A COMPARATIVE STUDY OF THE COOKING QUALITIES OF GREAT NORTHERN AND MICHIGAN PEA BEANS

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Marian A. Neidert

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A COMPARATIVE STUDY OF THE COOKING QUALITIES OF GREAT NORTHERN AND MICHIGAN PEA BEANS

By

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I. INTRODUCTION

A. Object of Study

Since Great Northern and Michigan Pea Beans compete in the same markets in the Middle West it would be of advantage to large consumers to learn whether one is superior to the other in any respect. In one of the largest cities in this region there is a decided preference for the Great Northern bean among institution users. To discover whether this preference was justified or not was the motive leading to this study. The investigation was conducted along three lines: (1) volume and areas of production of beans, (2) methods and costs of distribution, (3) cooking qualities in the processes of boiling, steaming and baking.

B. Review of Literature.

No material could be found comparing the Michigan Pea Bean with the Great Northern, but there is a small amount of information available on the relative merits of the two classes of beans. They both seem to fill a very definite place in commerce and in the habits and tastes of consumers.

While the Trinidad Bean and Elevator Company at Trinidad, Colorado, has issued several circulars, in the main these were written for advertising purposes only; hence the material therein is more or less biased. The Chamberlain Bean Company of Port

Huron, Michigan, has introduced a pre-cooked bean on the market which they believe will not interfere with the canned bean or the home-baked product. This will help advertise the Michigan Pea Bean and create a greater desire for it on the part of the consumer; incidently, the surplus might thus be utilized. It is said that the pre-cooked bean requires much less time for cooking, and is more easily digested.

Considerable experimental work has been done on the cooking of beans. One of the early writers on this subject was Mary Hinman Abel. In Farmers Bulletin Number 121, she quotes Strümpell's experiments on digestion of legumes and his comparison of the use of distilled water with that of hard water for cooking. "Lentils cooked in distilled water took up nearly double their own weight of water and cooked soft in one and one-half hours. Those that were cooked in hard water took up their own weight only of water, and after boiling the same length of time the skins had swollen and lay in folds over the kernel, which remained hard."(1) The reason given by Bailey (2) for preferring soft water is that the lime of hard water forms insoluble compounds with the protein of the legumes and then no amount of cooking will soften them. Abel (1) recommends a small quantity of soda to be added to the water in which the beans are cooked, probably in the proportion of a

teaspoon of soda to one gallon of water. Since the chief mineral present in hard water is calcium carbonate, the soda would help to render the water less hard."Beans cooked in this water are easily softened but experiments show the flavor is apt to be injured." Since the cook does not usually have any way of knowing the degree of hardness of water and the exact proportion of soda to add, it is thought that the best method would be to boil the water before using and pour it away from the sediment, since boiling alone will precipitate the bulk of the calcium carbonate. When the hardness is due to the presence of the sulphate of magnesia, neither boiling nor the addition of soda will remedy the evil. Distilled water is best and should be used for soaking and cooking.

Dominicis says the physical nature of protein changes during soaking and cooking. The change is from a granular state to a swollen state.The length of the cooking period of legumes depends upon the water absorption. They are cooked more tender and more easily when there is a large amount of water absorbed. Acids seem to retard water absorption and alkalies seem to hasten it, but the latter do cause the proteins to be transformed into a mixture of amino acids. Thus the food value is reduced and Dominicis advises that alkalies be dispensed with in preparing legumes. (3) Belle Lowe (4) gives

results, on the cooking of navy beans by the experimental classes at Iowa State College. Various methods were used. It was found that if soda was added to the cooking water, the beans became mushy on the outside while the center remained hard. A shorter cooking period was needed when the container was covered than when it was uncovered. It was also found that a minimum cooking time for beans in tap water containing soda was shorter than the minimum time for beans soaked in distilled water containing soda, but their averages were reversed. Lowe thinks that this was due to difference of opinion as to the time when the beans were done.

C. Importance of Beans as a Food.

"The common bean is probably a native of South America and is undoubtedly of ancient origin. Many varieties were grown by the American Indians before they became generally cultivated in Europe." (5) There have been a number of classifications developed for the varieties of beans. They may be classed according to their use such as those grown for the edible pod, or the so called string or snap bean, and those of the ripe shelled type as used in the dry state. They may be classed as field and garden beans. When the term "field beans" is used, it generally applies to those grown for drying and includes four types, kidney, marrow, medium and pea. Some of the important varieties of the pea type are: Boston Small

Pea, Marrow Pea, Medium Pea, Snowflake, Navy and Michigan Robust. (5) The latter was developed at Michigan State College and was registered as Strain Number 40520 in 1921. "It is immune to mosaic disease and resistant to blight. It grows vigorously and gives a high yield. It is a few days later and lacks the uniformity of size found in most of the commercial varieties grown in the state." (6)

The leading variety in Michigan is the White Navy which constitutes 90 percent of the Michigan crop with the red kidney bean second, making up 8 percent of the crop. The remainder of the crop is made up of Brown Swedish, White Kidney and Boston Yelloweye. The common white or navy bean is of American origin, and the name "navy" was applied to the bean because of its use in the food supply of the navy and the marine corps. (7)

Beans are used more in some regions and under some circumstances than in others. In lumber camps, for example, beans are a very important part of the diet. In a camp in Maine a dietary study was made by C. D. Woods and E. R. Mansfield in 1904. They found that beans supplied as high as 20 percent of the protein and 10 percent of the energy of the food consumed by the lumbermen. (8) Beans are a major army food because of their concentrated food value and because they can be easily shipped. Pound for pound they are nearly as valuable as meat and do not require such

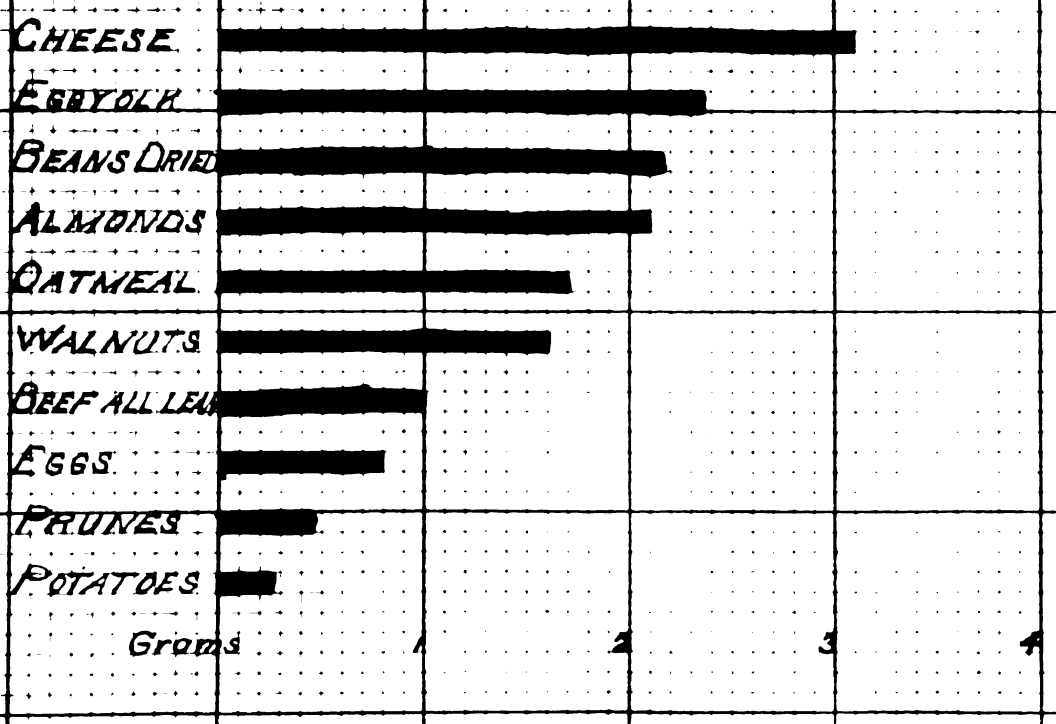
care in refrigeration and handling. Meat usually is high in price and there is a constant demand for a cheap source of protein. (9) Beans are rich in the food elements, protein, iron, calcium and phosphorus. "Cereal grains like wheat, corn, oat and rice kernels contain 11, 10, 15 and 9 percent protein respectively, while beans contain 23 percent." (10)

Graph I shows the protein content of various foods. Dried beans, as purchased, rank third highest of the foods shown in the table, being excelled only by cheddar cheese and dried split peas in amount of protein. They are higher than any of the lean cuts of meat in this important food constituent. According to the table on page 376 in Sherman's "Food Products", beans, lentils and peas range higher in protein than any of the other vegetables.

