional and subsistence type of agriculture, and is unlikely as far as the United States tree fruit industry is concerned. If lower prices are a sufficient disincentive, the capacity of the industry to grow and expand would be endangered since producers would lack incentive to invest in new plantings, improved technology and other innovative techniques consistent with development of the industry. It seems that a major task of the plum

industry leaders is to initiate a program aimed at creating relative stability of prices over a long run. This is not to say that stable prices are always desirable. Indeed prices may be stable while production costs are increasing. In this respect stable prices may be undesirable, at least from the producers point of view. Here the thesis is that producers want to know that there exists some minimum relationship between their production costs and price. If prices are at least stable the incentive to disinvest may not be as strong as it otherwise would have been. Similarly producers being fairly certain that prices will not fluctuate violently will have an incentive to reduce production cost, thereby increasing their profit margin.

On the other hand, the argument could be made that the incentive to disinvest, caused by fluctuating prices could be a good thing for the industry. Under such conditions inefficient, high cost producers will be forced to leave the industry. When this happens supply will be reduced and price raised.

From the consumers point of view of consistent supply of high quality products at a low price is what they are interested in. This can only be provided by producers who have the right incentive to make their efforts worthwhile.

TABLE 4: PRUNES PRICES RECEIVED BY GROWERS, MICHIGAN AND NORTHWESTERN STATES*

	MICHIGAN		OREGON		WASHINGTON	
	FRESH*	ALL PROCESSED*	FRESH*	CANNED*	FRESH*	CANNED*
1955-59 Avg.	$111.00	$74.80	$ 62.50	$ 50.46	$ 93.20	$ 48.40
1960-64 "	130.00	86.00	109.50	83.30	147.40	75.00
1965-68 "	147.20	75.25	153.75	69.60	195.00	67.20
1965 "	143.00	75.00	150.00	56.20	176.00	62.00
1966 "	130.00	68.00	119.00	51.50	209.00	82.00
1967 "	142.00	71.00	165.00	64.70	181.00	76.00
1968 "	174.00	87.00	181.00	106.00	214.00	116.00
1969 "	113.00	62.00	157.00	53.00	186.00	54.00

SOURCE: U.S. DEPARTMENT OF AGRICULTURE, CROP REPORTING BOARD

PRUNE AND PLUM UTILIZATION

Historically prunes and plums have been utilized in three major forms, canned, fresh and frozen. The past fifteen years have seen the transition from fresh sales to canned as the major outlet for Michigan plums. During the period of 1955-1959 fresh sales accounted for an average of 53 percent of all plums marketed in Michigan whereas 35.3 percent was sold as fresh fruits. The following five years saw an increase in canned sales, the reported figure being an average of 52.6 percent, with 42.8 percent for fresh sales. The decline in fresh sales, accompanied by increasing percentages of canned sales continued to 1968 at which time 67.8 percent of Michigan's output was canned with 23 percent being sold fresh. Although available data indicates that sale of frozen plums has been insignificant the trend has been upward. During the period 1960-64,

*Average prices as sold

frozen sales accounted for only 2.4 percent of total sales. This figure increased to 5.7 percent in 1966 and 7.5 percent in 1968.

Conversely, utilization in the competing Northwestern states has remained fairly stable over time. This condition persists although the percentage sold for drying in those states has to an extent decreased. Fresh and canned sales have been more erratic in these states than in Michigan. Frozen sales although very insignificant continues to increase reaching 2.4 percent to total sales in 1967, compared with 0.9 percent in the period 1955-59.

In general the Northwestern states continue their dominance of the fresh market with 87.6 percent of U.S. industry fresh sales in 1968 compared with Michigan's 12.4 percent. Michigan's performance in the area of canned plums has been more dramatic than fresh sales. During the period 1955-1959 average sales of canned plum as a percentage of industry total was only 8.9 percent, compared to the Northwestern states 91.1 percent. This figure gradually increased to 58.8 percent in 1968 compared to 41.2 percent for the Northwestern states.

TABLE 5: PRUNE - PLUM UTILIZATION - MICHIGAN AND NORTHWESTERN STATES

	Michigan % Sold: b			Northwestern States:a % Sold: b				Total Sales Fresh		Total Sales Canned	
	Fresh	Canned	Frozen	Fresh	Canned	Frozen	Dried	Mich. Share	N.W. Share	Mich. Share	N.W. Share
1955-59 Avg.	53.0	35.3	n.a	49.2	28.0	0.9	15.5	7.6	92.4	8.9	91.1
1960-64 "	42.8	52.6	2.4	48.2	31.3	0.7	11.1	13.4	82.6	22.6	77.4
1965-68 "	30.1	63.2	5.3	50.6	31.9	1.4	9.9	12.6	87.3	32.4	67.6
1965 "	27.2	79.6	n.a	48.3	35.6	1.5	9.1	7.8	92.2	22.7	77.3
1966 "	38.4	54.2	5.7	49.7	31.8	1.1	13.3	15.9	84.1	29.3	70.7
1967 "	31.0	62.5	6.4	46.2	34.4	2.4	12.3	14.4	85.6	31.1	68.9
1968 "	23.0	67.8	7.5	65.8	19.9	n.a	0.9	12.4	87.6	58.8	41.2

SOURCE: U.S. DEPARTMENT OF AGRICULTURE, CROP REPORTING BOARD, AS REPORTED IN AGRICULTURAL ECONOMICS REPORT, NO.162, MICHIGAN STATE UNIVERSITY, MAY 1970.

n.a = not available
a) = Washington, Oregon and Idaho
b) = Percent of total production

COMPARATIVE COST ANALYSIS - MICHIGAN AND OREGON

While it would have been worthwhile to analyse cost relationships between Michigan and all of the Northwestern competing states, Oregon has been selected primarily because it is the strongest competitor in terms of volume of production, and also because it was the only competing state for which data were available.

The cost analysis described in this section is based on previous studies done in Michigan by Myron Kelsey, Stephen Harsh, and Glen Antle, at Michigan State University. The Oregon analysis was done by Farm Management specialists at Oregon State University.

In both studies the method of survey was confined to interviewing some progressive growers in selected areas in both states. All jobs performed in these growers orchards were listed along with the amount of time they said it took them for performance. The rate figures used were based on the average of these growers responses and were computed at the then current rates for depreciation, interest, labor, and various other expense items.

I should point out that the figures in this analysis do not reflect average cost of plum production for all growers in both areas. This is due primarily to the method by which the survey was done. The participants were above average producers, so it is likely that the yield per acre will be higher and the cost of production relatively lower.

Uses of the Cost Information

A knowledge of the cost of production is vital to industry planners in more ways than one. First cost information helps local producers to determine whether or not they can compete effectively with other producing areas in the long run. Secondly, growers and processors need to know cost relationships in order to plan future production patterns, and aid in other decisions making processes. Cost information also provides a framework whereby industry people can suggest changes aimed at lowering costs, thereby making the industry more competitive. This is not to imply that lowering costs is always good or desirable. There are instances when costs might have to be increased to get a better quality product or to increase production. These are the major reasons for the following analysis.

