

# AGRICULTURAL EXPERIMENT STATION

KANSAS STATE COLLEGE OF AGRICULTURE  
AND APPLIED SCIENCE

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## SOME FACTORS INFLUENCING THE MID-SEASON POTATO MARKET



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## SUMMARY

1. Studies concerned with the marketing of the potato crop have dealt almost entirely with the late crops. Very little has been done with problems connected with the mid-season crop.

2. Several factors influence the market for an agricultural commodity in a given season. Among these are: (1) Total supplies; (2) position of the supplies; (3) rate of movement to market; (4) quality and condition of the product; (5) variations in needs of consuming districts; (6) general business conditions; and (7) general character of demand.

3. The mid-season market extends from July 1 to September 1. It overlaps to some extent the end of the early market and the beginning of the late market. The mid-season market is dominated by the Irish Cobbler variety.

4. The Eastern Shore of Virginia and Maryland, the Kaw valley and Orrick districts of Kansas and Missouri, and the Freehold district of New Jersey are the leading districts producing potatoes commercially for the mid-season potato market.

5. Production in the districts supplying the mid-season market has varied from 16,766,000 bushels in 1923 to 30,640,000 bushels in 1924. The acreage has varied from 179,080 acres in 1921 to 210,180 acres in 1924.

6. Shipments from the principal mid-season districts have varied from 27,698 carloads in 1925 to 40,139 in 1927.

7. In five years of eight an increase or decrease in acreage was accompanied by an increase or decrease in production, while in three years the reverse was true. A correlation coefficient of +.645 was found between acreage and production.

8. A correlation coefficient of +.888 was found between production and carload shipments. Estimates of shipments based on this coefficient show an average error of 6.14 per cent. Total United States production was found to influence shipments from the mid-season districts. An estimating equation which gave weight to the total United States production factor, reduced the error of estimates to 3.59 per cent.

9. A correlation coefficient of  $-.779$  was found between carload shipments from the principal districts supplying the mid-season potato market and average prices for the season at Chicago. Estimates of prices based on this coefficient show an average error of 21 cents per hundredweight, or 9.9 per cent. As in the case of

carload shipments, total United States production was found to influence mid-season prices. An estimating equation giving weight to the total United States production factor reduced the average error of estimates to 12 cents per hundredweight, or 5.69 per cent.

10. The position of supplies, though usually not of great importance in the mid-season market because of the rail-rate structure and the ease with which diversions are made, assumes considerable importance in some seasons. In 1922 the Chicago market averaged 53 cents per hundredweight above the New York market, while in 1923 the New York market averaged 36 cents per hundredweight above the Chicago market.

11. The usual seasonal price trend for mid-season potatoes is downward from early July to the first part of August. The first part of August is usually a period of price recovery. The middle of August shows price rises about half the time and the latter part of August most frequently show declining prices. Receipts at Chicago increase from the first part of July to the end of July, reaching a peak at the end of July. The first part and the middle of August are usually periods of light receipts, while the latter part of August is a period of heavy receipts.

12. Daily prices at Chicago are influenced to a considerable extent by daily receipts on that market. Correlation coefficients of  $-.6626 \pm .063$ ,  $-.0208 \pm .104$ , and  $-.5016 \pm .072$  were found between daily Chicago prices and receipts for the years 1927, 1926, and 1925, respectively,

13. The Chicago market dominates other markets to a marked degree. A correlation coefficient of  $+0.923 \pm 0.0154$  was found between Chicago daily prices and St. Louis daily prices. Between Chicago prices and Pittsburg prices the coefficient was  $+0.666 \pm 0.0663$ . Likewise, Chicago daily prices were found to influence shipping point daily prices in two of the leading producing districts.

14. Shipments from the Eastern Shore of Virginia, the Kaw valley of Kansas, and the Orrick district of Missouri are to a considerable extent responsible for the daily fluctuations in receipts on the Chicago market.

15. There is no apparent relation between daily receipts on the Chicago market and total United States shipments made one, two, three, four, or five days previously. The ease with which diversions are made in all probability accounts for this situation. A period of strong prices attracts shipments to Chicago, while a period of weak prices repels them.

16. Quality and grade as market factors can be measured only by a comparison of prices between various grades. The spread in price between grades varies from year to year as the quantity of the lower grades varies in proportion to the quantity of the higher grades.

17. Proper grading has resulted in higher net returns to potato growers in Kansas. Three years' records show that United States No. 1 potatoes sold for a higher price than partly graded potatoes from 70 to 80 per cent of the time.

18. Approximately 88 per cent of the total crop harvested in the Kaw valley of Kansas grades United States No. 1. This varies from farm to farm and from season to season. The low was 77 per cent and the high 91 per cent. Cultural practices play an important part in the quality of the product produced. Seed-treatment methods, the variety, and the strain of seed used were found to influence quality to a considerable extent.

19. Marketing conditions in the mid-season producing districts vary to a considerable extent. In some districts, the problem of assembly is more important than in others. In several districts cooperatives are well established, while in others cooperatives play no part. Marketing is controlled to a large extent in some districts by a few prominent dealers, while in others there are a great number of small shippers.

20. The needs of the areas consuming mid-season potatoes vary from year to year in accordance with the size of home-grown crops, and with the earliness or lateness of the crops in the early- and late-producing districts.

21. The demand for potatoes is relatively constant. Business conditions, except as they are reflected in the general price level, have been shown by Working to have little effect on the price of potatoes.

22. It is highly important to a producing section that its product be well graded in order that it may have a broad market outlet. The interests of the various producing districts are in conflict in this matter, for it would be advantageous for one to exclude the other from competitive territory by the adoption of superior grading. Each grower has a common interest in the quality of the product shipped from his district, for the reputation of the shipments from his district is important in determining from which district dealers in consuming markets will make their purchases.

23. Limitation of supplies by means of acreage reduction campaigns, imposition of severe grading regulations, and restriction of shipments to superior grades as a means of improving a marketing situation offer little possibility because the interest of individuals or groups of individuals is in variance with the interest of the group as a whole. "Intentions to plant" reports as issued by the Bureau of Agricultural Economics offer the best possibilities in this direction.

24. The control of the flow of the product to market to eliminate market gluts and famines and cross hauling offers possibilities for improving conditions in the mid-season potato market.

25. Coöperatives operating in the various mid-season producing sections have been unable to secure control of enough of the product to control the flow to market or exert the desired degree of price stabilization.

26. The clearing-house association and minimum-quotation plan offer possibilities to improve the marketing situation. The Eastern Shore of Virginia Farmers' Association is an effort in this direction.

27. An "estimate of arrivals" service would be advantageous to potato shippers, but would be dependent upon the coöperation of shippers in reporting promptly billings and diversions.

28. A plan embodying the organization of growers into strong local units, the organization of these units into a clearing-house association, and the coöperation of these associations among themselves and with the Market News Service is proposed.

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## SOME FACTORS INFLUENCING THE MID-SEASON POTATO MARKET<sup>1</sup>

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### INTRODUCTION

The marketing of the commercial potato crop in the United States has been studied and analyzed by several workers. Most of the work has, however, been confined to problems connected with the main or late potato crop. Aside from statistical data on production and distribution prepared by the Bureau of Agricultural Economics of the United States Department of Agriculture, the literature on the problems of marketing the mid-season potato crop is exceedingly meager.

The first publication dealing with the marketing of the mid-season potato crop was issued by the United States Department of Agriculture as Farmers' Bulletin No. 1316. It, however, deals primarily with the marketing of the early potato crop. Brief mention is made of the southern New Jersey, the Kentucky, and the Kaw valley districts. A distribution map of shipments from the Kaw valley for the years 1918, 1920 and 1921 is included.

The second publication issued deals with a price analysis and a method of forecasting the price of New Jersey potatoes.<sup>3</sup> Here it is shown that four factors enter into price estimation: First, total production of potatoes in the United States; second, the trend of potato production in the United States; third, the level of wholesale prices of all commodities; and fourth, the trend of prices of New Jersey cobblers.

The author has from time to time pointed out the influence of several factors affecting the mid-season potato market. In the first it is shown that a wider distribution of the Kansas potato crop resulted from the adoption of standard grades and shipping-point inspection service. The second<sup>5</sup> points out the seasonal trend

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2. Associate in Agricultural Economics, California Agricultural Experiment Station; formerly Specialist in Marketing, Division of College Extension, Kansas State College of Agriculture and Applied Science.

3. Waugh, Frederick V.: Forecasting Prices of New Jersey White Potatoes and Sweet Potatoes. State of New Jersey, Department of Agriculture, Circular No. 78, July, 1924, pp. 3-18.

4. Stokdyk, E. A.: The Value of Extension Organization. Kansas State College, Extension Circular No. 50, February, 1925, pp. 1-10.

5. Stokdyk, E. A.: Seasonal Tendencies in the Potato Market During the Kaw Valley Shipping Season. The Potato News Bulletin, October, 1925, pp. 386-387.

in prices during the mid-season market, and the third<sup>6</sup> gives a report of a survey of methods and practices in potato marketing as found in 10 of the leading cities in the Mid-West in 1925. These will be drawn upon in connection with the discussion to follow.

Recently, Bomberger<sup>7</sup> reported on the operations of the Quotation Committee of the Del-Mar-Va Eastern Shore Association as a market influence in 1927. He states that the operations of the association were responsible for a net return of \$1 per barrel to the growers over what would have accrued under the old methods of marketing under Eastern Shore conditions. This association will be described later.

Principles underlying the marketing of farm products in general and potatoes in particular have been demonstrated by numerous students of marketing. Where these have a bearing upon the specific problem under consideration they will be introduced.

It frequently happens that practices applicable to the marketing of one product do not apply to others. One commodity is more perishable than another. Conditions of production and assembly in various producing districts are different. It is evident, therefore, that methods and practices suited to one commodity or condition may not be adapted to all commodities or conditions. Potato producers realize this and as a consequence do not readily accept methods which have proved successful in the marketing of other products. It frequently happens, however, that even though situations appear quite dissimilar at first glance, the principles involved in marketing one product can be applied to another product. It is important, therefore, to analyze each situation, and employ, where it is practicable, methods which have been demonstrated to be successful.

### I. FACTORS THAT INFLUENCE THE MARKET FOR A COMMODITY

Several factors influence the market for any commodity. From the supply side, we must consider four principal factors, namely: total supplies; position of the supplies; rate of movement to market, whether controlled or uncontrolled; and quality and condition.