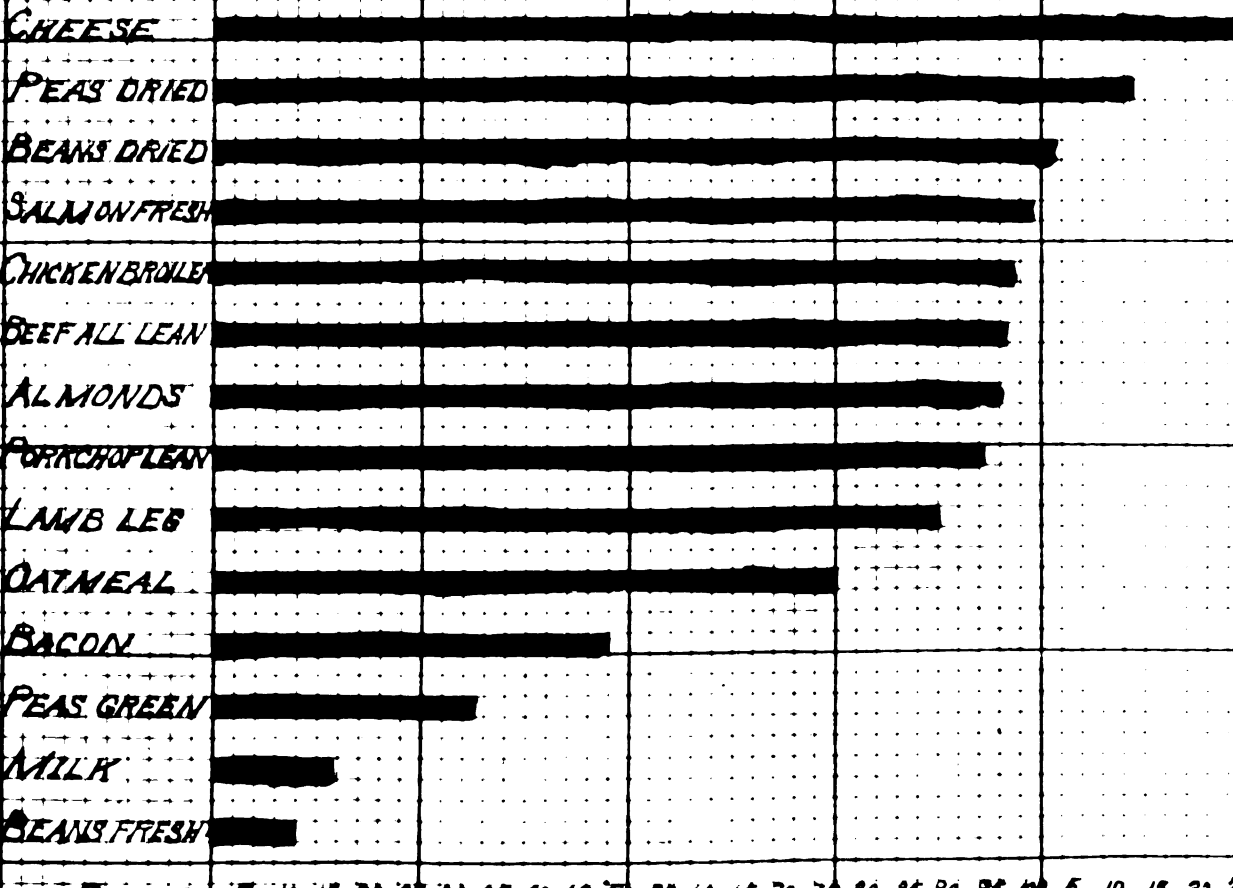
The composition of various foodstuffs in respect to calcium and iron are shown in Graph II. Beans are at the top of the calcium list even exceeding milk, the latter probably being recommended for young children more because of its ease of digestion. The graph on iron content reveals that beans have twice as much iron as do lean beef, whole egg and prunes. In consulting the phosphorus chart, Graph I, it is noted that beans are third on the list, preceeded only by egg yolk and cheese. Since beans are rich in protein and other food elements it would seem that they might appear more frequently in the American

GRAPH - I

PHOSPHORUS, GRAMS PER POUND EDIBLE SUBSTANCE.

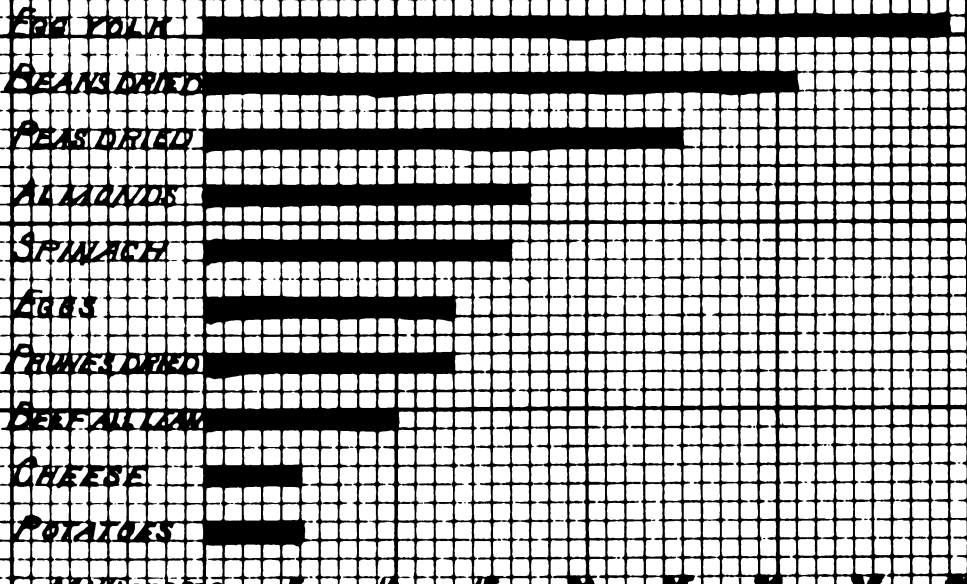


PROTEINS, GRAMS PER POUND EDIBLE SUBSTANCE

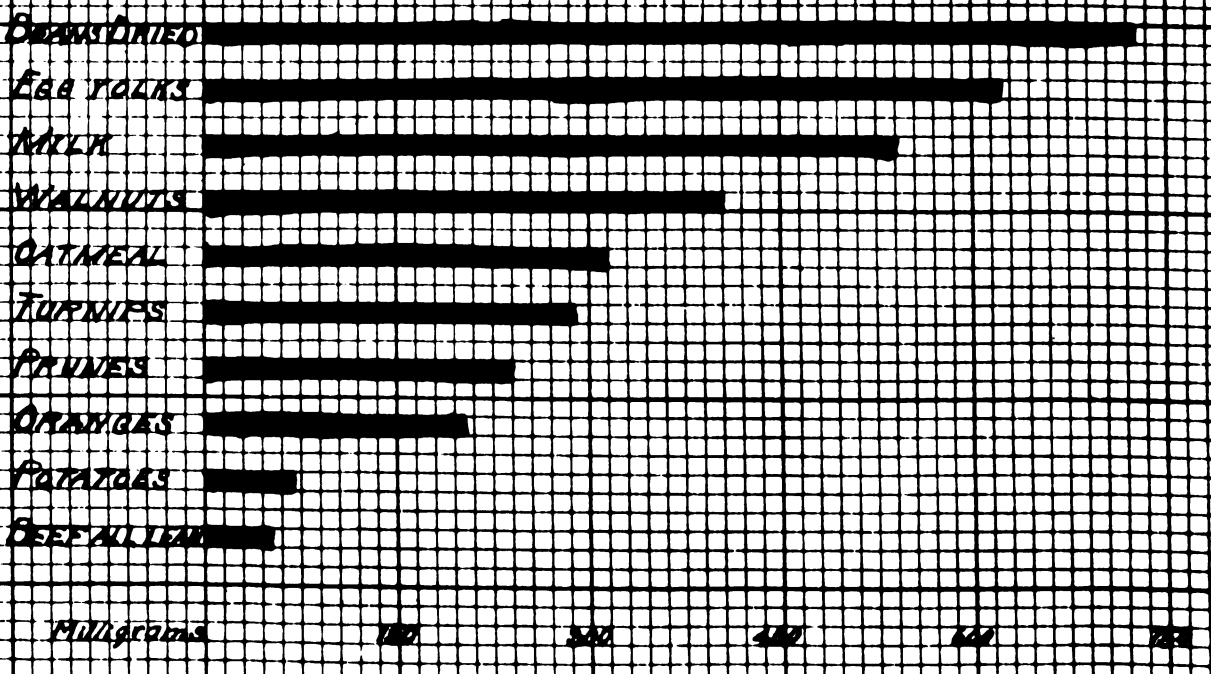


GRAPH - II

IRON, MILLIGRAMS PER POUND EDIBLE SUBSTANCE



CALCIUM, MILLIGRAMS PER POUND EDIBLE SUBSTANCE



diet. There has been little work done on navy beans to determine the vitamin content. Sherman, in his "Chemistry of Food and Nutrition" page 564, gives beans two plus for undifferentiated vitamin B. They contain only traces of the other vitamins.

"Although legumes contain a proportion of protein in excess of that of meat, a large amount of fat and considerable starch, they are less easily digested than animal foods."(11) Abel (1) gives three reasons for the above statement. First, "as generally prepared and used the nutrients of vegetable foods are inclosed in cells composed of cellulose or woody fiber, which is more or less hard and greatly interferes with their absorption." Second, "Vegetable food is prone to fermentation in the intestines, thus increasing the peristaltic movements, and if large amounts are eaten, hastening the food onward before there has been sufficient time for the absorption of its contained nutrients." Third, "The cellulose present acts as a local irritant and produces the same effect. Beans are considered a 'hearty food' and thought to be difficult to digest, perhaps due to the fact that a very small part of the digestion of the protein takes place in the stomach, because the medium or reaction of the stomach is acid, and the legumin is digested in an alkaline reaction."(1)

Beans are made more digestible if the skins which contain much indigestible cellulose, are

removed before cooking. (2) They are better digested in the puree form as a greater part of the cellulose which interferes with assimilation is then removed.(12) "Strümpell has shown that about 40 percent of the protein in cooked beans is left unabsorbed and that with a flour made from beans only 8.2 percent of the original amount of protein is left unabsorbed; so that when eaten simply cooked a much larger proportion remains unabsorbed than when divided into a powder." Proussnitz found that whole beans often pass through the intestinal canal undigested. (1) The digestibility of beans depends largely upon the way in which they are prepared and the amount eaten. Woods and Mansfield (8) found that the average coefficients of digestibility for the total diet of Maine lumbermen were, protein 85 percent, fat 97 percent, carbohydrates 98 percent and ash 88 percent. If one assumed that the nutrients of the other material in the diet was digested to the same degree the coefficient of digestibility of the protein of beans would be 78 percent. Snyder (13) found that if the skins of beans were not removed 25 percent less protein was digested, and the loss was still greater if the soda was eliminated in the cooking process. He recommends that not more than four ounces of uncooked beans or six ounces of baked beans be consumed in the diet daily. He found that a higher degree of digestibility may be obtained when

beans are combined in a mixed diet. Snyder says that "at ordinary prices beans are one of the cheapest foods for supplying protein in the diet." Wait (14) believed a mixed diet gave more favorable digestion. Johns and Finks (15) showed that, phaseolin, the principal protein of the navy beans should be cooked. They were able to obtain good growth in rats when beans were supplemented with cystine in the proportion of two percent of the protein by weight. McCollum, Simmonds and Pitz (16) found that a diet consisting solely of navy beans for the protein was of low nutritive value. These people advise that "navy beans be supplemented by other proteins of better quality and because of digestive disturbances that they should be used in moderation." Pittman (17) found that the nitrogen balance was negative when the beans were eaten without the cystine supplement, and that a slight improvement of nitrogen retention was noticed when there was an addition of cystine of two percent of the protein by weight. "Navy beans are not entirely satisfactory as the chief source of nitrogen in the diet." Pittman says that a healthy person can eat at least four ounces of navy beans, dry weight, daily.