Growing Costs

Here growing costs are regarded as those costs associated with cultural operations. Some components of growing costs are trimming, brush removal, and fertilizer (Table 6). The table reveals that total growing cost for one acre of plum in Michigan is $107.63, whereas in Oregon it is $83.90. The corresponding average yields per acre were estimated to be 250 bushels per acre in Michigan and 167 bushels per acre in Oregon. Labor costs $38.41 for producing an acre of plums locally, whereas in Oregon it costs $25.15. The table shows that trimming is by far the highest labor consuming operation, costing $26.10 in Michigan

as against $11.20 in Oregon.

Brush removal costs in Michigan is nearly four times the cost in Oregon, while the cost of applying fertilizer in Michigan is a little over two times that of Oregon. In the area of spraying both states have comparable costs, while Oregon's $5.60 for mowing is over three times greater than Michigan's.

Although Michigan has a higher growing cost per acre than Oregon it would appear that a part of this cost difference is compensated for by higher yields in Michigan.

A look at machinery costs will also reveal that in Oregon this cost is $28.38 compared to $13.05 in Michigan. It is likely that this apparent greater use of machinery by Oregon growers is because the entire machinery costs (both fixed and variable) are calculated on a per hour basis, whereas in Michigan fixed machinery costs are calculated separately.

The cost of material is another high cost item as far as Michigan growing costs are concerned. Here total material costs for growing one acre of plums in Michigan is $49.31 compared to $30.36 in Oregon. Whereas it is costing Michigan producers $37.28 for spray material, Oregon producers only pay $13.30. It would seem unlikely that the Oregon producers have access to a source of cheap spray material not known to the Michigan producers. This cost difference is probably associated with more regular spraying in Michigan, due to greater threat of diseases. Also it is likely that more trees per acre will require a somewhat larger

amount of spray material.

TABLE 6: PLUM GROWING COSTS PER ACRE - MICHIGAN[1] AND OREGON[2]

	LABOR		MACHINERY		MATERIAL		TOTAL	
	MICH.	ORE.	MICH.	ORE.	MICH.	ORE.	MICH.	ORE.
TRIMMING	**26.10**	11.20	3.54				29.64	11.20
BRUSH REMOVAL	2.24	.67	.83	3.30			3.07	3.97
FERTILIZER	1.12	.56	.45	1.55	8.70	10.90	10.27	13.01
HERBICIDES	1.34		.40		3.33		5.07	
SPRAYING	6.05	6.00	6.99	11.20	37.28	13.30	50.33	30.50
MOWING & CULT.	1.56	5.60	.84	9.35			2.40	14.95
OTHER		1.12		2.97		6.16	6.85	10.25
GROWING COST/ACRE	38.41	25.15	13.05	28.38	49.31	30.36	107.63	83.88

SOURCE[1]: COMPILED FROM AGRICULTURAL ECONOMICS REPORT, NO.162, PAGE 10, MICHIGAN STATE UNIVERSITY, MAY 1970.

SOURCE[2]: COMPILED FROM ENTERPRISE DATA SHEET, COOPERATIVE EXTENSION SERVICE, OREGON STATE UNIVERSITY, 1964.

Plum Harvesting Cost Per Acre - Michigan and Oregon

Harvesting costs are defined as those costs associated with reaping of plums. With hand harvesting these costs are primarily labor costs. Table 7, indicates some of the components of these costs.

Labor was again the high cost item in harvesting costs. Whereas Michigan producers are spending approximately $178 per acre to harvest plums, the Oregon growers are paying a little over $82. A part of this cost difference can be attributed to the greater yields in Michigan. Michigan produces approximately 83 bushels per acre more than Oregon, consequently one would expect higher harvest costs.

On the other hand plums are harvested by hand in Michigan compared to mechanical harvesting in Oregon. In this respect local growers pay $151.50 for picking an acre of plums compared to $57 by Oregon growers. Oregon growers on the other hand pay approximately $6 for machinery in harvesting plums due to the fact that shaker equipment is employed to perform this service.

It would appear that the major difference in harvesting costs lies primarily in labor. The Oregon harvesting operation appears to be highly mechanized judging from the machinery costs. Michigan on the other hand relies heavily on manual labor at harvest time, coupled with the fact that indications are that the services of labor is more expensive in Michigan ($2.25 per hour) compared with $1.70 for Oregon.

Because labor is such a high cost item in harvesting costs, local growers should continually ask themselves these questions:

(1) How efficiently is labor organized and managed?

(2) Are local producers employing too much labor?

(3) Could they economically switch to mechanical harvesting?

TABLE 7: HARVESTING COST PER ACRE - MICHIGAN[1] AND OREGON[2]

	LABOR		MACHINERY		MATERIAL		TOTAL	
	MICH.	ORE.	MICH.	ORE.	MICH.	ORE.	MICH.	ORE.
GROUND PREPARATION		1.12		2.30				3.42
SHAKE TREES		5.94		21.00				26.94
PICKING OR PICKING UP	151.50	57.12		5.94			151.5	63.06
SUPERVISION & HAULAGE	26.80	18.14		2.20	11.24	2.50	38.04	22.84
TOTAL HARVEST COST/ ACRE	**178.30**	82.32		31.44	11.24	2.50	189.54	116.26

SOURCE[1]: COMPILED FROM AGRICULTURAL ECONOMICS REPORT, NO. 162, PAGE 11 MICHIGAN STATE UNIVERSITY, MAY 1970

SOURCE[2]: COMPILED FROM ENTERPRISE DATA SHEET, COOPERATIVE EXTENSION SERVICE, OREGON STATE UNIVERSITY, 1964.

Fixed Costs

The fixed cost situation related to the Michigan and Oregon studies are outlined in the following table.

TABLE 8: FIXED COST SITUATION - MICHIGAN[1] AND OREGON[2]

	MICHIGAN	OREGON
GENERAL OVERHEAD		$ 1.90
TAXES ON LAND	$10.00	12.00
MACHINERY OVERHEAD	44.63	
OPERATING CAPITAL		1.60
INTEREST ON ORCHARD AND LAND AT $800 PER ACRE.	42.00	40.00
ORCHARD DEPRECIATION	60.00	26.20
TOTAL FIXED COST/ACRE	156.63	81.70

SOURCE[1]: COMPILED FROM AGRICULTURAL ECONOMICS REPORT NO. 162, PAGE 11, MICHIGAN STATE UNIVERSITY, MAY 1970

SOURCE[2]: COMPILED FROM ENTERPRISE DATA SHEET, COOPERATIVE EXTENSION SERVICE, OREGON STATE UNIVERSITY, 1964.

The table indicates that Michigan's fixed costs are almost double that of Oregon. However, it would appear that while some of this difference is genuine, others are due to the assumptions underlying the Oregon analysis. The assumptions of Oregon study precludes such factors as fixed cost on machinery and buildings which tends to deflate the fixed

cost figures. It has already been pointed out that the Oregon growers seem to have heavily mechanized orchards. Related to this is the fact that Oregon utilizes mechanical harvesters, whereas in Michigan harvesting is done primarily by hand picking.

In any case it seems that very little can be done about fixed cost once the orchard is set up and in operation. High average yields appear to be one way of keeping unit costs down.