**1. The influence of total supplies** has been demonstrated time and again. One of the most recent examples is reported by the

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6. Stokdyk, E. A.: The Mid-West Potato Markets in July, 1925. Proceedings of the Twelfth Annual Meeting of the Potato Association of America, December, 1925, pp. 56-58.

7. Bomberger, F. B.: Quotation Committee, Eastern Shore Farmers' Association. The Cooperative Marketing Journal, March, 1928, p. 35.

THE MID-SEASON POTATO MARKET

Canadian Wheat Pool of Winnipeg<sup>8</sup> in a discussion entitled *Prices versus Production*:

Interests opposed to the pool are stating that the pool is responsible for the drop in prices for the past three years, as the pool payment for the 1926 crop was smaller than its payment for the crops of 1925 and 1924.

The obvious answer is:

YEAR.	Net payment made by central selling agency to provincial pools.	World wheat production (Sanford Evans Statistical Service).
1924-1925 .....	\$1.66	3,471,823,000
1925-1926 .....	1.45	3,919,431,000
1926-1927 .....	1.42	4,180,130,000

The world's production in 1925 was over 447 million bushels greater than in 1924, consequently the pool's price was lower in 1925 than in 1924.

The world's production in 1926 was 260 million bushels greater than in 1925, which fact, coupled with the British coal strike and the Chinese civil war, is ample reason why the pool's price was slightly lower in 1926 than in 1925.

Working<sup>9</sup> has shown the relation between production and prices of late potatoes. He states: "When the production of potatoes is small the price tends to be high, and when the production is large the price tends to be low. In 1916 the production was only 72 per cent of normal and the price was 217 per cent of normal; in 1912 the production was 120 per cent of normal and the price was 77 per cent of normal. . . ." Working goes further and develops a price-forecasting formula. On the basis of a correlation between production and price he states:

When production is above normal (per cent).	Price will probably be below normal (per cent).
20 .....	29
10 .....	17
0 .....	0
Below normal.	Above normal.
10 .....	26
20 .....	70

Scoville<sup>10</sup> arrived at a similar conclusion:

"A 10 per cent change in the supply," he says, "has on the average an opposite change in price of 17 per cent."

Working's data indicate that a change of 10 per cent in supply causes an average opposite change in price of 29 per cent. A 10 per cent change in supply above normal causes an average opposite change in price of 23 per cent, and a 10 per cent change in supply

8. The Truth About Grain Prices: Pamphlet issued by the Canadian Wheat Pool, Winnipeg, Canada, 1928, p. 8.

9. Working, Holbrook: Factors Affecting the Price of Minnesota Potatoes. University of Minnesota, Agricultural Experiment Station, Technical Bulletin No. 29, October, 1925, p. 13.

10. Scoville, G. F.: Farm Economics. A mimeographed circular issued by Cornell University, September 25, 1923, pp. 56-57.



below normal causes an average opposite change in price of 35 per cent.

The disparity between the figures of Working and Scoville is probably due to two factors: (1) Working has calculated a "normal" on the basis of the trend of potato production in 27 late-crop states while Scoville has calculated a "normal" on the basis of a calculation of the per capita consumption and estimated population in the United States, which gives him a figure for the United States as a whole. Thus, Working's "normal" for the 27 late-crop states for the year 1923 is approximately 325 million bushels, while Scoville's "normal" for the United States as a whole is 419 million bushels; (2) Scoville has used a longer period than Working. Scoville's work covers the years 1895 to 1923, while Working uses the period 1902 to 1923. The point to keep in mind, however, is that a change in total supply has a decided effect on prices.

Nevertheless, the influence of total supplies as a price-making factor has been frequently overemphasized and has led to a *laissez faire* attitude toward marketing problems. By some it is assumed that the total supply is the only factor influencing the market. Boyle<sup>11</sup> in his discussion on *Farm Relief* states:

" . . . It is the size of the crop, not the flow of the crop to market, that influences prices in all the great staple crops handled on organized exchanges." He then cites cases, but in doing so chose instances where the size of the crop obscured other factors. Furthermore, in the case of wheat, he considers the movement to market in the United States alone, instead of the movement to market throughout the world. Such a view cannot be tolerated by careful students of marketing. The influence of other factors has been demonstrated time and time again. Green and Stokdyk<sup>12</sup> have shown the influence of the time and rate of movement of that part of the supply of wheat which is exported from the principal surplus countries as a price-making factor. Weakness and strength in wheat prices during various seasons of the year are demonstrated to be caused by periods of heavy and light exports from the principal exporting countries.

The extreme emphasis placed by many upon total supplies as a determinant of market prices arises, no doubt, out of a lack of distinction between total physical supplies and total economic

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11. Boyle, James E.: *Farm Relief*. Doubleday, Doran and Co., 1928, pp. 175-195.

12. Green, R. M., and Stokdyk, E. A.: *Judging Price Risks in Marketing Wheat*. Kansas State College, Extension Circular No. 54, 1928, pp. 7-10.

supplies.<sup>13</sup> In the case of highly perishable commodities, the two will almost coincide, but in the case of the more staple agricultural commodities physical supplies do not coincide with economic supplies. If they did we would not find a variation in the carryover of supplies from one season to another. The fact that price studies concerned with supplies are limited primarily to studies of physical supplies, because of a lack of data on economic supplies, adds to the confusion and tends to obscure the influence of economic factors.

That total physical supplies are a limiting factor must be recognized. They form boundaries beyond which other factors cannot exert an influence. Within the boundaries, however, there is room for several forces to act.

**2. The position of supplies** as a market influence is of considerable importance in the marketing of most commodities. For this reason the United States Department of Agriculture reports the number of cattle on feed east of and west of the Mississippi river. Similarly crop production in each of the large producing areas is reported separately. An illustration of the influence of the position of supplies was observed in 1925. In that year the winter wheat crop was small. Prices during the fall were higher at Kansas City than prices at Chicago, and Chicago prices were higher than Liverpool prices. The relationship between these markets is usually the reverse, particularly when an average crop is produced in the winter-wheat belt.

The potato market in February, 1928, illustrated the effect of the position of supplies. The Tabb Potato Service<sup>14</sup> commenting on the situation said: "The strongest feature of the present situation is the manner in which the remaining supplies are distributed. The states east of Chicago have at least 6,030 cars less than a year ago, and taking all of the states east of Colorado the holdings are 7,657 less than last February. Maine has been leading all the advances since January 1, and the eastern shortage is now becoming apparent to all."

**3. The rate of movement to market** and whether the rate is controlled or uncontrolled is of particular importance in the marketing of perishable commodities. For this reason some of the first

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13. Economic supply means the quantity offered for sale. Physical supply means the total amount that might be put on the market if sellers were willing to do so. That the two do not coincide is evident from the fact that since 1909 the carryover of wheat on farms has varied from a low of 8,063,000 bushels in 1918 to a high of 74,731,000 in 1916. See United States Department of Agriculture Yearbook for 1927, Table 11, Page 750.

14. Tabb Potato Service: Market Bulletin No. 90, 9 South Kedzie avenue, Chicago, Ill., February 24, 1928, pp. 1-5.

attempts that were made to control the flow of products to market dealt with fruits and vegetables.

As early as 1885 the orange growers in California formed the Orange Growers' Protective Union of Southern California to improve the methods of the sale of their fruit.<sup>15</sup> From this beginning there evolved one of the most outstanding examples of controlled marketing. To-day one city is not overloaded with oranges and another city without them. Each market is fed in proportion to supplies available.

The lamb market in the spring of 1928 furnished an example of what can be accomplished by controlling the rate of movement to market. The lamb feeders in the West decided to move their lambs to market in an orderly fashion. The United States Department of Agriculture<sup>17</sup> commenting on the factors contributing to the strength of the spring lamb market in 1928 said: "The third [factor] was that the large number of western lambs were marketed in an orderly way, and no gluts of dressed lambs occurred in the big eastern cities where lamb prices most easily make or break."

The most recent development in the control of distribution and the rate of movement to market in the field of marketing fruits and vegetables has taken the form of clearing-house associations. The Del-Mar-Va Eastern Shore Association was mentioned above. Others that have developed are: The Gravenstein Apple Growers Clearing House of California; the Clearing House of the California Vineyardists' Association; the Clearing House of the Canning Cling Peach Industry of California; and the Prune Shippers Traffic Association of Washington and Idaho. This effort is described by Sherman<sup>18</sup> as an attempt to organize producer groups into the larger field of industry groups. Mr. Sherman expresses the aims and purposes very clearly in the following words:

Too frequently competition resolves itself into a scramble for f. o. b. orders, or for dominance in certain terminal markets. The result is price cutting, and it is always the farmer's price which is cut. There has been a merry warfare among the competing market agencies which have sought the privilege of selling the farmer's product for him, but he has furnished the sinews of war for all the contending parties, and has dressed the wounds and paid the hospital bills for each. The drain on his purse has been so heavy that the banker, who holds the mortgage on his land and who advances money to help move his

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15. MacCurdy, Rahno Mabel: The History of the California Fruit Growers' Exchange. Pamphlet by the California Fruit Growers' Exchange, Los Angeles, Cal., 1925, pp. 1-106.

17. The Agricultural Situation: Bureau of Agricultural Economics, United States Department of Agriculture, Vol. 12, No. 5, May, 1928, p. 1.

18. Sherman, Wells A.: Unifying the Commodity Industry—Three California Examples. The Coöperative Marketing Journal, March, 1928, pp. 41-48.

crop, has become concerned for his welfare. It seems to have occurred to the banker and the farmer simultaneously that the farmer has nothing to gain and both of them have a great deal to lose by continuing this guerrilla warfare among their salesmen. Whenever a sales agency or national distributor receives a mortal wound and is carried out of the marketing battle, the farmer and the banker help to pay the undertaker. No wonder that they are scratching their heads over some plan for putting into effect a live-and-let-live policy.

And so the farmer and the banker are trying to call a halt, and to lay down some rules for the marketing game designed to reduce its cost, to quiet the spirit of panic, to prevent stampedes, to arrive at more public and joint decisions and fewer secret and competitive decisions.

In so far as this is done, confidence is established in the minds of the dealers in the markets, and the crop moves along toward the consumer under conditions which give him a relatively stable price and remove much of the speculative risk of the middleman.

The new concept is that of an entire industry unified in the effort to market its product to the best advantage of all, which means first, chiefly and inevitably to the advantage of the producer; whereas the concept of most organizers in the past has been that of a farmer group steadily signing up more and more tonnage, with the hope of acquiring in the end a virtual monopoly of the product, with the inevitable elimination of competition.