In general, beans are a valuable food, but small quantities should be eaten by persons in sedentary occupations, and should be taken in a mixed diet with plenty of other foods. People with

outdoor occupations doing hard manual labor may use beans up to one third of all their protein consumption in the diet and yet digest them to a reasonable degree. They should be taken advantage of more frequently by those with whom economy is a prime factor. McCollum speaks of beans as a "Poor man's meat."

D. Method Used in Making the Study.

Statistics on bean production were obtained from the United States Department of Agriculture Year Book of 1932. A report on "Bean Distribution" published in April, 1932, by the Bureau of Agricultural Economics, Washington, D.C., listed areas and volume of production. Prices were obtained from the weekly Bean Market Review of the United States Bureau of Agricultural Economics. Bulletins published by Montana State College, Utah Experiment Station, and Michigan State College gave information on production and distribution. (20,9,6,22) Bean jobbers, growers, and distributors were consulted in regard to their particular interest and phase of work on beans. Mr. Howard Kittle, Associate Marketing Specialist, in Lansing for the United States Department of Agriculture, Bureau of Agricultural Economics, furnished further information to make this study possible.

The three processes of cooking which were used

in the experiments were that of boiling, steaming and baking. In half the experiments the beans were soaked fifteen hours before cooking. In the other half, the beans were cooked without soaking. The cooked beans were rated by judges for tenderness, general appearance, flavor and retention of form. Covered aluminum pans of the same size were used for the boiling experiments. The sectional steamer was used in the steaming experiments and earthenware pots were used for baking.

A record was kept of the time required to cook the beans until they were tender. The amount of liquid used during the process of cooking was recorded and the percentage of absorption was calculated. The number of servings obtainable from a definite amount of beans was tabulated and the cost per serving computed.

II. PRODUCTION

Beans are adapted to both dry farming and irrigation. Most of the beans grown in America are warm season plants. They will grow on practically all types of soil from light sandy loams to heavy clays. A heavy soil is not good for there is likely to be much more vine growth and not enough bean pods.

The Civil War stimulated an increase in the production of beans during the years that immediately followed. The World War, with its insistent demands

for additional food production, resulted in a marked increase in the acreage of the bean crop. The United States ranks sixth in acreage, fifth in production, and is considered one of the world's principal bean producing countries. (18)

There are over twenty commercial classes of dry edible beans produced in the United States. In 1930 the total quantity produced was 13,757,000 bags of one hundred pounds each. Most of this production is limited to definite areas in a few states. The Pea Bean grown in New York is hardly distinguisable from the Michigan Pea Bean. Michigan normally produces about 40% of the entire bean crop in the United States. (19)

The Great Northerns were first brought to the attention of white farmers by the Oscar H. Will Seed Company of Bismark, North Dakota, and were secured from the Mandan Indians of Fort Montana about 1914. They came from the limited area in the Rocky Mountain foothills. They are now extensively grown in Idaho, Montana and Wyoming and spread a little into Colorado. They are, however, definitely a mountain bean in that they do not do so well in the eastern humid regions and do not succeed well in Michigan. The two beans are different in size. The pea bean is smaller, being only one-fourth inch to three-eighths inch in length, while the Great Northern averages three-eighths

to one-half inch. One important difference in the growing of Great Northerns and Michigan Pea Beans is that the weather condition in the Great Northern region is almost reliably dry at harvest time so that there is practically never any hand-picking to be done to prepare the beans for market. The crop is reliable and abundant when grown under irrigation.[I] A critical period in the growing of the Michigan Pea bean is after the beans have been pulled and are lying in the field either in windrows or piles so that they are exposed to fall rain damage. Field threshing is not always possible for the growers are not always able to get a threshing machine just at the time when their crop is ready. Often times the crop is damaged by weather while waiting. The operators of bean elevators in Michigan try to discourage field threshing, and urge that the growers haul the bean vines to barns where threshing can be done at the producer's leisure.

In western states, where the danger of fall rains is not as serious as in Michigan, almost all of the threshing is done from the fields.The average field of beans on a Michigan farm does not exceed fifteen acres. A fifty or hundred acre field is exceptional. In the western states,particularly

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I. Letter from D. N. Shoemaker,Horticulturist,of United States Department of Agriculture.

California, individual growers may raise five hundred or a thousand acres. Larger threshing machine equipment is used in the West than in the East; hence, the harvesting of beans is much simpler and the cost is reduced.

Yields per acre vary from year to year. The acreage planted is not an accurate indication as to the size of the crop which will be harvested. Weather conditions, during the growing and harvesting season, are in the main the cause for the uncertainty of the size of the crop. The western states with their irrigated land do have a higher productive cost. This is offset by the cheaper method of harvesting, namely, field threshing. Weather conditions being well under control in the West results in very little hand picking, which is another factor in lowering the production cost in the West. (19,20)

Table I gives the acreage by states for the two classes of beans for a period of eight years. The acreage for Michigan has been constant with little or no variation, while the states producing Great Northern have doubled and tripled their acreage. Idaho is the largest producing state and Montana ranks second in the production of Great Northern beans. In 1930 the Great Northerns comprised about 14 percent of the total production

of beans of all varieties in the United States. In the same year Idaho, Montana and Wyoming together produced over 96 percent of all the Great Northerns grown in the United States, Idaho producing 55%, Montana 21% and Wyoming 20%. The remaining 4 percent was produced in Colorado and Nebraska. (20)

Table II shows the production of the two classes of beans over a period of time. Since 1924 Pea bean production has not increased but has barely held its own, whereas Great Northern bean production has increased from 684,000 bags in 1924 to 2,006,000 bags in 1931.(21)

Graph III gives a vivid picture of the increased production of Great Northerns and the potential decline of the Michigan Pea bean. There was an increase in 1931 over the preceding four years, but from present reports of the 1932 crop, that year undoubtedly showed a decline again. Even though 1931 did show a marked increase over 1930 the crop was still not as great as that of 1926,which was much smaller than 1925.

TABLE I

Acreage, in thousands of acres, for Great Northern and Michigan Pea Beans in most important producing states.

State	1924	1925	1926	1927	1928	1929	1930	1931
Michigan	625	639	552	566	538	575	690	614
Montana	25	37	43	32	40	47	49	37
Idaho	65	72	54	72	86	134	168	178
Wyoming	8	12	16	17	24	31	37	36

TABLE II

Production, in thousands of bags of 100 pounds each, for Pea Beans and Great Northern.

Class	1924	1925	1926	1927	1928	1929	1930	1931
Pea Beans	3,799	4,684	3,729	2,750	3,268	3,305	2,825	3,709
Great Northern	684	918	815	1,349	1,229	1,744	2,066	2,006

1. "Bean Statistics" compiled by B. A. Stickle, Inc., Capital Bank Tower, Lansing, Michigan.

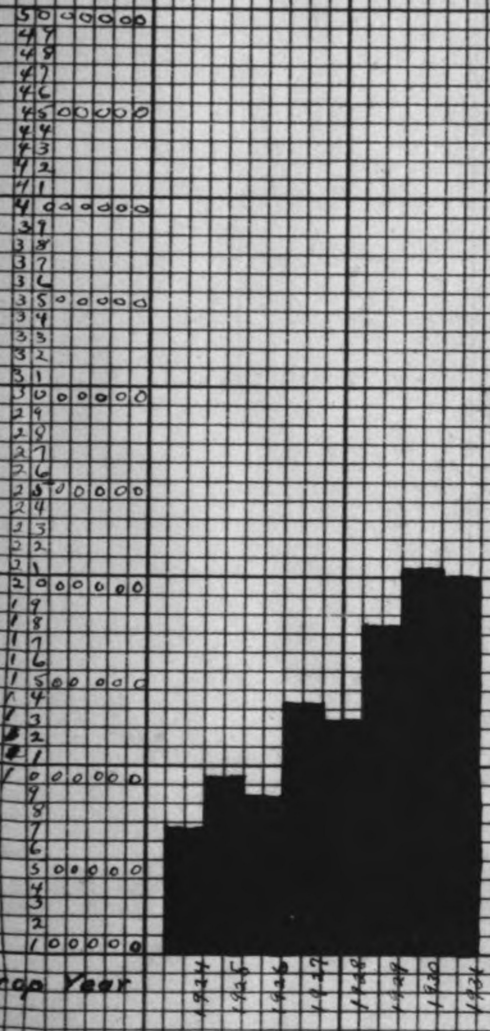
2. Report from U.S. Department of Agriculture on "Distribution of beans by Commercial Classes as Reported by Wholesale Grocers."