TABLE 9: COST COMPARISONS - MICHIGAN AND OREGON

VARIABLES	UNITS	MICHIGAN*	OREGON*
YIELD PER ACRE	Bushels	250	167
GROWING COST PER BUSHEL	Dollars	.43	.50
HARVEST " " "	Dollars	.75	.69
FIXED COST PER BUSHEL	Dollars	.63	.49
VARIABLE COST PER BUSHEL	Dollars	1.18	1.19
TOTAL COST PER BUSHEL	Dollars	1.82	1.68

Source*: COMPILED FROM COST STUDY DONE BY KELSEY ET AL IN THE "ECONOMICS OF PLUM PRODUCTION IN WESTERN MICHIGAN, AGRICULTURAL ECONOMICS REPORT NO. 162, MAY 1970.

Source*: COMPILED FROM "ENTERPRISE DATA SHEET" OREGON STATE UNIVERSITY, 1964.

Michigan's Competitive Position

The study shows that the cost differences between Michigan and Oregon are not very great. While some of these differences seem to be genuine, others appear to be caused by the assumptions underlying the

analysis. The cost of labor is the high cost factor in local plum production. In Michigan total labor costs for producing an acre of plums is $216.71 compared to $107.47 in Oregon. A part of this cost is offset by the fact that yields in Michigan are higher than in Oregon.

The table shows that both areas have about the same cost as far as variable costs are concerned yet Michigan has higher harvesting cost per bushel. It would appear therefore that local producers need to give some more attention to reducing labor costs. In this respect machinery costs might actually be increased in order to reduce labor costs. On the other hand attention should be given to the right size machinery for the given size operation. In cases where expensive machinery is required, growers could explore the possibilities of joint ownership of such equipment.

With regards to materials, the possibilities should be looked into for pool purchasing of these materials, as there are usually economies to be gained from large scale buying.

One very effective measure for reducing costs by individual growers, is to increase yields. This alternative may not be embraced readily, neither could it be strongly indicated in view of the influence of increase production on price indicated by the forecast equation. The yield of 250 bushels per acre used in the Michigan analysis was estimated to be an average yield over a period of several years for an above average plum grower.

The Michigan study however, revealed that if average yield can be increased through such means as superior site or management, then production cost per bushel would be substantially lower. This is shown in the table below.

TABLE 10: EFFECTS OF VARYING YIELDS ON COST PER HARVESTED BUSHEL OF PLUMS

HARVESTED YIELD PER ACRE	VARIABLE GROWING	VARIABLE HARVESTING	TOTAL VAR. GROWING & HARVEST.	FIXED GROW. & 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	0.52	1.64
350 BU	.32	0.76	1.08	0.45	1.53

SOURCE: AGRICULTURAL ECONOMICS REPORT NO. 162, MICHIGAN STATE UNIVERSITY MAY 1970.

MICHIGAN PLUM PRICE ANALYSIS

Earlier on it was pointed out that an analysis of Michigan plum price is a major objective of this study. It was also pointed out that a forecast price cannot be estimated with complete accuracy. Yet it is generally conceded that information regarding demand and price conditions is basis to any industry analysis. This is so in part because producers are concerned about future prices, since it is one basis for future planning and production patterns. Similarly processors are interested in the price they pay for their raw material, since this will in turn affect their costs, and consequently the price of their finished product. In this respect a systematic analysis of past market conditions and price relationships can provide a basis for predicting as accurately as possible future price relationships.

As far as Michigan plums are concerned the main objective is to develop a mathematical equation which can be used to predict plum prices at the farm level, given the available estimates that seem significant in their influence on plum price. It should be pointed out however, that such an equation is most accurate only when updated periodically. The variables comprising the equation should not be regarded as permanent, as indeed it is quite possible that one variable might significantly affect plum prices in one crop year, yet it might be insignificant in another period, In trying to arrive at the price predicting equation, the least square regression technique was used. Selection of market factors to be tested statistically was based upon economic theory,

a general knowledge of the plum market, and previous price studies of similar crops.

Plum Market Factors

Even within the context of economic reasoning, and a general idea of market conditions, the initial attempt to arrive at a price predicting equation was primarily one of trial and error. Factors that were thought to have some influence on plum price were tested. Some of these are discussed below.

(1) Disposable income: This was tested because theoretically one would expect more to be spent on plums with increases in the general level of disposable income.

(2) Population: Theoretically, an increase in population is usually associated with an increase in demand for food. To this end U.S. population was tested as a plum market factor to see what effect an increase in population had on the demand, and ultimately the price of plums.

(3) Canners Carryover Stock: The total supply of plums during any market period will include the current production, plus canners carryover stocks. If carryover stocks are large, it is likely that plum prices during that market period will be low. On the other hand if carryover stocks are small it is likely that prices will be higher. It is on this reasoning that canners carryover stock was tested as a plum market factor.

(4) Competing Fruits: Various measures of competing fruits were tested. The rationale here is that if a fruit competes directly

with plums, then assuming that the price of that fruit falls, the tendency would be for consumers to purchase more of that fruit and less plums. On the other hand the tendency would be reversed if plum prices were lowered. Some measures of competing fruits tested were:

(a) United States growers price of apples for canning and freezing.

(b) California growers price for cling peaches to be canned. This was tested as a market factor primarily because it largely represented U.S. growers prices for cling peach to be processed.

(c) The price received by Michigan growers for peach to be processed.

(d) The total supply of cling peaches (U.S.).

(5) The size of the Michigan Plum Crop: It is common knowledge within the industry that the size of the Michigan Plum crop will largely influence the price. Over the years the tendency has been that very large crops are associated with low prices. On the other hand small crops are associated with low prices. On the other hand small crops usually bring higher prices. Consequently the production of plums in Michigan was tested as a plum market factor.

(6) Production of the Competing States: The size of the crop in the competing states will inevitably affect the price of plums in Michigan. Large crops in the competing areas will in all

probability lead to lower prices in Michigan. On the other hand past price information has shown that high prices in Michigan were due partly to relatively small crops in the competing areas. This was the basis for testing the production of the competing areas as a market factor.

Market Factors That Proved Significant

The market factors that proved most significant in their effect on Michigan farm price of plums are:

(1) The size of the Michigan plum crop.

(2) The size of the crop in the Northwestern States combined with canners carryover stock expressed as fresh equivalent.*

(3) The price received by U.S. growers for canning and freezing apples.

The following equation was estimated:

$$P_F = 111.82480 - 4.27542A - 0.34877B + .94039C$$
$$R_2 = .83 \qquad S = 7$$

In which

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 anf freezing sales, expressed in dollars per ton.

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*To convert carryover stock to fresh equivalent multiply by 29.85 lbs., then divide by 2000 to express fresh equivalent in tons.

The R_2 value of .83 which is the coefficient of multiple determination, means that this equation explains 83 percent of the annual variation in plum prices. The mathematical price predicting equation can be interpreted as follows:

(1) The price of Michigan plums can be expected to increase by four dollars and twentyseven cents per ton if the Michigan production decreases by 1000 tons.