The new concept recognizes the fact that in most industries the grower cooperative has not been able to approach a monopoly; in fact, in some commodities we have two or more coöperatives operating in the same territory who have not been able to get together. The thing that is now proposed is that this competition be limited and regulated in such a way that it shall not result in needlessly low prices for the producer. Every legitimate field of service remains open to the grower-coöperative; only the privilege of destructive warfare is denied under the new regime which seems to be coming in. Internal competition for the privilege of marketing the grower's product and rendering him all sorts of related services can and should continue, but the industry must present a unified front to the outside world.

The organization of the clearing-house associations is modified to suit the situation in the particular industry and for the particular commodity. However, the fundamental principles of the various organizations are quite similar. Growers are signed for a period of years to market their products through shippers who are members of the clearing-house association. Shippers in turn are signed to abide by the rules, regulations, and policies of the clearing-house association. Penalties are imposed upon growers who fail to fulfill their contract, and likewise penalties are imposed upon shippers who fail to abide by decisions of the association. The aim is to control distribution and fix minimum prices. Shippers report daily shipments to the secretary of the association. Destinations are tabulated and a distribution plan followed. This aims to prevent an

oversupply in one market and an undersupply in another market. Minimum prices are set from time to time by a committee of growers and shippers after a thorough analysis of the market situation. Shippers may quote higher prices but are not allowed to quote lower prices. The operations of the Eastern Shore Association will be discussed more fully below,

**4. The quality and condition of a commodity** as a market factor is of utmost importance. This is particularly true of fruits and vegetables. A trip through a wholesale market will convince anyone of this fact. Quality products in good condition always command a premium. Unfortunately, however, producers of farm products often fail to realize the importance of quality because their local marketing agencies do not pay the individual producer on a quality basis. The failure to do so can usually be traced to three factors: (1) Excessive competition at local stations for volume of business; (2) lack of a satisfactory method of determining the quality at local stations; (3) indifference on the part of local dealers in attempting to correct the situation.

Statistical data showing the influence of quality and condition as a market factor are supplied daily by the market pages of the newspaper. There is no need to go further. However, the quotations on the market page only in a small way reflect the importance of quality and condition to a producer in a given district. The reputation of the producing district on the terminal markets has a decided effect on prices received at shipping point. If a district meets with severe competition from other districts at the time it is shipping, this is particularly true. It is, therefore, to the interest of every producer in a district to see that his product is well graded when it is sent to market. Terminal markets as a rule do not recognize individual shippers but judge the whole district by the shipment it first receives. If it is poorly graded the buyer will turn to some other district just as soon as he can get rid of the first shipment.

In the field of correcting trade practices which do not reflect prices for quality products to the individual producer, coöperatives have been markedly successful. This has promoted the production of a higher quality product. McGuire states that when the Land O'Lakes Creameries was organized, only 15 per cent of the butter scored 93-94, while in 1927 from 60 to 70 per cent of the butter scored 93-94.<sup>19</sup>

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19. McGuire, A. J.: *The Wheat Growers Journal*, Wichita, Kan., June 15, 1928.

From the standpoint of demand there are three principal factors which must be taken into consideration in the marketing of most commodities. These are the needs of consuming districts, general business conditions, and general character of demand, that is, whether the demand is elastic or inelastic.

**1. The needs in consuming districts**, particularly for commodities where production districts are distinct and separate from the principal consuming districts, has an important influence on the demand for the commodity when reflected to the producing territories. The wheat market exemplifies this situation quite clearly. The European countries are always dependent upon other countries for a portion of their wheat requirements. England, Ireland, France, Germany, Italy, and Holland are the principal importing countries. On the other hand, Canada, the United States, Argentine, and Australia are the chief exporting countries. The importing countries produce some of the wheat needed for their consumption, but not enough to fulfill their requirements. Production in these countries varies from year to year, and as it varies, more or less is needed from the exporting countries. A crop failure in the importing countries is soon felt as increased demand in the exporting countries. Contrariwise, a crop failure in one of the exporting countries is immediately reflected in prices that will not allow wheat to move to export.

It frequently happens that consuming territories undertake to produce their own products, which cuts off that much demand for the product from an older production area. The Kansas potato growers felt the effect of this factor when the Grand Junction and Fruita districts in Colorado expanded production to a point where they were able to supply the Colorado markets and shut out the Kansas grower. The potato crop in the corn belt is also a determining factor in the demand for potatoes from the principal mid-season producing districts. A short crop in the corn belt means an increase in demand for potatoes from commercial districts. Likewise the time of maturity of the corn-belt home gardens has an important bearing on the situation.

**2. General business conditions**, as expressed by the price level for commodities, is generally recognized as having an important influence on the demand for a particular commodity. For some commodities this factor has a much greater effect than for others. During the war, when common labor was paid high wages, the sale of silk shirts was large in volume. When the depression was

under way silk shirts were a drug on the market. As among agricultural products, there is a marked difference in the effect of business conditions and demand. Apple growers are well aware of this fact. The short apple crop of 1921 saw prices high at harvest time because of the competition of dealers and speculators to secure a supply in anticipation of making a profit. However, business conditions were slack and consumers went without apples. As a result storage stocks in the spring of 1922 were at a high figure and it was only at a reduced price that these apples could be moved into consumption. Statistical evidence of this situation can be gained from the United States Department of Agriculture Yearbook for 1925.<sup>20</sup> Production in 1921 was estimated at 99,002,000 bushels, as compared with 179,208,000 bushels for the five-year average from 1916 to 1920. However, storage stocks of boxed apples on January 1, 1922, were 11,061,000 boxes as compared with 6,158,000 boxes for the five-year average on January 1 for the period 1917 to 1921. Total holdings of boxed and barreled apples on January 1, 1922, were also above the five-year average. Average prices in January, 1922, were \$3.16 per box as compared with \$3.43 per box in October, 1921. The index number of wholesale prices as reported by Warren and Pearson<sup>21</sup> was 173 on January 1, 1921, and 141 in January, 1922. This was the lowest point reached in the downward swing of prices from the high point of 252 in May, 1920. Employment and wages in the early months of 1922 were also at a low point. Babson's<sup>22</sup> index figure of employment for January, 1922, stood at 92, which was one of the lowest figures for a considerable period. Likewise his index figure of wages was at a low point and had been at a low point preceding and following January, 1922. Thus business conditions affected the demand for apples to such an extent that prices had to be reduced to move a small crop into consumption.

General business conditions have some influence on the market for the more staple commodities. One commodity cannot for long stay out of line with the general level of prices without a decrease in demand. Pork products are perhaps one of the most staple agricultural products, yet it has been shown by Green and Stokdyk<sup>23</sup> that even this commodity is influenced by the conditions of

20. Yearbook of the United States Department of Agriculture, 1925, Tables 171, 179 and 180.

21. Warren, G. F., and Pearson, F. A.: The Agricultural Situation. John Wiley and Sons, New York, 1924, Table XXXI.

22. Babson's Statistical Service: Graphic Outlook Chart, April 3, 1928, p. 2.

23. Green, R. M., and Stokdyk, E. A.: Judging Price Risks in Marketing Hogs. Kansas Agricultural Experiment Station Circular No. 137, March, 1928, pp. 27-28.

business as expressed by the general level of prices. They show that when commodity prices are tending upward some improvement in hog prices within six to twelve months is usually witnessed, and that when commodity prices are on the down turn some decline in hog prices may, as a rule, be expected in six to twelve months.

**3. The general character of demand for a commodity**, that is, whether the demand is elastic or inelastic, is of particular importance in respect to the market price for agricultural commodities. The term elastic demand means that a number of new buyers are attracted by a reduction in price or that old buyers take more when prices are lowered. As a consequence prices do not fluctuate violently because of a slight increase or decrease in supply. The term inelastic demand means that few, if any, new buyers are attracted by a reduction in price or old buyers do not take more when prices are lowered. Consequently prices fluctuate violently with a slight increase or decrease in supply. Among agricultural products, eggs are perhaps one of the best commodities with which to illustrate elastic demand. The housewife economizes in the use of eggs when they are high in price, but uses them quite freely when the price is lower. A reduction in price encourages their use and an increase in price discourages their use. On the other hand, wheat is a product for which the demand is relatively inelastic. Consumers use about the same quantity of wheat whether prices are high or low. This is particularly true in highly civilized countries. As a result when there is a small decrease in the supply below what is normally produced consumers are willing to bid up prices to a high level, while a small increase in supply above what is normally produced causes a surplus which can only be disposed of at low prices. Comparatively few new buyers are attracted to the wheat market by a small price reduction.

Potatoes are a commodity for which the demand is relatively inelastic. Prices in the years 1924 and 1925 illustrate this quite clearly. In 1924 there were about 100 million bushels more potatoes produced than in 1925. Prices for the late crop in 1925 were nearly four times the 1924 price.<sup>24</sup> Consumers use nearly the same quantity of potatoes whether the price is relatively high or low. No doubt the reason for this is the fact that the potato is an economical source of starch for the human diet. Somers,<sup>25</sup> specialist in dietetics,

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24. United States Department of Agriculture Yearbook, 1927. Table 212, p. 894.

25. Somers, Ethel M.: Potatoes as a Source of Energy. Liberty, January 17, 1925, p. 47.



states: "Potatoes are an economical source of human energy. Up to 6 cents a pound potatoes are classed among the cheaper foods. At more than 8 cents a pound potatoes are classed as medium-priced foods. A bargain in an energy maker can always be had via the potato." It is seldom, indeed, that prices to the consumer, even when potatoes are relatively high, are above 10 cents a pound.

**Other Factors.**— That there are other factors which affect the market for a commodity is clearly recognized by students of marketing. Among these are tariffs and bounties; quarantines and import restrictions; the trend of demand as influenced by habits, styles, fads, and propaganda; the sentiment of the trade; and rumor and gossip. The effect of some of these is measurable in some instances while in others it is not. For a particular commodity one or more of these factors may become highly important. It is impossible to discuss each of these factors in detail, for it would lead the discussion too far afield from the main object. It is believed that the principal factors which have a bearing on the mid-season potato market have been outlined. It remains to apply the analysis to the subject at hand.