GRAPH - VI

PRODUCTION

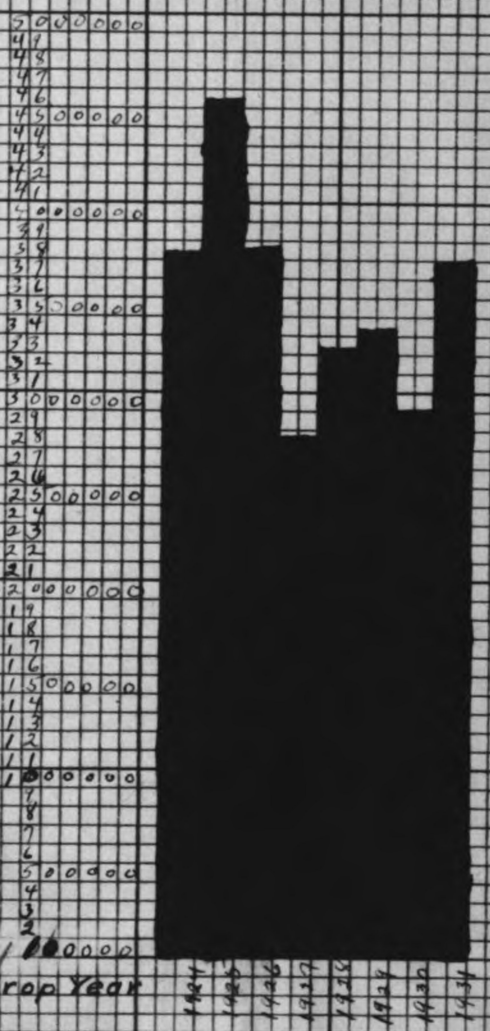
GREAT NORTHERN BEANS

100# Bags



MICHIGAN PEAS

100# Bags



III. DISTRIBUTION

The principal difference between the handling of beans in the western states and in Michigan is that the grading of Great Northerns is done by warehouses or the so called Transit Storage Holdings, who make that their entire business, while in Michigan the elevators do the elaborating process. (19)

Chart I shows the steps that the Great Northerns go through from producer to consumer. Chart II takes the Michigan Pea bean through its detailed route. Contact with the trade is made between the bean jobber and the canner, broker, or grocery buyer. Often times the sales to the grocery trade are made through brokers. There is no bean exchange in the sense that there is a grain exchange. Bean prices are based on supply and demand, and each individual trader has to establish his own price daily. (19)

Distributors for the Michigan Pea bean are as follows:

1. Michigan Elevator Exchange
2. Michigan Bean Company
3. Woolahan Company
4. M. J. Hart
5. J. B. Burroughes
6. Minor Walton Bean Co.

CHART-I

Flow Sheet of Great Northern Bean Distribution

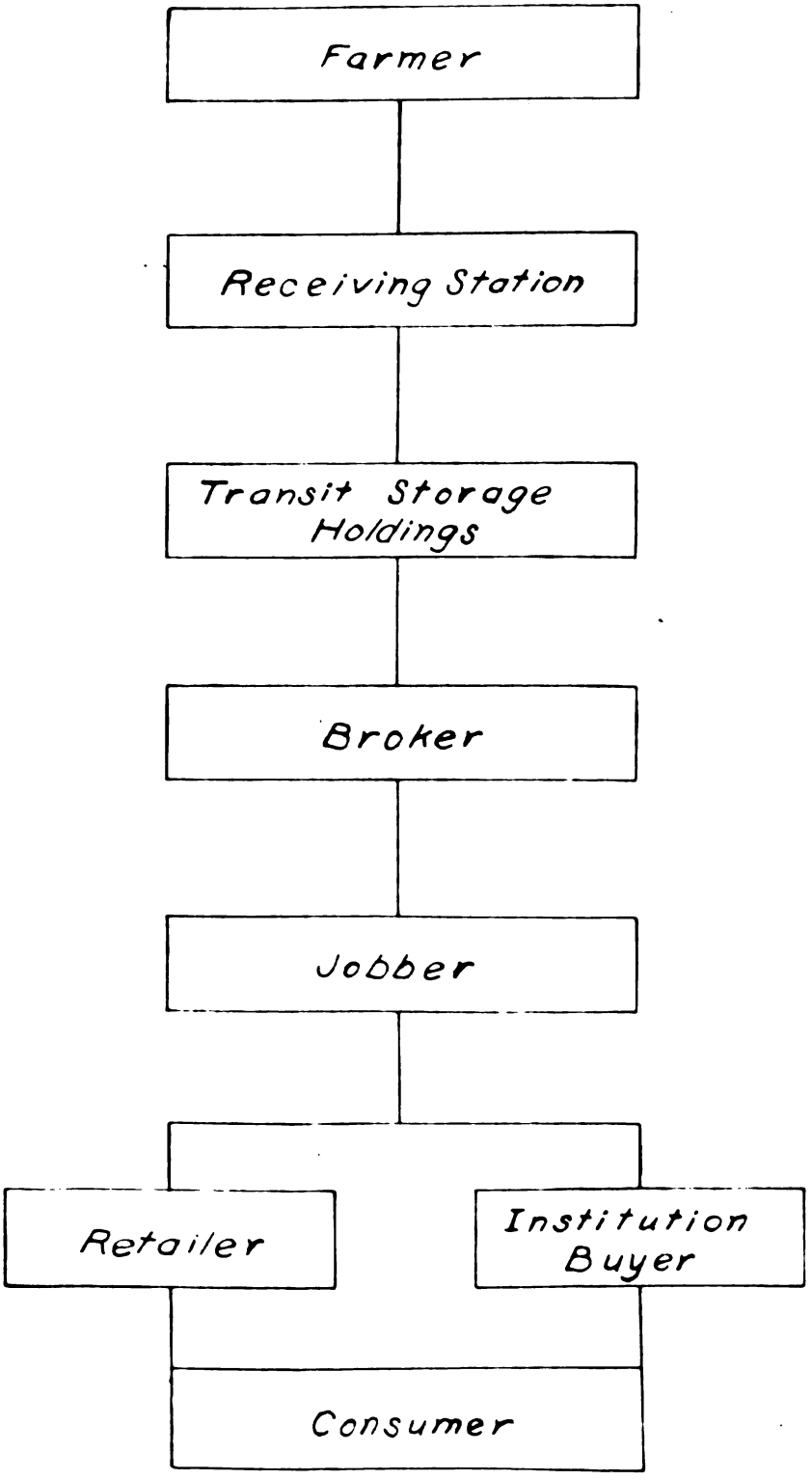
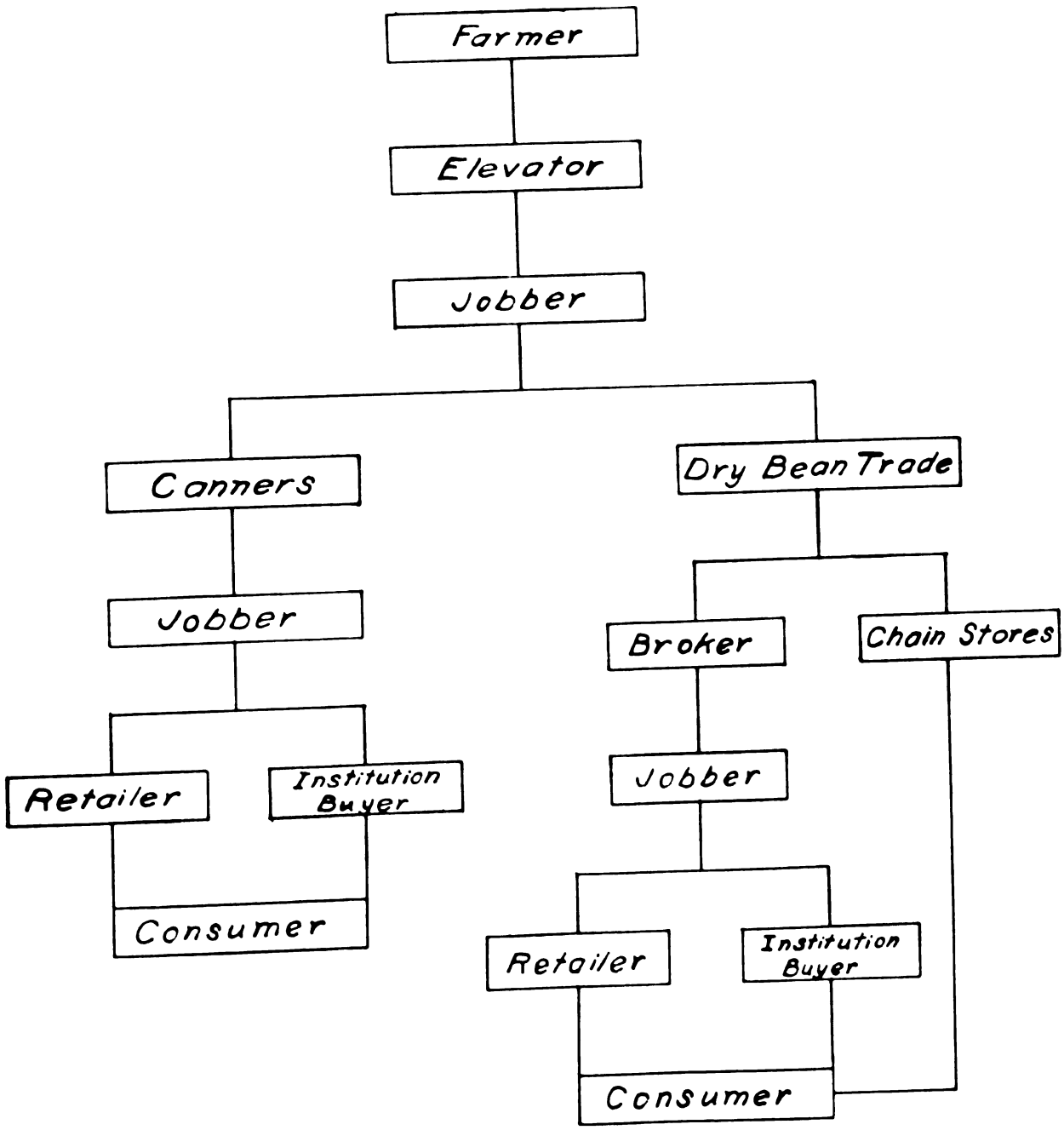


CHART-II

Flow Sheet of Michigan Pea Bean Distribution



7. B. A. Stickle Company

8. Ryan Grain Company

9. Christian Breisch Company

Distributors for the Great Northern Bean are as follows:

1. Trinidad Bean Company

2. Fair Bean Company

3. Denver Elevator Company

4. Buhl Seed Company

5. Mid-west Brokerage Company

6. Robinson Grain Company

Table III gives the total numbers of bags reported for each class of beans which was handled by wholesale grocers from July 1930 to June 1931. The figures show that approximately 25 percent of the beans handled by wholesale grocers during the period was Pintos, followed closely by Great Northerns with 21 percent. The Michigan Pea beans were third in importance representing 17 percent of the total. The three classes together constituted 63 percent of the total beans handled by wholesale grocers. The two classes with which this survey is concerned: namely, Great Northern and Pea beans constituted 38 percent of the total beans handled by wholesale grocers. This shows the importance of the two classes in the dry bean trade.