(2) The price of Michigan plums can be expected to increase by 34 cents per ton, if the production of the Northwestern states decreases by 1000 tons.

(3) The price of Michigan plums can be expected to increase by 94 cents per ton if the price of apples for canning and freezing increases by one dollar per ton.

Probably the most important point demonstrated by this equation is the fact that the size of the crop in Michigan is significantly more important than the size of the crop in the Northwest. This is demonstrated by the considerable increase of $4.27 per ton for a 1000 tons decrease in Michigan's production compared to a 34 cents increase per ton for a comparable quantity decrease in the competing states.

Plum Market Factors That Proved Insignificant

Disposable Income: One would have thought that disposable income would influence the price of plums significantly. In fact this variable proved significant when tested initially. In this case the R_2 value obtained when disposable income was tested along with Michigan production,

Northwestern production, U.S. population, and cling peach supply as a competing fruit was 69. The output data sheet indicated that if this variable was deleted the R^2 value would be reduced to 58.

Later on disposable income was tested along with Michigan plum production, Northwest production, plus carryover stock expressed as fresh equivalent, and U.S. apple growers price for canning and freezing. The R^2 value obtained then was 84. The output data sheet indicated that if disposable income was deleted the R^2 value would be reduced to 83. It was on this basis that disposable income was discarded as a plum market factor.

Population: As pointed out earlier the influence of population was also thought to be an important factor affecting plum prices. When U.S. population was tested as a variable the sign of the coefficient was negative, which is another way of saying that an increase in population is associated with a decrease in price. This variable was therefore discarded on the basis of unsound economic logic.

Canners Carryover Stock: One important observation was made during the course of the analysis. This was in respect to canners carryover stock. In all cases where carryover stock was tested as a market factor, it hardly raised the R^2 value. However, when expressed as fresh equivalent and added to the production of the Northwestern State the R^2 value was higher, (83) and the computer output data sheet indicates that the R^2 would have been about 60 had this variable been omitted.

Competing Fruits: All measures of competing fruits except the U.S. growers price of apples for canning and freezing were discarded primarily because they did not increase the R^2 value by any significant amount. However, when the Michigan growers price of cling peaches for processing was tested as a market factor, along with the Michigan plum production, Northwestern production and disposable income the R^2 value was 82 percent. When this variable was dropped the R^2 value decreased to 64 percent, which indicates that this is a significant variable as far as the price of Michigan plums are concerned.

However the bulk of the cling peaches produced in Michigan goes into the production of certain pie fillings and the manufacture of baby food. These products do not compete strongly with either fresh or processed plums. It was therefore on this basis that the cling peach price received by Michigan growers was discarded as a plum market factor.

The price of the 303 cans of applesauce was also tested and discarded as a measure of competing fruit. This was also due to the fact that it did not increase the R^2 value significantly.

Michigan Plum Price Forecast

The plum price equation can be used to predict the price of Michigan plums in future market periods by substituting into the equation the appropriate estimates of the relevant independent variables. In this case the variables are:

(1) Michigan plum production

(2) Northwestern states plum production, plus carryover stocks expressed as fresh equivalent.

(3) U.S. growers price of apples for canning and freezing.

Michigan's Expected Production

Michigan's future plum production can be estimated based upon tree number data and expected yields per acre.

When new orchards are planted it takes on the average about 5 years before significant production is obtained under typical Michigan conditions. Productive capacity increases each year until about age 12 when full productive level is reached. This full productive capacity may continue up to 25 years of age. With a non bearing period of 5 years and a 20 year bearing life it would take 25 percent non bearing trees to maintain a given bearing acreage.

If average yields per acre are assumed to remain at the present level through 1975, Michigan's production of plums, and the production of the Northwest competing states can be projected into this period, based upon tree numbers. Table 3 indicates that in 1964, Michigan had approximately 350,000 bearing trees and 295,000 non-bearing

Since we assume that 25 percent non bearing trees are needed to maintain bearing acreage, then 87,000 non bearing trees are needed for a constant bearing acreage. When this figure is subtracted from the 295,000 non bearing trees present in 1964, there are an additional 207,500 trees which can be expected to result in expanded bearing acreage. This figure combined with the present 350,000 bearing trees give rise to a grand total of 558,000 bearing trees during the early 1970's. This is approximately 1.6 times the amount in 1964. Data from a more recent (1968) survey conducted in the state supports this 1.6 times increase in bearing trees over the 1964 period. With a corresponding increase in production 1.6 times based on the recent 4 year average production plum production in Michigan can be expected to increase to an average of about 21,900 tons in the early 1970's.

Since many of the current bearing trees are of a relatively young bearing age, future production can be expected to increase more than proportional with the increase in bearing acres. Consequently it seems likely that Michigan's plum production will approximately double from the late 1960's to the early 1970's. If production doubles it is likely that the state will be producing about 27,600 tons of plums by 1975.

Expected Production in the Northwestern States

The same method can be used to estimate the plum production of the Northwestern competing states during the early 1970's. It was

assumed that 25 percent non bearing trees are needed to maintain a constant bearing acreage in the Northwest as in Michigan. Thus Washington and Oregon can be expected to increase their bearing tree numbers by 14 percent and 25 percent respectively by the early 1970's, while Idaho will probably have about the same number of trees then as during the late 1960's. Similarly, if yields per bearing acre remain constant, Washington's production can be expected to be about 17,800 tons by early 1970's with Oregon production averaging 29,500 tons and Idaho producing about 13,500 tons during the same period. All together the Northwestern states can be expected to produce 60,600 tons of plums during the early 1970's. This can be compared to recent 4 year average production of these states of 52,725 tons.

Canner's Carryover Stocks

Earlier on it was pointed out that the production of the Northwestern competing states plus canners carryover stock expressed as fresh equivalent was one significant market factor in predicting Michigan's plum price. Carryover stocks in the early 1970's were assumed to remain unchanged from recent average levels. Thus carryover stocks were computed by using the last 4 year average of carryover stocks expressed as fresh equivalent tons. This was then added to the production of the Northwest states, thus forming a total supply variable of 68,200 tons, with carryover stocks estimated at 7,400 tons.

U.S. Apple Prices - Canning and Freezing

William G. Tomek* has made a study of the U.S. apple industry including a price analysis and projection of 1975. The level of U.S. apple prices used in this plum price forecast is therefore based on the estimates made by Tomek in his study.

From the study Tomek concluded that by 1975, assuming a 160 million bushel crop with 52 percent produced in the Eastern states and Michigan, then apple prices may be expected to be about $68 per ton or $64 assuming production of 175 million bushels. These prices are generally higher than the present price levels given the expected crop size. Tomek argues that if 52 percent of the crop is produced in Michigan and the Eastern States then the demand for processing plums will be greater than the present level and hence the higher price. These prices are based on a price predicting equation estimated by Tomek.

Tomek further esrimated a price of $47 per ton for canning apples in 1975 based on a crop size of 160 million bushels, with 52 percent produced in Michigan and the Eastern states, and 48 percent produced in the west. This estimate was based on the extension of 1955-66 linear trends to 1975.