## II. PERIOD OF THE MID-SEASON POTATO MARKET

The mid-season potato market may be roughly defined as the period from July 1 to September 1. This period overlaps to some extent the end of the early potato movement and the beginning of the late potato movement. The Bureau of Agricultural Economics of the United States Department of Agriculture classes those districts which supply the mid-season potato market as the "second-early" districts. However, it classifies Virginia as an early district. This is due, perhaps, to the fact that Virginia usually ships heavily in June as well as in July, although the bulk of her shipments are made in July. For the purposes of this study the period from July 1 to September 1 was chosen as the period of the mid-season market. It is during this period that several of the leading districts supplying the mid-season market begin to harvest their crop and during the same period that several of the districts finish harvesting. New Jersey, Kansas, Maryland, Missouri, and Kentucky are the principal districts which begin to harvest and usually complete their harvest during the period from July 1 to September 1. Virginia, Oklahoma, and Arkansas usually complete their harvest during this period.

The mid-season potato market marks the end of the shipments of the Triumph variety and the beginning of the shipments of the Cobbler and Early Ohio. In the past few years the mid-season market has been almost entirely dominated by the Cobbler. The exception is the tail end of the season when the Osseo and Sandland districts of Minnesota ship Early Ohios. At the end of the mid-season market, several varieties which are grown in cooler regions and which are capable of being stored reach the market. Mid-season potatoes are grown in a comparatively warm climate and consequently are perishable to a greater degree than late potatoes. With a few exceptions, storage is not practiced, so that the crop must be moved and consumed within a short period of time.

**III. PRODUCTION AREAS SUPPLYING THE MID-SEASON POTATO MARKET**

The districts supplying the mid-season potato market are located in four distinct regions: The Atlantic coast, the Middle West, the Rocky Mountains, and the Pacific coast. Between the Middle West and the Atlantic coast only one commercial district is important and it is small.

The principal districts, together with carload shipments during July and August, 1926, are listed in Table I. These are recapitulated in figure 1. Virginia leads with 12,160 carloads, Kansas is second with 4,030 carloads, and New Jersey is third with 3,461 carloads. It is, therefore, these districts that are of particular importance as a source of supply for the mid-season market. The shipping districts are listed under the names commonly employed by the trade. The shipments originate from several points, as will be shown below.

From Tables I and II and figures 1 and 2 it is evident that the mid-season potato market, particularly the territory east of the Rocky Mountains, is supplied primarily with potatoes from the Atlantic coast and the Middle West. These states, classed as the second early states by the Bureau of Agricultural Economics, are those which are of most importance.

TABLE I.—PRODUCTION AREAS SUPPLYING THE MID-SEASON POTATO MARKET. (a)

State.	District.	Carloads shipped during July and August, 1926.
Virginia.....	Eastern Shore.....	9,193
	Norfolk.....	2,967
Kansas.....	Kaw Valley.....	4,080
New Jersey.....	Freehold.....	3,461
Maryland.....	East Shore.....	1,898
New York.....	Long Island.....	1,795
Missouri.....	Orrick.....	1,588
North Carolina.....	Elizabeth City.....	1,481
Colorado.....	Grand Junction and Fruita.....	1,428
Idaho.....	Caldwell.....	1,066
California.....	Stockton.....	1,018
	Shafter.....	554
Minnesota.....	Osseo.....	1,008
Washington.....	Walla Walla.....	784
Utah.....	Weber-Davis.....	677
Oklahoma.....	Fort Gibson.....	350
Kentucky.....	St. Matthews.....	333
Nebraska.....	Kearney.....	196

(a) Data from a mimeographed report of the Market News Service, Bureau of Agricultural Economics, Division of Fruits and Vegetables, Kansas City, Mo., prepared by R. H. Lamb. Marketing Kaw Valley and Orrick District Potatoes, 1927, p. 8.

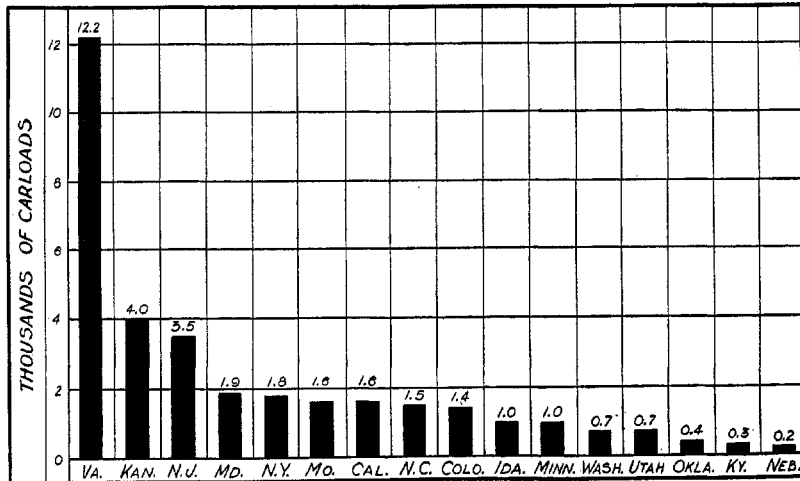


Fig. 1.—July-August potato shipments from principal mid-season states, 1926.

THE MID-SEASON POTATO MARKET

TABLE II.—COMPARATIVE DATA ON POTATO SHIPMENTS FROM PRINCIPAL MID-SEASON DISTRICTS, 1923-1927. (a)

STATE AND YEAR.	First car shipped.	Shipments reached volume of 25 or more cars per day.	Seven-day period of peak movement.	Carloads shipped during peak seven-day period.	Shipments dropped to less than 25 cars per day.
<b>OKLAHOMA:</b>					
1923	June 11	June 21	June 24-30	556	July 7
1924	June 7	June 17	June 22-28	658	July 4
1925	May 26	June 2	June 7-13	813	July 27
1926	June 2	June 8	June 20-26	802	July 8
1927	May 29	June 6	June 12-18	660	July 1
<b>NORTH CAROLINA:</b>					
1923	May 25	June 5	June 10-16	1,302	July 4
1924	April 1	June 3	June 22-28	1,457	July 21
1925	May 19	May 26	May 31-June 6	1,276	June 28
1926	May 27	June 2	June 20-26	2,052	July 22
1927	May 13	May 25	June 5-11	2,219	July 9
<b>VIRGINIA, NORFOLK SECTION:</b>					
1923	June 2	June 12	June 24-30	825	July 22
1924	June 2	June 18	July 6-12	1,071	Aug. 4
1925	June 1	June 5	June 21-27	759	July 20
1926	June 2	June 17	July 4-10	1,142	Aug. 1
1927	June 2	June 9	June 19-25	1,106	July 24
<b>VIRGINIA, EASTERN SHORE:</b>					
1923	June 5	June 14	July 1-7	2,295	Aug. 1
1924	June 6	June 18	July 6-12	3,539	Aug. 2
1925	June 1	June 5	July 5-11	2,561	Aug. 3
1926	June 10	June 16	June 27-July 3	3,029	Aug. 5
1927	June 1	June 9	July 3-9	3,328	Aug. 19
<b>KANSAS:</b>					
1923	July 3	July 7	July 29-Aug. 4	815	Aug. 19
1924	June 26	July 1	July 6-12	931	Sept. 14
1925	June 3	June 30	July 5-11	713	Aug. 10
1926	June 29	July 6	July 25-31	750	Aug. 27
1927	June 17	July 5	July 10-16	605	Sept. 16
<b>MARYLAND, EASTERN SHORE:</b>					
1923	June 22	July 6	July 22-28	635	Aug. 6
1924	June 26	July 8	July 13-19	618	Aug. 15
1925	June 15	July 8	July 12-18	478	July 30
1926	June 29	July 8	July 18-24	521	Aug. 6
1927	June 22	June 29	July 24-30	717	Aug. 15
<b>MISSOURI, ORRICK DISTRICT:</b>					
1923	July 6	July 18	July 15-21	151	Aug. 3
1924	June 30	July 7	Aug. 17-23	207	Aug. 23
1925	June 30	July 6	July 5-11	254	July 29
1926	June 16	July 13	Aug. 8-14	354	Aug. 22
1927	June 25	July 19	July 31-Aug. 6	365	Aug. 21
<b>NEW JERSEY:</b>					
1923	July 9	Aug. 1	Aug. 12-18	1,193	Oct. 3
1924	July 15	Aug. 2	Aug. 17-23	1,712	Oct. 13
1925	July 18	July 28	Aug. 9-15	913	Sept. 3
1926	July 21	July 31	Aug. 8-14	1,083	Sept. 22
1927	July 12	July 26	Aug. 7-13	1,400	Sept. 19
<b>KENTUCKY:</b>					
1923	June 12	July 11	July 29-Aug. 4	201	Aug. 17
1924	July 3	July 10	Aug. 10-16	244	Sept. 7
1925	July 2	July 11	July 12-18	190	July 19
1926	July 6	Aug. 6	Aug. 8-14	124	Aug. 14
1927	July 7	July 26	Aug. 14-20	210	Aug. 24
<b>NEBRASKA, ALL DISTRICTS:</b>					
1923	July 12	Sept. 22	Jan. 20-26	315	Mar. 13
1924	July 17	Sept. 24	Jan. 4-10	193	Feb. 11
1925	July 7	Sept. 17	Nov. 1-7	254	Nov. 16
1926	July 27	Sept. 10	Oct. 24-30	218	Nov. 18
1927	Aug. 8	Aug. 15	Jan. 22-28	319	Mar. 18

(a) Adapted from a mimeographed report prepared by R. H. Lamb entitled, Marketing Kaw Valley and Orrick District Potatoes, 1927, issued by the Market News Service of the Bureau of Agricultural Economics. July 1, 1928, pp. 4-5.

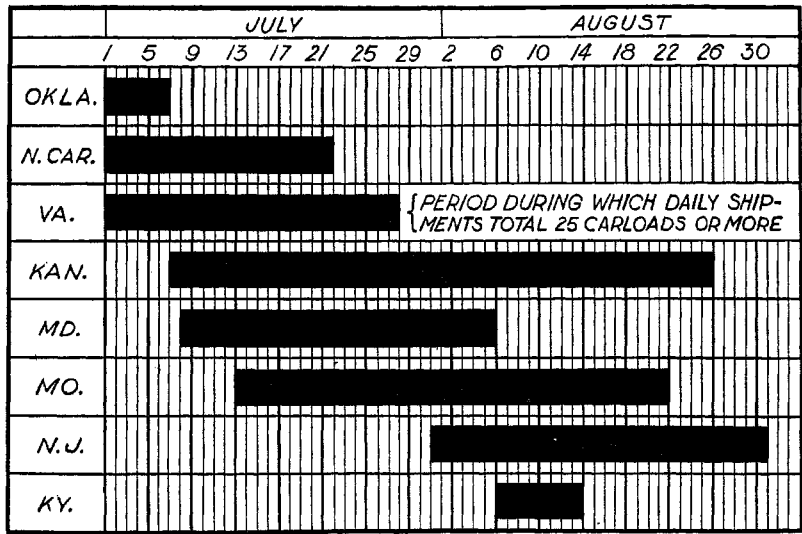


FIG. 2.—Marketing period in principal mid-season potato districts, 1926.