TABLE III

Total number of bags reported for each class of beans handled by wholesale grocers, July 1930--June 1931.

Class	Number of bags reported	Percent of total of all beans
Pinto	1,357,000	25.4
Great Northern	1,123,000	21.0
Pea Beans	898,000	16.9
Lima	489,000	9.1
Blackeye	323,000	6.0
Baby Lima	290,000	5.4
Small White	187,000	3.5
Pink	160,000	3.0
Small Red	96,000	1.8
Cranberry	78,000	1.5
Red Kidney	76,000	1.4
Marrow	48,000	0.9
Yelloweye	38,000	0.7
White Kidney	37,000	0.7
Large White	34,000	0.7
Other Classes	110,000	2.0
TOTAL	5,344,000	100,0

1. Report from U.S. Department of Agriculture on "Distribution of beans by Commercial Classes as Reported by wholesale grocers."

Tables IV and V show the relative importance of various states in the distribution of the two classes of beans. (21) The tables give the number of bags of Michigan Pea beans and Great Northerns which were reported for the state in 1930-1931. The percentage given represents the total quantity handled in each state. For example, 116,679 bags of Pea beans were reported from Ohio. The quantity represented 43 percent of the total number of bags of all beans reported handled by wholesale grocers in that state.

A study of Tables IV and V indicates that a large percentage of the Great Northerns are being distributed in areas where Pea beans formerly were the principal class consumed. J. E. Barr of the Bureau of Agricultural Economics, in his article "Changes in the Distribution and Consumption of Beans" in "The Bean Bag" May, 1932, makes the following statement: "Through most of the northern great plains area and the upper Mississippi Valley the shift in wholesale grocery sales has been almost entirely from Pea Beans to Great Northerns. There has also been an increase of sales of Great Northerns at the expense of Pea Beans in Illinois, Indiana, Ohio, Pennsylvania, N. Y. and New Jersey. In New York and Pennsylvania there is a tendency for Great Northerns to replace

1
TABLE IV

Volume of Production of Pea Beans and Percentages of Total Production.

State	Number of bags reported	Percent of total of all beans per state
Ohio	16,679	43
Illinois	92,365	31
Indiana	84,969	43
New York	69,051	24
Pennsylvania	65,701	26
Missouri	52,386	14
Iowa	49,458	35
Kentucky	35,722	12
Massachusetts	33,898	35
Michigan	30,800	59
West Virginia	30,600	19
Louisiana	26,633	21
Wisconsin	25,810	75
Maryland	24,156	37
New Jersey	20,570	38
Virginia	20,238	13
Minnesota	19,179	51
Tennessee	10,675	4
North Carolina	10,172	7
Florida	10,143	14

1. Report from U S Department of Agriculture on"Distribution of beans by Commercial Classes as Reported by wholesale grocers."

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TABLE V

Volume of Production of Pea Beans and Percentages of Total Production

State	Number of bags reported	Percent of total of all beans per state
Missouri	135,891	37
Tennesee	95,272	35
Illinois	87,418	27
Kentucky	85,345	28
Oklahoma	71,960	32
Iowa	64,874	46
Kansas	58,409	57
Arkansas	55,435	31
Indiana	53,279	27
New York	51,729	18
Pennsylvania	47,894	19
Ohio	43,954	16
Nebraska	35,849	72
West Virginia	27,445	17
Virginia	26,423	16
Texas	22,739	4
Maryland	17,555	27
North Carolina	17,085	12
South Dakota	15,723	90
Minnesota	12,120	32

1. Report from U.S. Department of Agriculture on "Distribution of beans by Commercial Classes as Reported by wholesale grocers."

also Marrows and Medium Whites."

The increase of Great Northerns in Ohio and Indiana would seem to be a critical situation for Pea bean growers since these states border on Michigan, the most important Pea bean producing state. This increase might be due to the extensive advertising that is being done by Great Northern growers and distributors. This increase may be partially due to personal prejudice, either on the part of the retailer or the consumer. The size of the bean no doubt has some influence on consumers' preference, some Great Northern consumers stating that they liked the larger bean.

Tables IV and V reveal that during the year ending June 1931, Pea beans ranked first in volume in: Ohio, Indiana, Michigan, Wisconsin, Minnesota, New York, New Jersey and Massachusetts. Pea beans ranked second in Illinois, Iowa, Pennsylvania and West Virginia. States in which Great Northerns were first in importance were Iowa, Kansas, Missouri and Nebraska and ranked second in Arkansas, Illinois, Indiana, Kentucky, Maryland, Ohio, Oklahoma, South Carolina, Tennessee, Texas and Virginia.

Freight rates from producing areas to large cities where beans are consumed may be one factor in determining which class of beans will be used in that certain section. Table VI gives the freight

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TABLE VI

Freight Rates forMichigan Pea and Great Northern Beans and Cost per 100 pound bag to Important Consumption Points in the United States

	Rate for Michigan Pea Beans Since July, 1932	Rate for Great Northerns Since July, 1932	Cost of Michigan Pea Beans Delivered on March 30, 1933. $1.85 per 100 lb.bag	Cost of Great Northerns Delivered on March 30, 1933. $1.55 per 100 lb. bag
Columbus, Ohio	.23	1.05	2.08	2.60
Cincinnati, Ohio	.26	1.05	2.11	2.60
Memphis, Tennesee	.63 rail .53 barge	.96 1.05	2.48 2.38	2.51 2.60
St. Louis, Missouri	.31	.97	2.16	2.52
Peducah, Kentucky	.33	1.05	2.18	2.60
Louisville, Kentucky	.28	1.05	2.13	2.60
Chattanooga, Tennessee	.64	1.05	2.48	2.60
Knoxville, Tennessee	.60	1.05	2.45	2.60
Charleston, W. Virginia	.29	1.05	2.14	2.60
Atlanta, Georgia	.71	1.05	2.56	2.60
Greensboro, N. Carolina	.63	1.05	2.48	2.60
Norfolk, Virginia	.44	1.05	2.29	2.60
Baltimore, Maryland	.39	1.05	2.24	2.60
New York, New York	.39	1.05	2.24	2.60
Pittsburgh, Pa.	.26	1.05	2.11	2.60
Scranton, Pa.	.24	1.05	2.19	2.60
Rochester, New York	.28	1.05	2.13	2.60
Syracuse, New York	.30	1.05	2.15	2.60
Albany, New York	.35	1.05	2.20	2.60

TABLE VI continued

Freight Rates for Michigan Pea and Great Northern Beans and Cost per 100 pound bag to Important Consumption Points in the United States

	Rate for Michigan Pea Beans Since July, 1932	Rate for Great Northerns Since July, 1932	Cost of Michigan Pea Beans Delivered on March 30, 1933. $1.85 per 100 lb.bag	Cost of Great Northerns Delivered on March 30, 1933. $1.55 per 100 lb bag
Boston, Mass.	.38	1.05	2.23	2.60
Providence, R. I.	.39	1.05	2.24	2.60
Portland, Maine	.49	1.05	2.34	2.60
New Orleans, La.	.86 rail .71 barge	.96 1.05	2.71 2.61	2.51 2.60
Burmingham, Alabama	.72	1.05	2.57	2.60
Little Rock, Arkansas	.81	1.05	2.66	2.60
Des Moines, Iowa	.53	..97	2.38	2.52
Witchita, Kansas	.77	.85½	2.62	2.40½
Jefferson City Missouri	.54	.97	2.39	2.52
Lincoln, Nebraska	.67	.89	2.52	2.44
Tulsa, Oklahoma	.87	1.05	2.72	2.60
Nashville, Tennessee	.58	1.05	2.43	2.60
Chicago, Illinois	.23	1.05	2.08	2.60

1. Interview with Mr. Fry in B. A. Stickle's office, 1108 Capital Bank Tower, Lansing, Michigan.

rates and cost at consumption points for Great Northern and Michigan Pea beans. The freight rate from Alma, Michigan, sets the rate for all Michigan Pea beans. Twin Falls, Idaho, sets the rate for Great Northerns. However, there are a few exceptions; beans going from Montana to Minnesota have a cheaper rate, which is 75 cents per hundred, and all beans from Wyoming west of the Mississippi river go at 85 cents per hundred.[1.] The rate is given for 500 bag cars. Before the new rates came into use, July, 1932, there was a penalty on 500 bag cars; at the present time they are given a premium rate. Additional reductions have been proposed for both classes of beans and will probably be accepted. The railroads have taken the step toward the reductions in order that they might compete with the trucking companies.

An examination of Table VI shows that there are only 6 cities on the list where Michigan Pea beans cost more than Great Northerns. Consequently, it would seem that there would be less demand for the Great Northern, since its price is much higher but this is not the case. "The Michigan White Pea bean and the Great Northern bean are directly competitive with each other in the market. Both are

1. Interview with Mr. Fry in B. A. Stickle's office, 1108 Capital Bank Tower, Lansing, Michigan.

white beans and are used for canning, although the Pea bean has in the past been much more extensively used for canned 'Pork and Beans' than the Great Northern bean, and both are used for home baked beans." (20)

Formerly the greatest consumption of beans took place on the premises where they were cooked, as those prepared by the housewife or by chefs in public eating places. In the last few years there has been an increasing number of beans going into cans. This has probably been due to the advertising done by the National Canners Association stressing the food value, digestibility, healthfulness, and convenience of canned beans. There are two reasons why consumption of canned beans, by the American public, has increased; first, labor and fuel cost are eliminated; and, second, preparation time is shortened. Beans may be canned with or without pork, with or without tomato sauce, and they may be oven baked or boiled.