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*Author of "Apples in the U.S.: Farm Prices and Uses," 1947-1975, Cornell University Agricultural Experiment Station, New York, State College of Agriculture, New York, July 1968.

Forecast Prices

In forecasting a price for Michigan plums for the early 1970's the relevant variables are:

(a) Michigan's expected production 21,900 tons

(b) Northwest expected production 68,200 tons.

(c) Expected price of U.S. apples for canning and freezing

(1) 64 dollars per ton (2) 68 dollars per ton

(3) 47 dollars per ton.

It should be pointed out that the plum price equation estimated does not make provision for increases in disposable income, population and other factors which are likely to affect plum price levels in the long run. It is likely that increases in disposable income and population will shift the demand curve for plums to the right, which in all probability will lead to higher prices. Consequently it should be borne in mind that such factors like disposable income and population though not included in the equation are forces which influence the price level of plums, and any price forecast is likely to be understand without considering these factors.

(1) $P_F = 111.82480 - 4.27542A - 0.34877B + .94039C.$

Coefficient of A = 21.9 tons (Michigan's production)

B = 68.2 tons (Northwest plus carryover stocks)

C = 64.0 ($ per ton for U.S. apples)

When these values of the independent variables are substituted into the equation the result is:

$P_F = 111.82480 - 93.6225 - 23.7861 + 60.18496.$

Farm price of Michigan plums

P_F = \$54.60 per ton.

(2) If apple prices are assumed at \$68 per ton and Michigan's production at 21,900 tons then:

P_F = 111.82480 - 93.6225 - 23.7861 + 63.94652

= 58.36 dollars per ton.

(3) Assuming apple prices at \$47 per ton and Michigan's production at 21,900 tons then:

P_F = 111.82480 - 93.6225 - 23.-861 + 44.19833

= \$38.61 per ton

(4) Assuming Michigan's production doubles to 27,600 tons and apple prices are \$64 per ton then:

P_F = 111.82480 - 117.9900 - 23.78611 + 60.18496

= \$30.23 per ton

(5) Assuming Michigan's production doubles and apples are \$68 per ton then:

P_F = 111.82480 - 117.9900 - 23.78611 + 63.94652

= \$33.99 per ton

(6) Assuming Michigan's production doubles and apples are \$47 per ton then:

P_F = 111.82480 - 117.9900 - 23.78611 + 44.19833

= \$14.25 per ton

Thus the analysis shows that Michigan plum growers can expect plum prices to average between $30 and $58 per ton. These prices are lower than recent price averages which have been $93 per ton during the last 4 years.

If Michigan plum production doubles and the apple price average $47 per ton, a very low price of $14 per ton is indicated by the analysis. Since harvesting costs average about $20 per ton, growers would not harvest plums for that price. Hence prices could not be expected to go below harvesting costs. This doesn't indicate, however, that extremely low grower prices may not occur by the early to mid 1970's.

CALIFORNIA - A MAJOR AREA FOR FUTURE COMPETITION

Much of the focus so far has been on the Northwestern States of Oregon, Washington, and Idaho as far as competition for the Michigan industry is concerned. This is due to the fact that both these areas share a high degree of similarity in terms of market, and product characteristics, which contributes to their being close competitors in the plum industry.

However, California is also a major producer of plums. In fact this state is the largest plum producer in the United States. The major portion of California's plum production is marketed in the fresh state, whereas that of Michigan is marketed primarily in the processed form. It has in the past been debated whether or not California fresh plums do compete with Michigan's. The arguments that tend to discount the California competition in the fresh market is based largely on the fact that both areas have different marketing periods and varietal characteristics.

As to whether or not both industries do compete will not be debated here. However, reports from the industry are that late California plums do compete with Michigan's plums, and it would therefore seem ill advised for local industry leaders to discount the present or future threat of competition from the largest plum producing area in the country. Indeed the potential of California as a major source of competition becomes even more pronounced when one considers the great changes taking place in transportation and other areas of marketing in the U.S. The following section is therefore intended to give a

brief insight into the California industry.

The California Situation*

Commercial production of plums is confined principally to a few specialized growing areas in California. Production in this state quadrupled acreage until about 1935, but since has been largely due to increased yields. Like Michigan, production varied considerably from year to year because yields fluctuated widely with changes in weather conditions.

The literature shows that acreage expanded rapidly in the state up to about 1935, and then leveled off at an average of about 23,000 bearing acreas up to 1968. This expansion and levelling off in acreage has also been associated with varietal, age and locational changes. Yield remained at about 2.2 tons per acre until about 1935, but rose considerably since then to the present 4.4 tons per acre, now being produced.

Varietal Characteristic

Some 15 to 20 varieties of plums are produced in California. Plum varieties show differences, sometimes very pronounced in appearance, palatability, marketability, tree growth and productiveness. These differences have a significant effect on the economic and technological aspects of production and marketing.

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*All of the information on the "California Situation" was taken from the report "California Plums," Economic Situation 1968, put out by California Agricultural Experiment Station, April 1968.

Plums grown for fresh consumption are primarily of the European and Japanese groups. The Japanese varieties are characterised by being typically medium to large, flat, round, or heart shaped, crimson or red, never blue or purple and usually are very juicy. Conversely, the European varieties generally are smaller, oval or roundish, and purple or blue. Compared to the Japanese varieties, most European plums are milder and have a firmer texture. This unique characteristic of European varieties have limited canning primarily to this variety, especially plums of the Jefferson, Washington and Yellow Egg varieties.

California producers are continually attempting to find adapted varieties, to increase yield, and to recognize buyer preferences, as such they constantly alter the varietal composition of their acreage. Fresh sales account for 95 percent of total plums marketed in the state. Of this total approximately one fifth is sold within California while the remaining four-fifths are shipped to markets outside of the state. In contrast over 67 percent of Michigan's production reaches the market as canned plums.

Given the upward trend in Michigan's production and the substantial expected increase in production during the 70's local producers could start programming future action towards obtaining a greater share of the fresh plum market, not withstanding varietal differences.

Farm prices for California plums have varied considerably. The average level being determined primarily by changes in consumer purchasing power. Annual fluctuations are attributed mainly to year

variations in production. The general price level has increased gradually from a depression low of $25 per ton in 1931-1933 to $50 in 1941, after which period prices rose steadily to an average of $140 per ton, a price that has been maintained through 1969.

The Basis For California's Potential

There is no doubt that California controls a sizable portion of the total U.S. fresh market. This state's ability as a source of competition for Michigan plums primarily in the processed market is severely limited largely because the varieties of plums produced are not suited to processing.

With respect to fresh sales, the ability of California to compete cannot be discounted. In the past local producers have discounted this source of competition on the basis of varietal differences and different marketing periods for fresh plums. The fact is that while 67 percent of Michigan's plums are processed almost a third goes to fresh sales, indicating that this is still a big source of income to the industry and producers in general. As such all plum producing areas must be regarded as sources of potential competition. Although highly speculative at this stage, it is quite possible that some new technique for storing plums without affecting quality will be found. In the event that this happens varietal differences would be of minor importance since consumers have been known to alter their consumption habits in certain line of foods under vigorous promotional campaigns.

This does not preclude the plum industry.