TABLE III.—ACREAGE IN THE PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET, 1921-1928. (a)

STATE.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	(b) 1928.
Virginia.....	93,600	94,200	92,300	100,520	90,050	89,000	78,700	85,480
New Jersey....	38,090	39,140	41,100	52,000	44,000	40,000	44,800	47,000
Kansas.....	15,780	15,600	15,700	17,100	16,500	15,800	17,300	18,160
Oklahoma.....	6,260	6,560	5,580	9,900	14,500	14,400	14,940	17,030
Maryland.....	12,090	13,520	15,300	15,980	13,150	14,800	15,400	17,240
Missouri.....	2,600	3,500	4,100	4,500	4,800	5,000	5,180	5,830
Kentucky.....	5,120	5,800	5,700	5,680	5,620	5,620	5,340	5,340
Arkansas.....	2,040	2,540	2,240	2,500	3,400	4,180	3,890	6,030
Nebraska.....	3,500	8,000	5,250	2,000	1,500	1,200	1,700	1,900
Totals.....	179,080	188,860	187,270	210,180	193,520	190,000	187,250	204,010

(a) Data from the Market News Service, Bureau of Agricultural Economics. By courtesy of B. C. Boree.  
(b) Preliminary for 1928.

Table III presents a summary of the acreage in the second-early districts and Virginia from 1921 to 1928, inclusive. There was a variation of from 179,080 acres in 1921 to 210,180 acres in 1924. Table IV is an estimate of production in the districts listed in Table III. It is apparent that there is considerable variation in production in the various districts. In the year 1924 the total production

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was 30,640,000 bushels, while in 1923 production amounted to only 16,766,000 bushels. The relation between acreage and production will be developed below.

Table V is a calculation of the average price per hundred pounds for Kansas potatoes on the Chicago market for the years 1921 to 1927, inclusive. The average was calculated from the daily reports of the Market News Service of the Bureau of Agricultural Economics at Kansas City, Mo. The data used for the calculation of the averages are shown in Tables XXXVII, XXXVIII, XXXIX, and XL, Appendix. In the earlier years the data are not so satisfactory as in the later years because market news reports were not issued on Saturday. Again, Kansas potatoes were not quoted throughout the season, and on some days during the season they were not quoted at all. However, it was thought best to use the quotations where they are available on one grade of potatoes from one district, rather than to use quotations for several grades of potatoes from several districts. The error that is likely to occur is less when one particular grade from a particular district is used.<sup>26</sup>

TABLE IV.—PRODUCTION IN THE PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET, 1921-1928, IN BUSHELS ('000 OMITTED). (a)

STATE.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	(b) 1928.
Virginia.....	11,606	10,362	9,230	15,983	9,185	9,345	14,087	11,711
New Jersey.....	4,723	6,067	2,466	7,800	4,664	5,600	6,362	6,298
Kansas.....	1,515	1,420	1,648	2,873	1,700	2,481	2,508	2,034
Oklahoma.....	257	630	474	792	1,450	1,411	1,539	1,277
Maryland.....	1,499	1,866	1,469	1,518	1,131	1,421	2,156	1,983
Missouri.....	213	287	390	495	480	1,000	648	700
Kentucky.....	353	638	598	841	601	584	662	534
Arkansas.....	112	295	134	188	289	280	276	446
Nebraska.....	329	864	357	150	172	132	255	276
Totals.....	20,607	22,429	16,766	30,640	19,627	22,254	28,463	25,259

(a) Data from the Market News Service, Bureau of Agricultural Economics. By courtesy of B. C. Boree.

(b) Preliminary for 1928.

26. Statistical calculations supported this belief. A closer agreement was found between carload shipments from the principal districts supplying the mid-season potato market and the average of top prices at Chicago on one grade of potatoes than between shipments and average prices on all grades of potatoes as reported by the United States Department of Agriculture Yearbook for 1927. The correlation coefficient in the first case was  $-.779$ , while the latter was  $-.714$ . Similarly, there was a closer agreement between the average of top prices and total United States production than between average prices for all grades of potatoes and total United States production. The correlation coefficient in the first instance was  $-.809$ , while in the second it was  $-.662$ . See Tables XXX, XXXIII, XXXIV and XXXV, Appendix.

TABLE V.—AVERAGE PRICE PER HUNDRED POUNDS FOR KANSAS POTATOES AT CHICAGO, 1921-1927. (a)

Year.	AVERAGE PRICE PER CWT.	Average price reduced to 1910-1914 level. (b)
1921.....	\$2.18	\$1.51
1922.....	1.77	1.12
1923.....	2.25	1.47
1924.....	1.61	1.06
1925.....	2.95	1.90
1926.....	2.15	1.41
1927.....	1.97	1.33

(a) Calculated from the top daily price for Kansas potatoes on the Chicago market during the mid-season marketing period. Data taken from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo., Tables XXXVII, XXXVIII, XXXIX, and XL, Appendix.

(b) Prices reduced to a 1910-1914 level by dividing the average price per hundred pounds by the index of wholesale prices of all commodities for July and August as given by Warren and Pearson. Op. cit., p. 66, and subsequent publications entitled Farm Economics issued by Cornell University. See Table VI.

The average prices for each season were revised by dividing the actual price by the index number of wholesale prices on a 1910-1914 basis by using the figures given by Warren and Pearson in their book, *The Agricultural Situation*<sup>27</sup> and the subsequent publications issued by Cornell University entitled *Farm Economics*.<sup>28</sup> The index numbers are given in Table VI.

TABLE VI.—INDEX NUMBERS OF WHOLESALE PRICES, 1921-1927. (a)

Year.	July.	August.	July-August average.
1921.....	144	145	144.5
1922.....	158	158	158.0
1923.....	154	153	153.5
1924.....	150	153	151.5
1925.....	163	164	163.5
1926.....	154	152	153.0
1927.....	147	149	148.0

(a) Data from Farm Economics, Cornell University, April, 1928, p. 1, and Warren and Pearson, *Agricultural Situation*. Op. cit., p. 66.

Prices are expressed on a 1910-1914 basis since it is thought that they would more nearly express the price situation with reference to the effect of supply on price than if the actual price figures were used. It was shown above that the general price level had an effect on the price for a commodity. Therefore, to eliminate this factor is desirable when trying to measure the effect of the factor of supply.

Table VII gives a summary of the carload shipments from the various districts supplying the mid-season market. The shipments from the principal districts that are classed as second-early dis-

27. Warren, G. F., and Pearson, F. A.: Op. cit., p. 66.

28. Farm Economics: Cornell University, April, 1928, p. 1.

TABLE VII.—CARLOAD SHIPMENTS OF POTATOES FROM DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET, 1921-1927. (a)

STATE.	1921.		1922.		1923.		1924.		1925.		1926.		1927.	
	Shipments up to Sept. 1.	Total for season.	Shipments up to Sept. 1.	Total for season.	Shipments up to Sept. 1.	Total for season.	Shipments up to Sept. 1.	Total for season.	Shipments up to Sept. 1.	Total for season.	Shipments up to Sept. 1.	Total for season.	Shipments up to Sept. 1.	Total for season.
Virginia, first crop...	16,732	16,791	18,069	18,101	15,111	15,126	22,501	22,952	15,666	15,674	15,895	15,951	23,081	23,136
New Jersey.....	7,856	(b) 7,856	10,628	(b) 10,628	3,955	(b) 3,955	4,255	(b) 4,255	3,032	(b) 3,032	3,562	(b) 3,562	5,081	(b) 5,081
Kansas.....	2,191	2,349	2,287	2,433	3,545	3,565	4,400	4,797	2,730	2,735	4,035	4,062	3,551	4,341
Oklahoma.....	267	267	997	1,000	1,029	1,035	1,177	1,262	2,326	2,335	2,109	2,184	2,092	2,129
Maryland, first crop,	1,812	1,830	2,739	2,762	2,242	2,255	2,360	2,438	1,459	1,463	1,926	1,937	3,193	3,210
Missouri.....	285	325	349	387	774	810	933	1,194	916	919	1,607	1,616	1,260	1,294
Kentucky.....	474	643	393	496	1,111	1,241	1,255	1,593	711	735	333	430	822	879
Arkansas.....	98	138	323	341	221	231	432	449	534	537	516	526	482	484
Nebraska.....	782	(b) 762	621	(b) 621	293	(b) 293	181	(b) 181	324	(b) 324	197	(b) 197	577	(b) 577
Totals.....	30,477	30,961	36,406	36,769	28,281	28,511	37,494	39,121	27,698	27,754	30,180	30,445	40,139	41,131
New York, Lg. Island	(c).....	(c).....	902	(b) 902	1,935	(b) 1,935	494	(b) 494	2,267	(b) 2,267	1,795	(b) 1,795	1,585	(b) 1,585
Delaware.....	41	(b) 41	73	(b) 73	57	(b) 57	53	(b) 53	19	(b) 19	33	(b) 33	68	(b) 68
Colorado.....	1,098	(b) 1,098	862	(b) 862	1,304	(b) 1,304	805	(b) 805	1,262	(b) 1,262	1,448	(b) 1,448	851	(b) 851
Minnesota.....	1,049	(b) 1,049	1,940	(b) 1,940	1,770	(b) 1,770	600	(b) 600	3,130	(b) 3,130	1,008	(b) 1,008	1,285	(b) 1,285
Idaho.....	2,105	(b) 2,105	1,450	(b) 1,450	1,839	(b) 1,839	795	(b) 795	1,046	(b) 1,046	1,066	(b) 1,066	879	(b) 879
North Carolina.....	3,044	3,089	4,163	4,194	3,441	3,478	6,425	6,568	4,037	4,040	6,659	6,713	7,462	7,537
Utah.....	665	(b) 665	742	(b) 742	577	(b) 577	322	(b) 322	714	(b) 714	716	(b) 716	292	(b) 292
Washington.....	290	(b) 290	368	(b) 368	273	(b) 273	463	(b) 463	697	(b) 697	764	(b) 764	606	(b) 606
Grand totals.....	38,769	39,298	46,906	47,300	39,477	39,744	47,451	49,221	40,870	40,929	43,669	43,988	53,167	54,234

(a) Data from the Market News Service, Bureau of Agricultural Economics. By courtesy of B. C. Boree.  
 (b) Shipments up to September 1 listed as total for season. This state ships late crop as well as early, shipments not separated. Figures for 1927 subject to revision.  
 (c) Unavailable.