Beans are easily divided into two groups, that of the whites and that of the colored beans. These two groups go to market in the dry state and as canned beans. Regardless of all the other classes which come under the two great groups and appear on the market at the same time, none of them compete with the Michigan Pea bean except the Great Northern. The

reason for this is probably due to the fact that they are both white beans and can be used in the same manner. The Great Northern influences the price of the Michigan Pea bean since the former is finding favor among the dry bean trade, thus reducing the demand for the Michigan product. It is fortunate for the growers of the Pea beans that the Great Northerns are not favored by the canners owing to its thin skin which breaks easily under the canning process and prevents the well formed, whole beans which canners prize in their product. (22) It is thought that 60 percent of the Michigan Pea bean crop is canned and the other 40 percent is sold by Michigan bean dealers to wholesale grocers and chain stores. (19)

In 1926 the United States Department of Agriculture, through its Bureau of Agricultural Economics, proposed standards for the grading of beans. The dealers in the Western area have not generally adopted these standards. It has been difficult therefore for those dealers who were willing to accept the standards, to abide by them. Thus, there has been a delay in the progress of the Great Northern beans. A system of uniform grades, that would be generally accepted by all dealers, would help undoubtedly to develop a good future for the Great Northern beans. If beans are not graded

properly, they will not cook evenly, and canners give this as their reason for preferring Michigan Pea beans for the canned product. Thus, one outlet is practically closed to the Great Northerns due to the failure of the dealers to accept better standards of grading. (20)

Only since July 1, 1931, has Michigan started to use federal grades. Previously, the Michigan Pea bean was graded according to the standards of the Michigan Bean Jobbers Association. The standards could be interpreted a number of ways: hence, the grades were not always uniform and the product was below standard. It is reasonable to assume that any wholesale grocer or any kind of bean shipper can not develop a good bean business except with a quality product. "Just as Campbell, Heinz, Vancamp and other canners have increased their output year by year by packing a quality product, the grocery trade can increase its bean sales by marketing a quality product." (19)

During 1932 the Great Atlantic and Pacific Tea Company purchased from Michigan producers more than 650 cars of Pea beans, or a sum total of 26,262,800 pounds.[1.] These beans were distributed by the Atlantic and Pacific to its millions of customers over the counter throughout the United

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1. Detroit Free Press

States and Canada. The Atlantic and Pacific is not only one of the Michigan Pea bean's best customers, but also one of its greatest boosters. At one time a plan was being considered by some of the larger distributors, whereby demonstrations would be given in retail stores to bring before the consumer the various methods of cooking and preparing beans.[1] The plan was never carried out due to the financial condition of the country.

A few years ago the Great Northern growers advertised in the Saturday Evening Post. Due to their distance from the central markets it was necessary for them to advertise in order to get their product before the consuming public. It is only recently, when competition became more evident that Michigan Pea bean growers have started to do some advertising of their product.

Table VII shows the average monthly quotations as made by bean jobbers to the trade. Prices are quoted on a basis of 100 pounds net. The table covers a period of two years for both Great Northern and Michigan Pea beans. Prices were higher for both classes in 1930-1931 than they were in 1931-1932. Prices were abnormally low in 1931-1932 due to the financial situation of the country. However, a study of graph IV reveals that there are times during the

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1. Interview with Michigan Elevator Company.

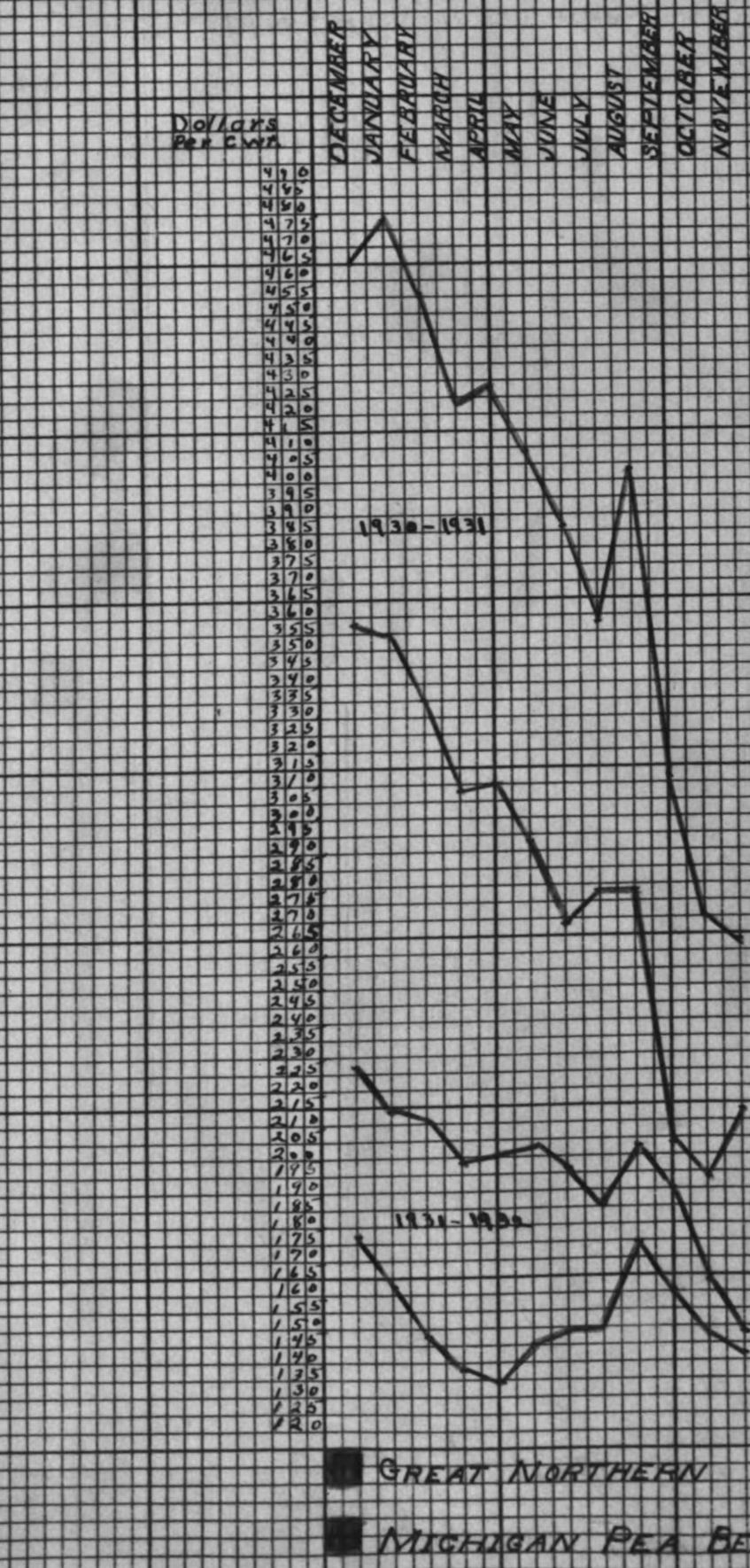
TABLE VII
1.

Michigan Pea		Bean Jobbers Quotation to Trade of 100 pounds Net											
		Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.
1930-1931	Low	4.58	4.63	4.33	4.05	4.18	4.00	3.80	3.35	3.85	2.80	2.40	2.55
	High	4.75	4.88	4.68	4.40	4.40	4.20	4.00	3.70	4.20	3.65	2.85	2.75
	Average	4.65	4.77	4.55	4.23	4.27	4.09	3.86	3.57	4.04	3.06	2.70	2.64
1931-1932	Low	2.15	2.00	2.05	1.94	1.90	1.95	1.89	1.79	1.85	1.79	1.49	1.44
	High	2.35	2.25	2.20	2.09	2.10	2.14	2.05	1.89	2.19	1.99	1.74	1.50
	Average	2.26	2.14	2.11	1.97	1.98	2.03	1.96	1.85	2.02	1.89	1.64	1.46
Great Northerns													
1930-1931	Low	3.40	3.43	3.28	3.01	3.02	2.70	2.65	2.70	2.65	1.78	1.79	2.12
	High	4.10	3.60	3.43	3.13	3.15	3.08	2.70	2.83	2.85	2.30	2.05	2.16
	Average	3.57	3.55	3.35	3.07	3.08	2.93	2.69	2.77	2.77	2.04	1.95	2.14
1931-1932	Low	1.68	1.54	1.45	1.33	1.33	1.36	1.48	1.45	1.48	1.46	1.43	1.38
	High	1.83	1.75	1.50	1.43	1.40	1.49	1.51	1.55	1.98	1.79	1.49	1.50
	Average	1.77	1.62	1.48	1.38	1.35	1.45	1.49	1.50	1.74	1.60	1.46	1.42

1. Weekly Bean Market Review of the United States Bureau of Agricultural Economics.

GRAPH - IV

AVERAGE MONTHLY BEAN JOBBERS QUOTATIONS TO TRADE FOR MICHIGAN PEAS AND GREAT NORTHERN BEANS



year when the prices are at a peak and again when they are low. The months from January to August showed the highest price with a pronounced peak in August. These are the months in which to avoid the buying of dry beans. September and October showed the lowest prices. This probably is due to the fact that there are more beans on the market at that time since this is the harvesting season for the crop. By January the crop is beginning to be diminished, consequently, the price naturally goes up. The prices during the spring months often are determined by weather conditions in the producing areas. If conditions are ideal and there is a good outlook for next year's crop then there probably will be more beans sold and not such a large carry over for the next year. In February, 1932, farmers sold freely in order to meet delinquent taxes which forced more beans on the market than were needed to supply the demand; hence, a decline in price followed as will be noticed on graph IV.

IV. COMPARISON OF COOKING QUALITIES OF THE MICHIGAN PEA BEAN AND THE GREAT NORTHERN BEAN.

The value of dried beans depends solely upon whether they will cook soft. Abel (1), writing in 1916 about the principal requirements in the cooking of dry beans, says that the aims are:

"1. To so soften and disintegrate the cellulose that the nutrients that exist in close connection with it are set free.