Specific policy measures are hard to suggest at this stage. However, it would appear that industry leaders will be in a better position to meet this source of competition if and when technology and rapidly changing market conditions bring these two industries head on into the market place if they are aware of the potentials of the California industry as a source of competition.

TABLE 11: CALIFORNIA PLUMS: PRODUCTION, ACREAGE AND YIELDS 1955-1957

CROP YEAR	PRODUCTION	ACRES			
	(TONS)	BEARING	NON BEARING	TOTAL	YIELD PER BEARING ACRE (TONS)
1955	86,000	21,094	4,978	26,072	4.08
1956	100,000	21,555	6,011	27,566	4.64
1957	81,000	22,340	6,031	28,371	3.63
1958	61,000	21,297	6,934	28,231	2.86
1959	93,000	21,755	7,579	29,334	4.27
1960	82,000	23,268	6,137	29,405	3.5
1961	87,000	22,211	5,844	28,055	3.92
1962	84,000	23,237	4,965	28,202	3.61
1963	106,000	24,232	5,928	30,160	4.37
1964	116,000	25,478	5,190	30,668	4.55
1965	113,000	25,420	3,820	29,240	4.45
1966	95,000	22,090	2,470	24,500	4.30
1967	98,000	22,000	N.A.*	N.A.*	4.45

SOURCE: GIANNINI FOUNDATION RESEARCH, REPORT NO. 295, CALIFORNIA PLUMS, ECONOMIC SITUATION, 1968 Page 29.

*Not Available

PAST PERFORMANCE OF THE INDUSTRY

Joe Bain* has defined performance as the composite results flowing from the industry to the firm, and is related to the structure and conduct of the industry. The term is indeed a normative concept since it considers "good" and "bad," "right" and "wrong."

In assessing the past performance of the Michigan plum industry the following performance criteria will be considered.

(1) Efficiency

The term efficiency is an engineering concept which considers useful outputs in relation to useful inputs. When used socially the term usually defines certain value judgements. Here we shall examine efficiency in terms of

(a) Operational Efficiency

(b) Pricing Efficiency

With respect to operational efficiency there is very little that can be said in view of the lack of information in this respect. However, sources close to the industry point out that with respect to technology, the latest is employed by industry personnel.

The number of processing plants is another factor directly related to the operational efficiency of the industry. Too many small plants might impair operational efficiency by increasing operational costs. Similarly operational efficiency would be impaired if the plants are not operating at full capacity. This in turn is reflected in high prices

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*Bain, Joe S., "Industrial Organization," John Wiley, 1st Edition

to consumers and/or heavy losses to processors.

In Michigan it is reported that there are about 20 plants involved in processing plums. While all the plants are not processing the same end product it would appear that this number seems high considering total plum production in the state. More recently this has become less of a problem with the continued diversification of the processing plants. Some plants are now equipped to process plums, apples and other fruit tree crops, so that unit cost is lower for the fruits involved, in that over head costs and variable costs are spread.

It has also been reported that fruits sometimes reach the market in inferior condition due to the time lag between reaping and the various retail outlets. In this respect, steps taken to reduce this time lag will greatly improve operational efficiency.

(b) Pricing Efficiency

One would have expected the price system to reflect supply and demand conditions. In the past this has not always been the case. The indications are that a certain amount of collusion exists on the buying side of the industry. Some processors, it is pointed out, sometimes collude in setting prices paid for their raw material. On the other hand the pricing system has been inefficient in that it has not adequately reflected back to producers the need for improved quality plums reaching the market. Inferior quality plums have been sold on the market along with good plums for the same price. This condition would not have existed had the pricing system been working efficiently.

Another serious problem in the industry as far as price is concerned is the year to year fluctuation. During short crop years prices are high, as would be expected. The problem is that some producers interpret this as a signal to increase production by planting substantially more orchards. This increase in production further serves to depress prices in later years. Conversely, during period of a bumper crop prices are inevitably low. Some producers sees this as a signal to cut back on production, which again serves to drive up prices in the long run. Consequently fluctuations in prices is not always a function of demand and supply conditions only, but also to the faulty working of the price system.

2. Product Suitability

The expansion in the growth of the canned plum industry would seem to indicate that in this respect the industry is putting out a product that is desired by the consumers. This conclusion is supported by the fact that such an expansion would never have been possible, considering the wide array of substitute products, if the product was not suitable. The situation in the fresh market however has not been as good. Early season sales usually bring better than average prices, hence the temptation is strong to harvest, and market fruits often before they are ripe. This has been a major reason for the incidence of poor quality fruits on the market. Related to this is the fact that early reaping causes the fruits to have low sugar content and a flat taste, rather than the full tart-sweet flavor that is desirable.

On the other hand, when labor is scarce the reverse situation sometimes develop as a result of the fruits hanging on the trees too long. In this case the flavor at harvest is usually good, but the fruits are unable to withstand the rigors of the marketing process. Consequently they reach the consumers in inferior condition. Two possible sources of remedy maybe

(1) The need for better planning in the marketing process. In this respect producers need to seek out market outlets in advance of reaping so that very little time is wasted between reaping and the fruit reaching the market.

(2) A program for more uniform reaping. In this respect the incentive to reap early so as to fetch higher prices would be greatly reduced, and the incidence of poor quality fruits reaching the market would also be reduced.

3. Innovativeness of the Participants

Innovativeness of the participants is probably one factor that best portrays the performance of an industry. In this respect it seems that the Michigan plum industry has had a high degree of success. The literature shows that the producers have rapidly adopted to new techniques. Producers have adopted the latest spraying and fertilizer materials. Orchards are highly mechanized to the extent that the various levels of operation will permit, including mechanical harvesting.

On the other hand a fair degree of research is being conducted aimed at finding better adapted varieties, consumers preferences and

cultural practices that might aid the development of the industry. It would appear that more work is needed in the area of research and development, chiefly in respect to market expansion and the development of new products.

Ease of Entry and Exit

As pointed out previously, performance is closely associated with market structure and conduct. One market structure variable is the conditions of entry and exit. The conditions of exit and entry will invariably have some influence on the performance of any industry.

The Ease of Entry

Relative to the local growers it would appear that the only barrier to entry is a large capital requirement. This is not generally the case at the processors level. In some sections of the processing industry entry is fairly difficult. This is particularly the case in the baby food industry. Here capital requirements are large, coupled with the fact that there is a high degree of concentration by large well established firms, with well established brand name products. Because of this new firms are faced with high promotional outlay, if they are to compete effectively with these wll established firms.

The Ease of Exit

In terms of exit it appears that the plum industry shares the common problem of nearly all other agricultural enterprise, that of the difficulty of exit due to a high degree of asset fixity.*

*Asset fixity is defined as the condition where the marginal value product is less than the acquisition cost but greater than the salvage value.

It was pointed out earlier that capital requirements for entry is large, coupled with the fact that some items of equipment are fairly specialized, so that when the need arises for producers to leave the industry, it is invariably difficult.

On the other hand increasing diversification of enterprises has made it increasingly less difficult for exit from the industry. Some processing operations are geared to handle more products than one. These producers are therefore in a position to switch enterprises without any undue difficulty.