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tricts are shown separately in the upper portion of the table. The lower portion of the table shows the shipments from the districts that contribute to some extent to the total shipped during the mid-season market. A few others might be included, such as South Carolina, Texas, Louisiana, and California, for in some seasons a part of their movement may extend into July. However, the main part of their movement is over in most seasons prior to the mid-season market, and in the case of California shipments are confined to territory that usually does not come into competition with other districts.

#### IV. THE INFLUENCE OF TOTAL SUPPLIES

Total supplies as an influence affecting the price of potatoes during the mid-season potato market can be clearly demonstrated both graphically and statistically. Before developing this phase, it might be well, however, to consider the factors influencing total supplies. It is generally recognized that three factors contribute to the total supply. The first is acreage, the second climatic conditions during the production period, and the third the cultural practices employed by the growers. Those who have kept in touch with methods of potato production in the past several years cannot fail to realize the progress that has been made in potato culture through the control of plant diseases, the selection of seed, the use of adapted varieties, soil improvement, crop rotation, fertilization, and insect control. These practices have stabilized the potato industry and eliminated many of the hazards of potato production by raising the average yield per acre. Corbett<sup>29</sup> shows this to be true by the records of the average yield of potatoes per acre by periods. During the period 1900 to 1909 the average yield of potatoes in the United States was 91.98 bushels per acre, from 1910 to 1919 it was 95.37 bushels per acre, while from 1920 to 1925 it was 107.87 bushels per acre. The author has had opportunity to visit some of the principal potato-producing districts in Oklahoma, Kansas, Missouri, Colorado, Minnesota, Iowa, and Wisconsin. It was apparent in every district that scientific principles and practices were being employed.

The relation between total acreage and the production of potatoes in the principal districts supplying the mid-season market is shown in figure 3. In five years, 1921, 1922, 1923, 1924 and 1925, an increase or decrease in acreage was accompanied by an increase

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29. Corbett, L. C., *et al.*: Fruit and Vegetable Production in the Yearbook of the United States Department of Agriculture, 1925. Table 5, p. 346.

or decrease in production. In three years, 1926, 1927 and 1928, an increase or decrease in acreage was not accompanied by an increase or decrease in production.

From Tables III and IV a correlation coefficient was calculated as shown in Table XXII, Appendix. This was found to be +.645, which is a higher degree of correlation than one might assume to be the case from inspection of the data.<sup>30</sup>

However, in view of the fact that there were three years when the curves of acreage and production do not move in the same direction and that the number of observations is small, it is thought

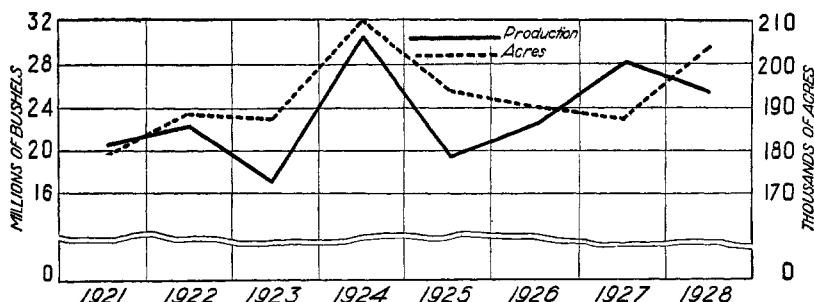


FIG. 3.—Acreage and production in principal mid-season potato districts, 1921-1928.

that an estimating equation based on the correlation coefficient would be of little value. Consequently an estimating equation was not developed. Furthermore, estimates of production by the United State Department of Agriculture are available sufficiently early each year to be of more value in gauging price movements than an estimate of production based on a correlation coefficient.

The relation between production and shipment is shown in figure 4. Shipments, as one would expect, vary directly with production. In every case the curves move in the same direction. The correla-

30. For those who are not familiar with statistical methods, it is of interest to note that a correlation coefficient is used to express the relation between two variables. It is a refinement of the method of comparing two curves on a graph. The curves tell the story in a general way, while the correlation coefficient sums up the agreements and disagreements in one figure. It is an attempt to measure what the eye does not easily see when one compares two curves of a graph. A perfect correlation coefficient would be +1 or -1. No correlation whatever would be 0. When the correlation coefficient is -, there is an inverse variation between the variables. When the coefficient is +, there is a direct variation between the two variables. Usually a second figure is shown with the correlation coefficient. This is the probable error. A correlation coefficient is usually considered significant if it is four times the probable error, and may be considered indicative if it is twice the probable error. Where the number of observations are too small to warrant calculating a probable error, the correlation coefficient does not carry the same weight. However, it may be used with caution as an indicator. When it is apparent that two curves express a relationship either inversely or directly, the correlation coefficient becomes of more value. When a correlation coefficient is significant, it may be used in an estimating equation. When used in this manner it is assumed that the relationships that held in the past will hold in the future.

tion coefficient, as shown in Table XXIII, Appendix, is +.888. This is quite near a perfect correlation. One of the reasons, no doubt, that the relation between the curves is not exact is that in some seasons movement by truck is more important than in other seasons. A poor potato crop in the immediate vicinity of a commercial district stimulates trucking from that district and cuts down the carload movement. This is particularly true if the district is adjacent to densely populated territory. An instance of this situation came to the author's attention in the fall of 1926. The Hollandale district of Minnesota moved a large portion of its crop by truck into Iowa, where the home garden potato crop was short. In fact, the manager of the Potato Growers Association was unable to fill carload orders because of the demand from truckers.

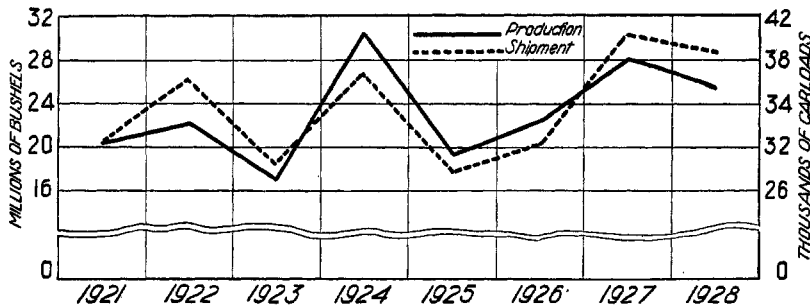


Fig. 4.—Production and shipment in principal mid-season potato districts, 1921-1928.

Since the correlation coefficient for production and shipments is high, and the direction of the curves are in agreement in each case, an estimating equation will be of some value. The development of the estimating equation is to be found in connection with Table XXV, Appendix. The equation follows:

Probable shipments in carloads =  $1.008(E) + 9789$ , where E is the estimate of production in the principal districts supplying the mid-season potato market.

An idea of the limitations of the equation will be gained from Table VIII and figure 5. The estimate for each year is compared with the actual shipments.

The estimates of shipments in Table VIII are based on estimated production in the mid-season districts. Consequently they are subject to errors in crop estimates. Those made a month or two before harvest are quite frequently in error because weather con-

ditions during the latter part of the growing season have a tremendous influence on the potato crop. This was illustrated in 1927. Private estimates two weeks before harvest placed the Virginia crop at 10,000 carloads. Actual shipments totaled more than

TABLE VIII.—ESTIMATES OF SHIPMENTS FROM PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET COMPARED WITH ACTUAL SHIPMENTS, 1921-1928. (a)

Year.	Estimate of shipments, carloads.	Actual shipments, carloads.	Error, carloads.	Error, per cent.
1921.....	30,561	30,477	84	0.27
1922.....	32,397	36,406	4,009	11.01
1923.....	26,689	28,281	1,592	5.63
1924.....	40,674	37,494	3,180	8.48
1925.....	29,573	27,698	1,875	6.77
1926.....	32,221	30,180	2,041	6.76
1927.....	38,510	40,139	1,629	4.06
1928.....	(b) 35,250			
Average.....			2,059	6.14

(a) Estimates based on a correlation coefficient of +.888.

(b) Based on an estimate of 25,250,000 bushels issued by the Bureau of Agricultural Economics, June, 1928.

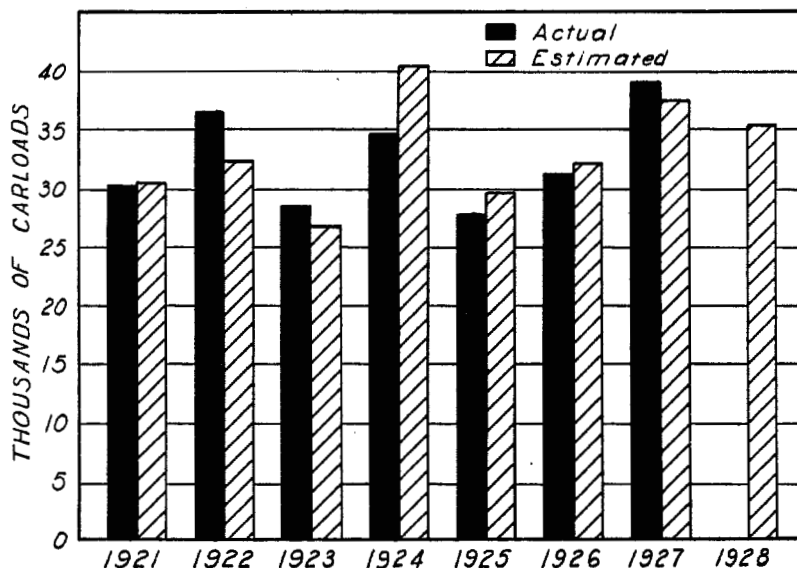


FIG. 5.—Actual and estimated shipments from principal mid-season potato districts, 1921 to 1928. (Estimates obtained by use of equation No. 1.)

23,000 carloads. Likewise Kansas shipments were estimated at 3,300 carloads two weeks prior to harvest, while shipments were more than 4,300 carloads. The limitations of the estimates of production of a crop such as potatoes must be fully realized by those who use them as a basis for judgment in marketing.