2. To cook the protein constituent so as to make it digestible and palatable.

3. To swell and burst the starch grains.

4. To combine the various flavoring matters, as salt, pepper, fat, herbs, butter or fat meat so that the results shall be a palatable dish."

"It has been universally said that long cooking at a moderate temperature develops the flavor of beans and, most important, does soften the tissues. This is illustrated by the delicious flavor of the 'Old Fashioned Pork and Beans' of New England which has been brought to perfection by baking for at least 12 hours in the slow-cooking brick ovens. The addition of fat and salt pork not only adds to the flavor, but also supplies needed ingredients to make a better balanced ration."

The comparison of cooking qualities of the two beans was done in five series of experiments, using three methods of cooking, namely: boiling, steaming and baking. An equal weight of beans of each class was used. Half were soaked and half were used unsoaked. The time of soaking before cooking was fifteen hours. Both classes of beans used were of the crop harvested in the fall of 1932. Soft water

was used in cooking them.

Covered aluminum pans, of the same size with as nearly the same degree of heat as possible, were used. The boiling was done on an institution gas range with perforated top. The steaming experiments were conducted in a sectional steamer under a pressure of 15 pounds. In the baking experiments, the beans were steamed from 40 to 50 minutes, depending on the length of time necessary to loosen the skins. When the blow test was applied, the skins would break and curl up. The beans were baked in earthenware pots for 8 hours, the following recipe being used:

10 pounds beans
10 pounds brown sugar
7 tablespoons salt
3 teaspoons mustard
22.5 quarts bean liquor

The cooked beans were rated by three judges, all of whom were members of the Institution staff. The score card allowed 25 points for each of the following: general appearance, tenderness, flavor, and retention of form; one hundred points representing a perfect score. General appearance is of importance to the person selling food over the cafeteria counter for, after all, the consumer selects his food chiefly with his sense of sight.

Tenderness and flavor are factors of prime importance in determining quality. Retention of form is of value to the user in deciding which class of beans holds its shape best for long time baking periods, and which class would be likely to mush quickly for puree soups and similar dishes.

The amount of liquid used during the process of cooking was recorded and the percentage of absorption was estimated. The length of the cooking period was noted for each type of experiment. The number of servings and the cost per serving were calculated.

Discussion of the Results of the Cooking Experiments.

The cooking of the Michigan Pea beans and the Great Northerns showed very definite results which would be of value to users of beans. Each class seems to have its advantages and disadvantages which adapt it to a particular use.

Table VIII

Boiling - Average Scores

Kind	General appearance	Flavor	Tenderness	Retention of form	Total
Michigan Pea Unsoaked	22.4	22.9	22.2	22.6	90.1
Great Northern Unsoaked	20.6	23.1	18.5	20.3	82.5
Michigan Pea Soaked	20.3	19.4	23.1	21.1	83.9
Great Northern Soaked	18.6	22.8	20.3	19.1	80.8

Table VIII shows the average scores of all the judges for the boiled, soaked and unsoaked beans. The unsoaked beans in both cases excelled the soaked beans in general appearance, flavor and retention of form. The Great Northerns surpassed the Michigan Peas in flavor, whether soaked or unsoaked; however, the Michigan Pea beans were scored ahead of the Great Northerns in all other respects. The Great Northerns cooked unevenly, which was the main factor in reducing their score. The soaked beans were more tender than the unsoaked beans. In comparing the total scores of the experiments in boiling the Michigan Pea unsoaked beans were highest with a score of 90.1 out of a possible 100 points. The soaked Michigan Peas were second with a score of 83.9 out of a possible 100 points. The Great Northerns unsoaked ranked third, and the soaked Great Northerns fourth.

Table IX

Boiling - Average Scores

	Quantity used	Yield in qts.	Number of servings	Cost per serving	Time in minutes	Water absorption in quarts
Michigan Pea, Unsoaked	10Lbs	11.1	66	.0036	94	24.7
Great Northern Unsoaked	10Lbs	11.8	71.1	.0063	97	28.5
Michigan Pea Soaked	10Lbs	11.5	68.8	.0034	56	30.4
Great Northern Soaked	10Lbs	12.15	72.9	.0061	63	32.5

Table IX gives the average score of the five series of the experiments in boiling, for time, yield, water absorption and cost. The soaked beans cooked quicker than the unsoaked ones. The Michigan Pea bean cooked quicker than the Great Northerns whether soaked or unsoaked. The largest yield was obtained from the soaked beans, the Great Northerns producing the larger yield whether soaked of unsoaked. Water absorption was highest in the soaked beans, the Great Northerns absorbing a trifle more than the Michigan Pea beans.

Table X

Percentage Absorption of Water in Boiling

	Quantity of beans used	Quantity of water used	Amount of water absorbed	Percentage of absorption
Michigan Pea, Unsoaked	10 lbs.	34 quarts	24.7 quarts	72.64%
Great Northern, Unsoaked	10 lbs.	34 quarts	38.5 quarts	83.8%
Michigan Pea, Soaked	10 lbs.	34 quarts	30.4 quarts	89.4%
Great Northern, Soaked	10 lbs.	34 quarts	32.5 quarts	95.5%

The data in Table X indicate the percentage of absorption for the two classes of beans. The soaked Great Northerns had the greater absorption with 95.5 percent. The Michigan Pea soaked was second with 89.4 percent. This greater absorption of the Great Northerns undoubtedly was responsible for their higher yield in comparison with the Michigan Pea beans, which has already been noted in Table IX.

Probably the absorption percentages are not entirely accurate, however, for some of the disappearance of the cooking water would probably be due to slight evaporation losses even though boiling took place in covered pans. The beans which showed the highest percentage of absorption also produced the highest yield in servings which would

indicate, that it is correct to assume that most of the disappearance of water was due to absorption and not to evaporation.

At the time when this study was made the Great Northerns cost .045 cents per pound and the Michigan Pea beans .024 cents, the higher cost of the Great Northerns being due to the fact that they are foreign to this territory. Two-thirds of a cup, cooked, was considered as an ample measure for a serving. This is the standard size generally used on a commercial cafeteria counter. Cost figures were computed on a quantity of ten pounds. The Great Northerns yielded the largest number of servings. From a quantity of ten pounds of beans there was a difference of four servings between the two classes when they were soaked and a difference of five servings when they were unsoaked.

Table XI

Steaming - Average Scores

	General appearance	Flavor	Tenderness	Retention of form	Total
Michigan Pea, Unsoaked	23.3	20.8	22.3	22.6	89.0
Great Northern, Unsoaked	21.3	22.6	19.8	21.3	85.0
Michigan Pea, Soaked	22.3	19.6	23.5	22.2	87.6
Great Northern, Soaked	19.5	22.2	22.5	19.6	83.8

Table XI gives the average scores of all the judges for the experiments in steaming. In both cases the Michigan Pea bean was superior to the Great Northern in general appearance, tenderness, and retention of form. The flavor of the Great Northern was superior to that of the Michigan Pea bean. The flavor of the soaked beans of both classes was inferior to that of the unsoaked beans. The unsoaked beans of both classes had a better general appearance and held their shape better than the soaked ones. The soaked beans were more tender than the unsoaked ones. The Michigan Pea scored higher in this respect. The Great Northerns cooked very unevenly. This uneven cooking was probably due to careless grading since the Great Northern dealers do not use Federal standards in grading. In comparing

the total scores, the Michigan Pea unsoaked ranks highest with the Michigan Pea soaked ranking next. The Great Northern unsoaked was third and the soaked Great Northerns received the lowest score.

Table XII

Steaming - Average Scores

	Quantity used	Yield in quarts	Number of servings	Cost per serving	Time in minutes	Water Absorption in quarts
Michigan Pea, Unsoaked	10Lbs.	13.05	78.3	.003	103	8.2
Great Northern, Unsoaked	10Lbs.	13.75	82.3	.0054	108	18.7
Michigan Pea, Soaked	10Lbs.	14.02	84.1	.0028	53	8.55
Great Northern, Soaked	10Lbs.	14.85	89.1	.005	61	8.85

The average scores of all of the experiments in steaming for time, yield, water absorption, and cost are shown in Table XII. Less time was required to cook the Michigan Pea bean whether soaked or unsoaked. The yield was greatest in the soaked beans, the Great Northern bean yielding slightly more than the Michigan Pea bean. The water absorption in the process of steaming for the two classes of beans was almost equal, the Great Northerns taking up a little more than the Michigan Pea beans.

Percentage Absorption of Water in Steaming

	Quantity of beans used	Quantity of water used	Amount of Water Absorbed	Percentage of Absorption
Michigan Pea, Unsoaked	10 lbs.	22.5 quarts	8.2 quarts	36.4%
Great Northern, Unsoaked	10 lbs.	22.5 quarts	8.7 quarts	38.6%
Michigan Pea, Soaked	10 lbs.	22.5 quarts	8.55quarts	38.0%
Great Northern, Soaked	10 lbs.	22.5 quarts	8.85quarts	39.3%

The data in Table XIII indicate the absorption in percentages. The soaked Great Northerns had the highest absorption with a percentage of 39.3. The Great Northern unsoaked were second with a percentage of 38.6 and the Michigan Pea soaked were a close third with a percentage of 38. From ten pounds of beans, five more servings were obtained from the soaked Great Northerns than from the Michigan Pea beans. From the same quantity of beans, four more servings were obtained in the case of the unsoaked Great Northerns than in that of the Michigan Peas. Even though the Great Northerns did give a larger yield the cost per serving was more than that of the Michigan Pea bean because of the fact that the price of

the Great Northerns was almost double that of the Michigan Pea beans. If the price of the two classes of beans were the same, then the Great Northerns would cost less per serving, since they give a larger yield per given poundage. The cost per serving of the Michigan Pea bean was .003 cents while the Great Northern was .0054 cents per serving at the price levels which existed when this study was made. In calculating the serving cost in the experiments in both boiling and steaming, only the cost of the beans was taken into consideration. There were no seasonings used such as salt pork, bacon or tomatoes.