The situation is somewhat different from the growers point of view, and exit is not as easy. The fact is that plum orchards are long term investments, as such a orchard established today will take years to come into production. In this situation the desire to leave the industry is not very easy, and in most cases must be a long and gradual withdrawal.

The degree of difficulty associated with exit becomes even more meaningful when one considers that in some cases producers are actually producing inefficiently and at high costs, but cannot exit readily. The result is that these producers continually incur heavy capital losses.

A SUMMARY ON PERFORMANCE OF THE INDUSTRY

The evidence indicates that performance of the industry is good in certain respects. These are as follows:

1. The level of technology is fairly good within the industry.
2. The quality of process plums has been good and indications are that it will improve.

3. The growers have been innovative, as demonstrated by their willingness to employ new methods and technology.

4. Entry and exit is fairly easy in some sections of the industry.

5. Though more commitment is needed, industry people have demonstrated a willingness to engage in research and development.

On the other hand it would appear that significant improvement is needed in the following areas.

1. The quality of fresh plums reaching the market.

2. The high degree of concentration evident in some sections of the industry, specifically the processing section.

3. Collusion on the buying side which tends to impair the efficiency of the pricing system.

4. Reducing the time lag between harvesting and the ultimate consumer for fresh plums so as to improve fruit quality.

It should be borne in mind that performance variables are selected results relevant to the attainment of broad social and economic goals. The above is not an exhaustive list of the variables by which performance might be measured. However, it is likely that action geared towards improving the conditions listed under the various performance criteria, will aid the industry in moving towards more desirable performance.

THE MARKET POTENTIAL FOR LOCAL PLUMS

Fresh and processed plums compete with a host of other fresh and processed fruits for the consumers dollar. Local plums also compete with a similar product from the Northwestern producing states of Washington, Oregon and Idaho. California plums are also a minor source of competition.

This tendency for keen competition, coupled with the fact that the present productive capacity of the industry is greater than at any other time in the history of the industry points up the need for extensive market research aimed at expanding the present market. Several factors appear to influence the degree to which the market can be expanded. The quality of fruits is one of such.

The Stanley and Bluefre varieties have demonstrated excellent quality when well grown and properly handled. However, in the past, plums of inferior quality have been known to reach the market. This both hurts the movement of plums and lower prices to local producers. There are many post-harvest factors affecting the quality of processed plum products. Holding the fruit too long in the lug or bin before processing may cause the flesh to discolor, gas cavities to form, or the sugar content may be reduced. Molds and yeasts may even grow on the fruit without being visible to naked eye. Plums picked in the warmer part of the day will hold the heat and spoil more rapidly than those picked in the morning or late evening. To minimize this condition,

processing schedules should be arranged, so that warmer fruits are processed as soon after harvesting as possible. Where this is not possible producers should try to have the plums hydrocooled immediately so as to increase shelf life.

Another factor that needs consideration is the need for better shipping containers. Presently the half bushel basket is being rapidly replaced by corrugated cardboard cartons. Consumers have demonstrated an interest in a convenient to carry consumer size pack. The three to four pound size shrink film overwrapped paper pulp tray is presently being used to some extent. Some consumers are not willing to pay the extra cost for producing such a pack. A major problem therefore is the need for a package that will carry plums to the market in very good condition, and at the same time be competitive in costs with fruits packed in other containers.

In considering competitive factors affecting the Michigan plum industry, we must look at the broad picture. First, since plums are a food product, they compete with all other foods. Second, since plums are a fruit crop, the strongest competition could be expected from other fruits. To meet this type of competition, consumers must be wooed from the standpoint of image of the product, quality of the product or price. Price competition is probably the least attractive both from the industry's viewpoint and the consumer. Some producers claim that too little has been done by way of industry promotion. Even though the

evidence so far has shown that the demand for processed plums is growing, it would still appear that further research is needed to determine consumers preferences in terms of form, quality and package in which plums are most desired. This would in turn form the basis for future expansion in promotional activities.

The need for development of new products cannot be over-emphasized. More recently several new and improved products have appeared on the market. A technique has been developed to pit fresh prune - plums. This will in all probability lead to the development of a superior canned product. Sparkling, clear, fresh prune - plum juice has not found wide acceptance because of the rapid darkening of the juice after opening the container. Recently, however, scientists have found a way of stabilizing the color and extending the shelf life of this excellent product. Another new product just announced is jelled prune - plum puree. It can be used in molds or in jelled salads with other fruits. Taste test panel results have also indicated that frozen Stanley prune - plums make an acceptable pie.*

The development of the export market may be expected to play a major role in future market expansion. In the case of dried prunes the United States has been a major exporter among the principal producing countries. Michigan at present does not produce dried prunes, so it seems that export considerations will have to be limited to processed plums. The present productive capacity of the local industry however

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* Antle, Glen G., and Greig, Smith, W., "The Potentials for Plum Pie," Agricultural Econ. Report No. 146, Michigan State University, August 1969.

might make it worthwhile for serious considerations be given to breaking into the export market for dried plums, since the market for this product is already present. To the extent that export considerations will help to increase the market potential for dried and canned plums, depends on supply situations in other producing countries, and the extent to which trading agreements between importing countries become more liberal.

Currently, new products and new uses offer an unknown but possibly great potential, but it is always wiser to work more vigorously with what is already present, rather than to be complacent and wait for some bonanza which might never come. In the meantime I will reiterate the steps which should be taken to provide the basis for increasing the market potential of the local industry.

1. A study of the market for plums, both foreign and domestic, with a view of expanding the local market where possible.

2. A determination of the factors that influence consumption of plums.

3. An analysis of packers and shippers records to determine the distribution pattern for Michigan plums and to determine import changes that have occurred during recent years. In this way producers will be in a position to plan based on the information he has at his disposal.

This information once assembled would enable the local industry to make decisions, plan programs and take a more objective approach to the marketing process. It should be remembered, however, that no matter how much information is assembled, analyzed, and made available to the industry, an orderly and effective program must include provisions for consistent regular production of high quality plums.

OUTLOOK FOR THE FUTURE

Although the outlook for the future is difficult to state precisely, prospects for the future can be indicated in general terms. As far as production is concerned, continued increases are expected. This situation is imminent since bearing acreage is expected to increase. A continued rise in average yield seems assured providing local producers continue to employ the latest husbandry consistent with high yields.

Relative to farm prices, it would appear that they will be lower if present potential for production locally and in the competing areas are realized. This may not be the case however. First, if the trend towards processed sales is continued it appears that the ability of processed plums to be stored would help create greater stability of prices that would not have been otherwise possible. Secondly, if more ways are found for utilizing plums, then this might help to offset price depressing tendencies caused by increased production. An expansion of the export of plums may well serve to diminish the possibility of low prices. Programs to ensure supply control, and ultimately price stability may be necessary to advocate acreage quota under a marketing order for the industry. Outside of a marketing order for the industry, it would appear that if prices become sufficiently low, producers with diversified enterprises might be most likely to initiate a program of supply control by reducing acreage since they have alternative income bearing sources.