A possible correction for the estimate of carload shipments was sought by using the estimate of total United States production. Estimates of production for particular districts are usually not so accurate as estimates of total production because the facilities for gathering data are not so well developed. It was thought, therefore, that a partial correlation between total United States production, in the mid-season districts, and carload shipments would develop an estimate based solely on production in the mid-season districts. An estimating equation was developed as shown in connection with Tables XXIII, XXIV, XXV, XXVI, XXVII and XXVIII, Appendix. The equation follows:

Probable shipments in carloads = .842 (E) + 44.4 (T) - 3757, where  
 E is the estimate of production in the principal districts supplying the mid-season potato market and T is the estimate of total United States production in millions of bushels.

It is apparent from Table IX and figure 6 that the estimates of shipments are in closer agreement with actual shipment when the factor of total United States production is taken into consideration.

TABLE IX.—ESTIMATES OF SHIPMENTS FROM PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET COMPARED WITH ACTUAL SHIPMENTS, 1921-1928. (a)

Year.	Estimate of shipments, carloads.	Actual shipments, carloads.	Error, carloads.	Error, per cent.
1921.....	29,667	30,477	810	2.66
1922.....	35,241	36,406	1,165	3.20
1923.....	28,830	28,281	549	1.94
1924.....	40,734	37,494	3,240	8.90
1925.....	27,110	27,698	588	2.12
1926.....	30,699	30,180	519	1.72
1927.....	38,305	40,139	1,834	4.57
1928.....	(b) 38,246	.....	.....	.....
Average.....	.....	.....	1,238	3.59

(a) Estimates derived from estimating equation:  $X_1 = .842X_2 + 44.4X_3 - 3757$ . See Tables XXIII, XXIV, XXV, XXVII, and XXVIII, Appendix.

(b) Based on an estimate of 25,259,000 bushels in mid-season districts, Table VII, and on the September 1, 1928, crop estimate by the Bureau of Agricultural Economics of a total United States production of 467,000,000 bushels.

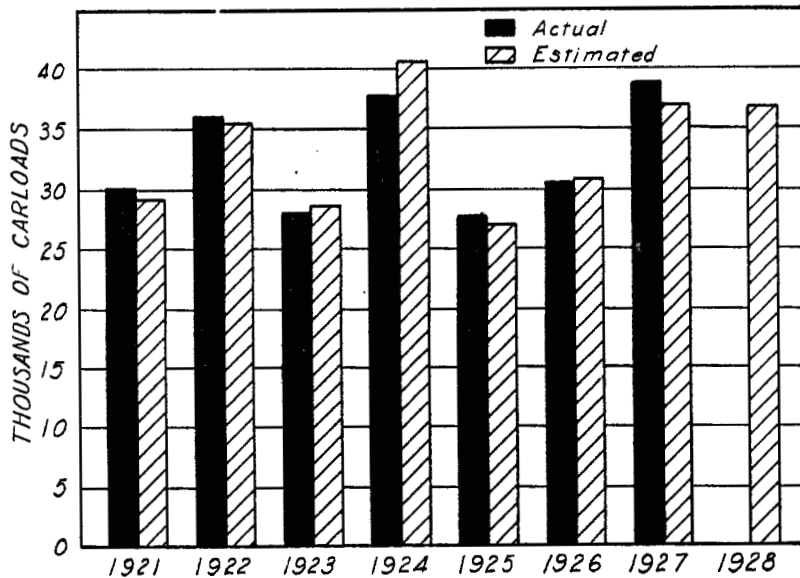


FIG. 6.—Actual and estimated shipments from principal mid-season potato districts, 1921-1928. (Estimates obtained by use of equation No. 2.)

The estimates of shipments in Table IX are more nearly in accord with the actual shipments than the estimates in Table VIII. The two are given, however, because prior to July 10 the estimate of total production is not available, and until it is available the estimates of production in the mid-season districts must suffice as a basis for judgment.

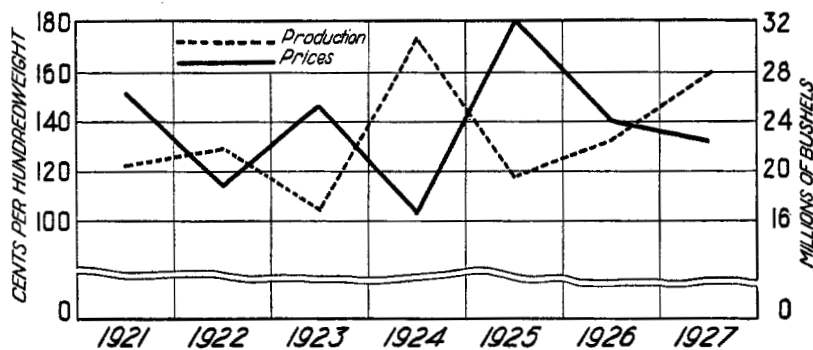


FIG. 7.—Potato production and prices during the mid-season market, 1921-1927.

**Production in the Mid-season Districts and Prices.**—The influence on prices of production in the principal districts supplying the mid-season potato market is illustrated in figure 7. In each

case a movement of the curve of production is accompanied by an opposite movement of the curve of prices. When measured statistically the correlation coefficient becomes  $-.665$  (Table XXIX, Appendix). However, since a higher degree of agreement was found between carload shipments and prices, an estimating equation on the basis of the correlation coefficient between production and prices was not developed.

**Shipments from the Mid-season Districts and Prices.**—Carload shipments from the principal mid-season districts and prices are quite closely related as is shown in figure 8. When measured statistically, a correlation coefficient of  $-.779$  is obtained. (Table XXX, Appendix.) There is, however, not so marked a relation between carload shipments from all the mid-season districts and prices as between shipments from the principal districts and prices. The correlation coefficient of the former is  $-.603$  (Table XXXI, Appendix).

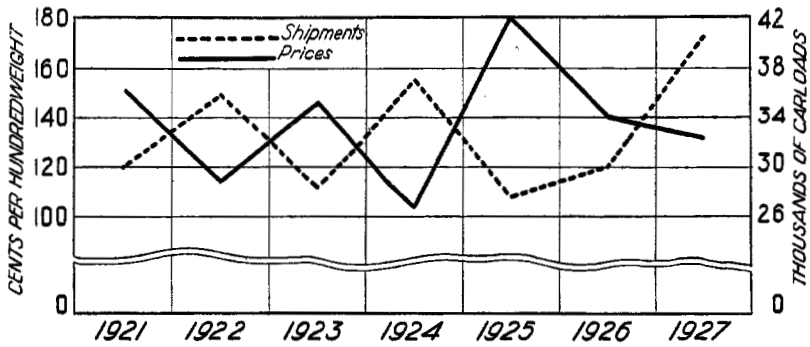


FIG. 8.—Potato shipments and prices during the mid-season market, 1921-1927.

With the correlation coefficient  $-.779$ , an estimating equation may be developed. (See discussion in connection with Tables XXV, XXX, XXXII, Appendix, for the development of the regression equation.) It becomes:

Probable season's average price =  $[-.0000383 (C) + 2.651 (I)]$ , where  
 C is the estimate of carload shipments from the principal districts supplying the mid-season potato market, and I is Warren and Pearson's index number of wholesale prices.

The estimates of the season's average price compared with the actual price are shown in Table X and figure 9. These are calculated both on a 1910-1914 basis and a yearly basis.

THE MID-SEASON POTATO MARKET

TABLE X.—ESTIMATES OF SEASON'S AVERAGE PRICE FOR MID-SEASON POTATOES AT CHICAGO, 1921-1928. (a)

Year.	1910-1914 basis.				Yearly basis. (b)			
	Estimate, dollars per cwt.	Actual, dollars per cwt.	Error, dollars per cwt.	Error, per cent.	Estimate, dollars per cwt.	Actual, dollars per cwt.	Error, dollars per cwt.	Error, per cent.
1921.....	1.48	1.51	0.03	2.00	2.14	2.18	0.04	1.83
1922.....	1.26	1.12	0.14	12.50	1.99	1.77	0.22	12.43
1923.....	1.57	1.47	0.10	6.80	2.40	2.25	0.15	6.66
1924.....	1.21	1.06	0.15	14.15	1.83	1.61	0.22	13.67
1925.....	1.59	1.80	0.21	11.66	2.60	2.95	0.35	11.86
1926.....	1.49	1.41	0.08	5.37	2.28	2.15	0.13	6.05
1927.....	1.11	1.33	0.22	16.54	1.64	1.97	0.33	16.70
1928.....	1.19				1.80			
Average.....			0.13	9.90			0.21	9.90

(a) Estimates derived from the estimating equation  $Y = -.0000388X + 2.65$ . See Tables XXV, XXX, and XXXII, Appendix.  
 (b) Derived by multiplying the 1910-1914 figures by the yearly index of wholesale prices for July and August in Table VI.

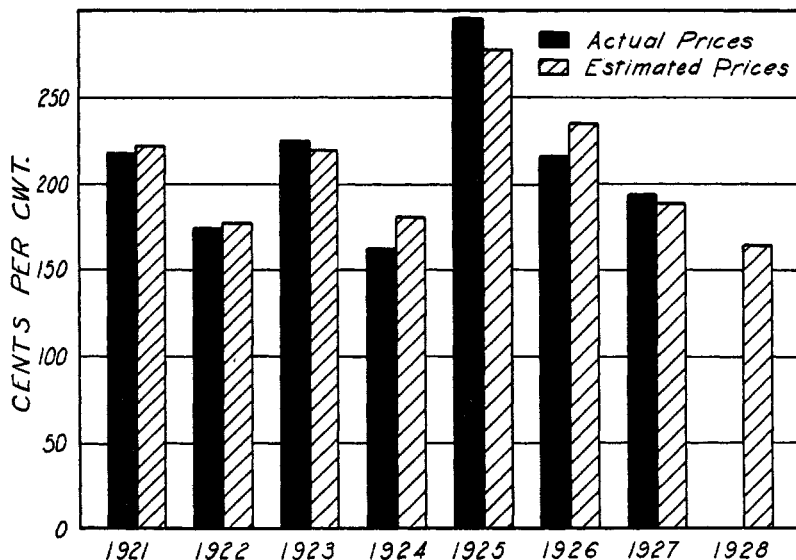


FIG. 9.—Actual and estimated prices for mid-season potatoes, 1921-1928. (Estimates obtained by use of equation No. 3.)