A study of Tables VIII and XI reveals that the general appearance, tenderness and retention of form were highest when the steaming process was used for cooking. However, the flavor was better when the boiling process was used.

The data in Tables IX and XII show that the time required for cooking was shorter in the boiling process; 94 minutes being required in boiling soaked Michigan Pea beans as against 103 minutes in steaming. In spite of the fact that boiling required less time, there was a greater water absorption when this cooking process was used than in the case of steaming. The greater absorption

was probably due to the fact that there was a great deal of evaporation in spite of the use of covered pans. The yield was greater when the beans were steamed instead of boiled. A heavy sediment was detected in the bottom of the liquid when boiling was made use of, showing that the skins had burst open, hence, a material loss of the bean solids which would cause a decreased yield.

Table XIV

Baking - Average Scores

	General Appearance	Flavor	Tenderness	Retention of form	Total
Michigan Pea, Unsoaked	23.0	21.6	23.8	23.5	91.9
Great Northern, Unsoaked	21.7	22.5	23.2	20.7	87.7
Michigan Pea, Soaked	19.3	21.3	24.3	19.3	84.2
Great Northern, Soaked	17.3	22.1	23.6	16.2	79.2

Table XIV exhibits the average scores of all the judges for the experiments in baking. The unsoaked beans in both classes had a higher rating in general appearance than did the soaked beans. The Michigan Pea soaked was higher than the soaked Great Northerns. The general appearance of the

Michigan Pea bean was highest in both cases, but the Great Northern unsoaked scored higher than the soaked Michigan Pea.

The Great Northerns again exceeded in flavor as they did when boiled and steamed, and the unsoaked beans had a higher score than the soaked beans. There was no appreciable difference noted in the tenderness of the two beans after eight hours of baking.

The unsoaked beans retained their form better than the soaked beans. The Michigan Pea bean, whether soaked or unsoaked, ranked higher than the Great Northern. The unsoaked Great Northerns ranked only slightly higher than the Michigan Pea soaked. The judges all remarked on the "mushiness" of the Great Northerns. The supposedly thin skin on the Great Northerns is probably the cause of the beans mushing so badly, thus resulting in a low score for both retention of form and general appearance. There was little difference noted in the flavor of the two classes of baked beans. This was probably due to the brown sugar and other seasonings that were added which would tend to mask the real flavor of the beans. The Great Northerns did score about one point ahead of the Michigan Peas.

Table XV

Baking - Average Scores

	Quantity used	Yield in cups	Number of servings	Cost per serving	Time of parboiling	Time of baking	Water Absorption in cups during parboiling
Michigan Pea, Unsoaked	10lbs.	56.00	84	.0091	65 min.	8 hrs.	28.5
Great Northern, Unsoaked	10Lbs.	58.30	87.45	.0112	65 min.	8 hrs.	29.6
Michigan Pea, Soaked	10Lbs.	59.00	88.5	.0086	50 min.	8 hrs.	36.1
Great Northern, Soaked	10Lbs.	60.1	90.1	.0108	50 min.	8 hrs.	37.6

Yields, cost per serving and water absorption for the two classes of beans when baked are shown in Table XV. The Great Northerns absorbed more water than the Michigan Pea beans. The yield was greater in the soaked beans, the Great Northerns yielding more whether soaked or unsoaked. The soaked Great Northerns produced about one and one-half more servings than the Michigan Pea beans. The unsoaked Great Northerns produced about three servings more than the unsoaked Michigan Peas. The Michigan Pea bean was cheaper per pound, thus making the cost per serving .009 cents which was less than that of the Great Northern, as the latter averaged .011 cents per pound. Regardless of the extra yield

derived from the Great Northerns, they are not economical to serve in the Michigan Pea bean territory when their price is approximately twice that of the Michigan bean.

In purchasing beans the institution user must decide what qualities he expects them to have and choose the bean accordingly. If he were buying for flavor then he would select Great Northerns; if for general appearance, retention of form or tenderness he would decide on the Michigan Pea bean; if he is buying for price, as had been stated above, whenever the price of the two classes of beans is approximately the same he would buy Great Northerns since the number of portions per given quantity was somewhat greater.

V. SUMMARY AND CONCLUSION

Since the United States ranks sixth in acreage and fifth in production of beans, it is evident that this commodity is of greater importance than is generally realized. Michigan usually produces about 40 percent of the entire bean crop of the United States, while the Great Northerns comprise only 14 percent of the total. The production of the Great Northern bean in the past four or five years has been increasing, while the Michigan Pea bean has shown a potential decline. Of all the dry beans

handled by wholesale grocers throughout the United States in the year 1931, Great Northerns comprised 21 percent while the Michigan Pea beans comprised only 16 percent. Great Northerns are being distributed in areas where pea beans were formerly the principal class consumed. In spite of the handicap of the Great Northern bean due to poor grading, it is giving the Michigan Pea bean increased competition, partially due, no doubt, to the national advertising done by the western growers. Michigan Pea beans are preferred by canners while the Great Northerns are preferred by the dry bean trade. September and October appeared to be the best months for the purchase of dry beans by the institution buyer.

Dry beans have many advantageous qualities which make them a useable product for every menu maker, regardless of the type of institution which he is managing. As is the case with other commodities, the two classes of this one have specific uses for which each is superior to the other. The comparative study of the cooking qualities of the two beans showed the following results:

1. The steamed beans were superior to the boiled in tenderness, general appearance and retention of form, but the flavor of the boiled beans was preferred to that of the steamed ones.

2. The baked beans were more tender than those boiled or steamed.

3. Less time was required for cooking the beans when they were boiled than when they were steamed but the yield was greater when the beans were steamed.

4. The unsoaked beans excelled the soaked beans in general appearance, flavor and retention of form when cooked but were less tender than the soaked beans.

5. The soaked beans cooked more quickly than the unsoaked and also gave a larger yield.

6. Water absorption was greater in the soaked beans and the Great Northerns absorbed more than the Michigan Pea beans.

7. In boiling and steaming the Great Northerns were superior to the Michigan Pea beans in flavor but the two classes showed little difference when baked.

8. The Michigan Pea beans ranked higher than the Great Northerns in general appearance, tenderness and retention of form when boiled, steamed or baked.

9. The Michigan Pea beans cooked more quickly than the Great Northerns whether soaked or unsoaked, but the Great Northerns produced a larger yield.

10. The Michigan Pea beans used in this study

cost less per serving than the Great Northerns. If the two classes of beans had been priced the same per pound, the Great Northerns would have cost less, since they produced a larger yield than did the Michigan Peas.

11. The Michigan Pea beans are recommended for either baking or boiling while the Great Northerns are better for purees and soups.

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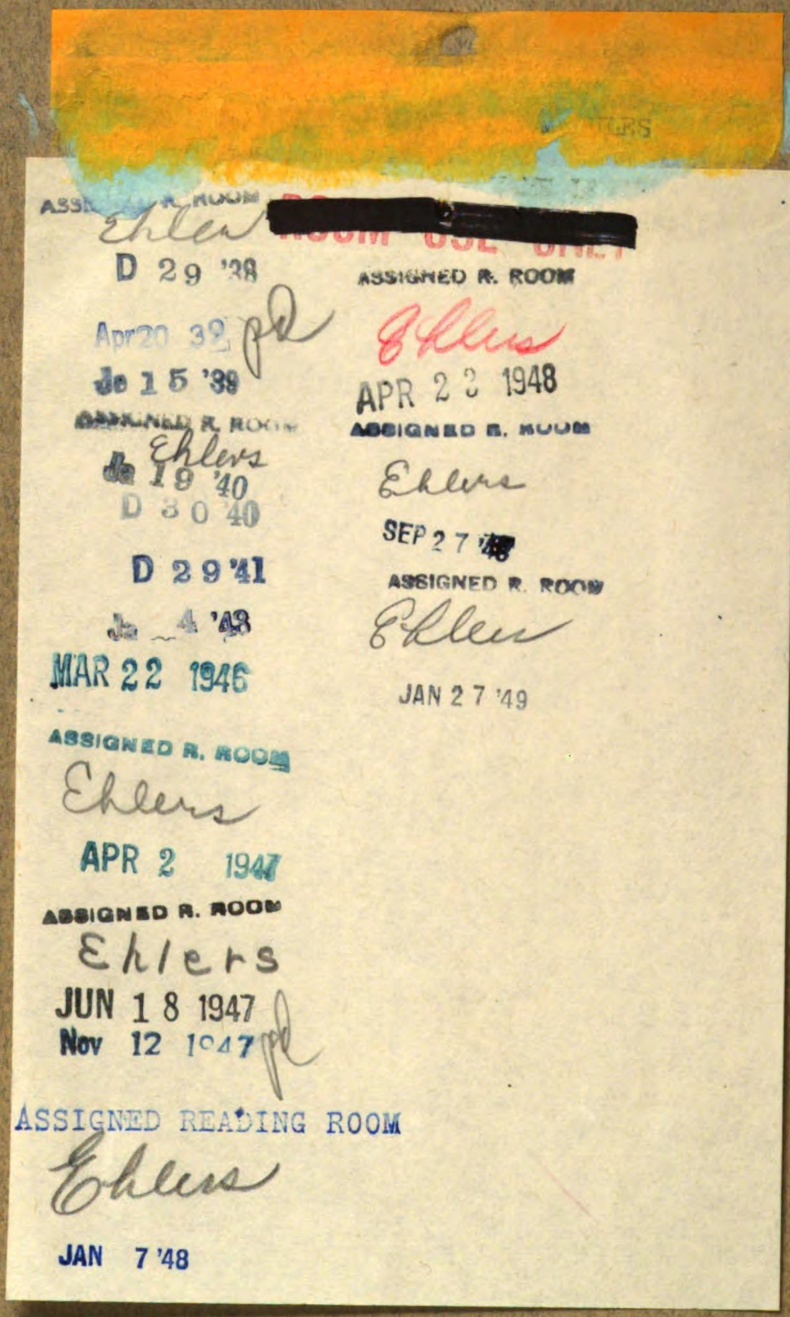

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