The prospects for fresh storage seem remote, since processors have indicated that plum quality deteriorates rapidly under refrigeration, especially after thirty days in storage. When storage facilities are used other than for plums this situation is different. In the past shippers have used their apple storage facility for plum storage also, so that the unit cost of operating is very low. In any case it appears that until some scientific means are developed to maintain quality under refrigeration, the prospects for prolonged storage of plums are not too good.

If the trend towards fresh sales in the Northwest continues, it is likely that Michigan's processed sales will increase. This might be a good thing for local producers, since the competition with this area would be less direct.

The need for cost reducing measures by growers, shippers and processors cannot be overemphasized. This becomes even more important considering that present productive capacity points up the need for expanded markets. This might mean trying to get into the market of other producing areas. This might not be possible if the present cost structure continues into the future.

Presently, an exact measure of capacity of processing plants, or a breakdown on total production handled by each is not available. However, given present production it is doubtful that all plants are operating at full capacity. If this is the case the condition is not expected to continue indefinitely. Indeed, present productive capabilities,

coupled with the fact that a number of new processed products are coming on the market would suggest that processing plants can be expected to handle more plums in the future and produce a wide range of products. Other than this, it would be unfair to speculate further on any aspect concerning the structure of the industry, since present data along these lines are inadequate. This scarcity of information regarding structure would suggest that a great deal more research is needed in this area.

In general the outlook for the future does not seem very good. This conclusion is supported by the increased new plantings taking place. Production is likely to increase by 60 percent during the 1970's. Production will also be increasing in the competing areas. This indicates that prices may be expected to be substantially lower during the years ahead. Producers have in the past interpreted high prices in short crop years as a signal that more plums are needed. This is in part one reason for the heavy new plantings. This points up the need for improved information in respect of price and demand conditions. More work is needed in this area to prevent future over-planting situations.

SUMMARY AND CONCLUSION

The production of plums has grown steadily in Michigan especially since the early sixties. This is supported by the fact that production increased from an average of 6,400 tons in the early fifties to 14,500 tons in 1969. This increase in production has been made possible through increased plantings and increased yields per acre. The major varieties of plums produced in the state are the Stanley and Bluefre with the Stanley being the most popular. Commercial production is largely confined to the Western part of the state.

For the past decade fresh plum prices received by growers have shown an increasing trend. The processed prices are however the most important to local growers since 67 percent of the plums produced in the state goes for processing. Fluctuation in prices have been evident, due largely to bad weather in some years. Price levels in the future are likely to become low due primarily to expected large increases in supply both in the state and in the competing areas.

The major competing areas as Idaho, Washington and Oregon. These areas dominate the fresh market with 87.6 percent of the four state fresh sales in 1968 compared to Michigan's 12.4 percent. Michigan's canned sales have moved from 8.9 percent of the four state sales during the 1950's to 58.8 percent in 1968.

The lack of adequate pricing information in the industry has substantially impeded long range planning. An analysis of plum prices indicate that three factors influence the price of Michigan plums significantly..

These are:

1. The size of the Michigan crop
2. The supply of the Northwestern competing states, plus canners carryover stock expressed as fresh equivalent.
3. United States growers apple price for canning and freezing.

These factors explain 83 percent of the annual variation in plum prices. The most important point demonstrated by the equation is the fact that the size of the crop in Michigan is significantly more important than the size of the crop in the Northwestern States. This is demonstrated by the fact that a 1000 ton decrease in Michigan's production is associated with a $4.27 per ton increase in price. Conversely a comparable quantity decrease in the Northwestern states is associated with only a 34 cents increase in the Michigan price.

The price predicting equation indicated the following prices for the early 1970's.

1. If local production increases to 21,900 tons, with the supply from the Northwestern states being 68.200 tons, and apple price at $64 per ton, farm price of plums is expected to be $54.60 per ton.

2. If apple prices are assumed at $68 per ton and Michigan's production is 21,900 tons, farm price of plums is expected to be $58.36 per ton.
3. Assuming apple prices at $47 per ton and Michigan's production at 21,900 then farm price of plums is expected to be $38.61 per ton.
4. If Michigan's production doubles to 27,000 tons and apple price is $64 per ton, Michigan farm price of plums may be expected to reach $30.23 per ton.
5. Assuming Michigan's production doubles and apples are $68 per ton, Michigan's plum price may reach $33.99 per ton.
6. If Michigan's production doubles and apples are $47 per ton, plum price locally may be expected to go as low as $14 per ton.

This last situation is however quite unlikely since harvest costs are higher and growers would in all probability not harvest at this price.

Michigan producers have in the past discounted the California industry as a source of competition. This attitude is based on the argument that California has a different marketing period and wide differences exists in variety. The potential of this state as a source of competition needs much more consideration than that afforded it at present, because rapidly changing market conditions and technological advances may well make both areas competitors in a common market place in the near future.

As far as industry is concerned performance has been good in certain areas while others need serious attention. The level of technology employed by the industry has been relatively good, so is the quality of processed plums. The participants have been fairly innovative, as demonstrated by their willingness to employ new methods. The attitude towards research and development has been fairly good, though more effort is needed in this area.

On the other hand more effort is needed to reduce the incidence of inferior quality plums reaching the market. The evidence is that a fairly high degree of concentration exists in certain areas of the industry, specifically in processing. Collusion by processors also tends to impair the functioning of the price mechanism. The time lag between reaping and the ultimate consumer has in some case been too long, so that fruits deteriorate on its way to the market.

Minor cost differences exists between Michigan and the competing state of Oregon. Labor and the cost of material are comparatively high in respect of the Michigan industry. It would seem that more attention needs to be given to labor management, and the size of machinery employed by individual enterprises.

Cooperative buying may be one way of reducing material costs. The present productive capacity of the industry makes large increases in supply inevitable for the future. This points up the need for expanded markets to offset lower prices. The development of the

export market for canned plums could be one way of offsetting future dip in prices. The development of new products have already aided in market expansion and may be counted on to do so in the future. Generally, it would appear that more research is needed to determine consumers preferences in terms of form, quality and package in which plums are most desired. Aggressive promotional campaigns are also needed to contribute to market expansion.

The outlook for the future is difficult to state precisely. However, it seems that if programs are not implemented to control future supplies,then lower plum prices will be inevitable. A program of acreage quota under a marketing order program may be one way of effecting such a supply control program. Judging from the increased new plantings within the industry it would appear that producers are optimistic about the future of the industry. However, in some cases new investments have been known to be caused by the wrong signals reaching the industry through the price mechanism, as such improved information is needed in respect of demand and price conditions.

CONCLUSION

The Michigan plum industry is now on the threshold of developing into a highly progressive industry. There are however, certain factors inherent in the industry that threatens the attainment of this goal. The tendency to oversupply is one. Important changes have taken place in the past, they are taking place now and can be

expected to take place in the future. Uncontrolled changes may have undesirable results, so that it would appear that bold new policy measures will be needed in the future to bring about desired changes.

Future action should be geared towards achieving those goals that are regarded as economically and socially desirable, and attainable. Whatever the goals for the future might be one important principle should be borne in mind. That is, the consistent production of high quality plums.

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