The estimates in Table X are based on carload shipments from the principal mid-season districts. When a calculation is to be made, as for the year 1928, the estimate for carload shipments as calculated in Table IX is used when the estimate of total United States production is available. When the total United States estimate is not available the estimate for carload shipments as calculated in Table VIII is used.

From Table X it is apparent that the price-estimating equation is limited in its application. An average error of nearly 10 per cent, although not large, is too high to be of great practical value, particularly when in four of the seven years the error was 12 per cent or more. Consequently a compensating factor was sought.

Again, as in the case of the estimates of carload shipments from the mid-season districts, total United States production was found to be an important factor influencing the estimate of mid-season potato prices. As a matter of fact, it developed that there is a slightly higher degree of correlation between total United States production and mid-season potato prices than between carload shipments and mid-season prices. (Tables XXX and XXXIII, Appendix.) Attention has already been called to the fact that a higher degree of correlation was obtained between the average of top prices at Chicago for one grade of potatoes and shipments than for the average price for all grades. Likewise a higher degree of correlation was obtained between total United States production and an average of top prices for one grade than between total United States production and average prices for all grades of potatoes. (Compare Tables XXXIII and XXXIV, Appendix.)

The estimating equation which involves the factors of carload shipments and total United States production follows. (See discussion in connection with Table XXXIII, Appendix, for development of the multiple regression equation,)

Probable season's average price =  $[-.0000211 (C) + -.00284 (T) + 3.1961 (I)]$ , where C is the estimate of carload shipments from the principal districts supplying the mid-season potato market, and T is the estimate of total United States production in millions of bushels, and I is Warren and Fearson's index number of wholesale prices.

The degree to which the estimates made by using the equation approximate actual prices is shown in Table XI and figure 10. These estimates are of considerably greater value than those in Table IX. The average error of 12 cents per hundredweight, or

5.69 per cent, is quite small, particularly for a commodity such as potatoes. The estimates are in line with other price estimates for potatoes. Those of Waugh for New Jersey Cobblers show an average error of 9.8 per cent, or 14 cents per hundredweight, with an extreme error of 41 per cent.<sup>31</sup> Working's estimates of prices for Minnesota potatoes show an average error of 8 per cent, or 11 cents per hundredweight, with an extreme error of 16 per cent.<sup>32</sup> The estimate should, however, only be used as a basis for judgment. Current information is usually available which will indicate whether the estimate is likely to be too high or too low. The estimate of prices is likely to be too high when shipments from those districts known as the early districts, such as Florida, Georgia, Louisiana, and Texas, do not move so early as usual and their carload movement seriously overlaps the first shipments from the mid-season districts. On the contrary, the estimate is likely to be too low when shipments from the early districts move to market earlier than usual. Furthermore, as will be shown later in the discussion of the movement of the crop to market, there are temporary market gluts and famines which may depress or enhance prices to such a degree that the estimated price may not be realized. Again, the general feeling of the trade toward the market situation has a bearing on prices. These are factors which cannot be assembled and placed in a mathematical formula. It is surprising, in view of the many factors influencing prices, that an estimating equation should enable one to approximate the actual price. At best, however, the price estimate should be used only as a basis for judgment in attempting to gauge a market situation. Finally it must be remembered that the price estimates, based on production estimates, will be subject to all the errors in these crop estimates.

Summary of equations mentioned:

EQUATION No. 1.—Probable shipments in carloads from the mid-season potato districts =  $1.008(E) + 9789$ .

Where (E) is the estimate of production in Virginia, New Jersey, Kansas, Oklahoma, Maryland, Missouri, Kentucky, Arkansas, and Nebraska. (Table IV.)

This equation is used when the July 1 estimates of total United States production are not available.

Example for 1928:  $1.008 \times 25259 + 9789 = 35250$

31. Waugh, Frederick V.: *Forecasting Prices of New Jersey White Potatoes and Sweet Potatoes*. Op. cit., p. 6.

32. Working, Holbrook: *Factors Affecting the Price of Minnesota Potatoes*. Op. cit., p. 21.

TABLE XI.—ESTIMATES OF SEASON'S AVERAGE PRICE FOR MID-SEASON POTATOES AT CHICAGO, 1921-1928. (a)

Year.	1910-1914 basis.				Yearly basis. (b)			
	Estimate, dollars per cwt.	Actual, dollars per cwt.	Error, dollars per cwt.	Error, per cent.	Estimate, dollars per cwt.	Actual, dollars per cwt.	Error, dollars per cwt.	Error, per cent.
1921.....	1.53	1.51	.03	2.00	2.21	2.18	.03	1.38
1922.....	1.14	1.12	.02	1.80	1.80	1.77	.03	1.13
1923.....	1.42	1.47	.05	3.40	2.18	2.25	.07	3.11
1924.....	1.21	1.06	.15	14.15	1.83	1.61	.22	13.67
1925.....	1.70	1.80	.10	5.55	2.78	2.95	.17	5.76
1926.....	1.55	1.41	.14	9.93	2.37	2.15	.22	10.23
1927.....	1.20	1.33	.13	9.77	1.88	1.97	.09	4.57
1928.....	1.06	.....	.....	.....	1.60	.....	.....	.....
Average...	.....	.....	.09	6.66	.....	.....	.12	5.69

(a) Estimates derived from the estimating equation:  $X_1 = -.0000211X_2 + -.00284X_3 + 3.196$ . (See Tables XXV, XXVI, XXVIII, XXX, XXXII, and XXXIII, Appendix.)

(b) Derived by multiplying the 1910-1914 figures by the yearly index of wholesale prices for July and August as reported by Warren and Pearson.

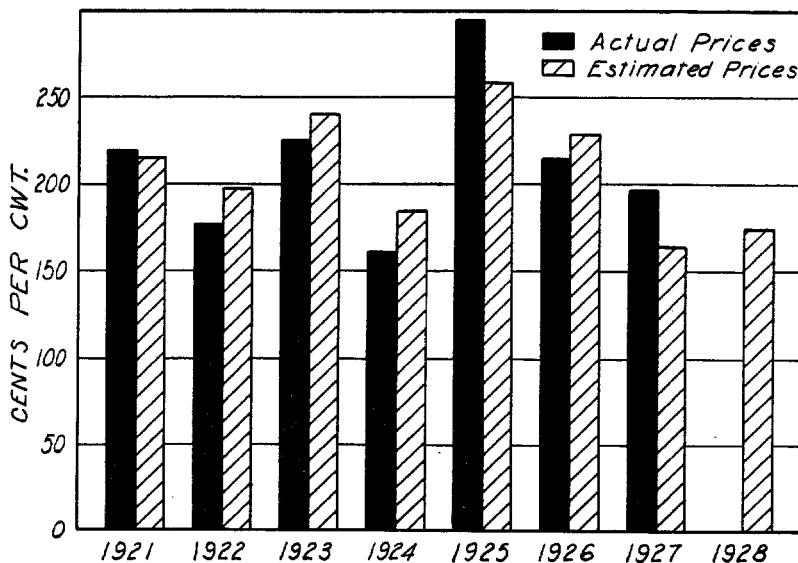


FIG. 10.—Actual and estimated prices for mid-season potatoes, 1921-1928. (Estimates obtained by use of equation No. 4.)

EQUATION No. 2.—Probable shipments in carloads from the mid-season potato districts =  $.842 (E) + 44.4 (T) - 3757$ .

Where (E) is the same as in Equation No. 1.

Where (T) is the estimate of total United States production in millions of bushels. The latest figure available is the one used. That is, when the July 1 estimate is available it is used and when the August 1 estimate is available it is used.

Example for 1928 :  $.842 \times 25259 + 44.4 \times 467 - 3757 = 38246$ .

EQUATION No. 3.—Probable wason's average price per hundredweight at Chicago =  $[-.0000383 (C) + 2.651 (I)]$ .

Where (C) is the estimate of carload shipments from the principal mid-season districts as determined by equation No. 2. In case the July 1 figure for total United States production is not available the estimate determined by equation No. 1 is used as (C).

Where (I) is Warren and Pearson's index number of wholesale prices as shown in Table VI. To have this index number available, one may request the Director of Extension of Cornell University, Ithaca, N. Y., to place his name on the mailing list for *Farm Economics*. The latest figure of Warren and Pearson was used in this study. For instance, when this equation was prepared the latest figure available was 151, for April, 1928.

Example for 1928:  $[-.0000383 \times 38246 + 2.651 \times 151 = \$1.80$ .

EQUATION No. 4.—Probable season's average price per hundredweight at Chicago =  $[-.0000211 (C) + -.00284 (T) + 3.1961 (I)]$ .

Where (C) is the estimate of carload shipments as determined by equation No. 2.

Where (T) is the estimate of total United States production in millions of bushels.

Where (I) is Warren and Pearson's index number of wholesale prices as noted in equation No. 3.

Example for 1928:  $[-.0000211 \times 38246 + -.00284 \times 4671 \times 151 = \$1.60$ .

## V. THE INFLUENCE OF THE POSITION OF SUPPLIES

The position of supplies is usually not of great importance as a factor affecting the mid-season potato market. Railway service from the principal producing sections to the consuming markets is excellent and the rate structure is such that diversions are made easily. During the 1925 season the author made a survey of several markets in Illinois, Indiana, Ohio, and Missouri, and found potatoes from the principal producing sections competing in these market. The report of Strowbridge<sup>34</sup> on the origin and distribution of the commercial potato crop illustrates the wide distribution of the crops from the various producing sections. Nevertheless the position of supplies has at times been important as a market in-

33. Stokdyk, E. A.: The Midwest Potato Markets in 1925. Annual Proceedings of the Potato Association of America. December, 1925, pp. 56-58.

34. Strowbridge, J. W.: Origin and Distribution of the Commercial Potato Crop. Technical Bulletin No. 7, United States Department of Agriculture. July, 1927, pp. 1-24.

fluence. The effect of this factor was illustrated in 1922 and 1923. In the year 1922 the Chicago potato market averaged 53 cents per hundredweight above the New York market during July and August, while in 1923 the Chicago market averaged 36 cents below the New York market. (Table XII.) In 1922 shipments from Virginia, New Jersey, and Maryland up to September 1 totaled 31,436 carloads, while in 1923 shipments from these districts totaled 21,308 carloads. On the contrary, shipments in 1922 from Kansas, Oklahoma, Missouri, Kentucky, Arkansas, and Nebraska up to September 1 total 4,970 carloads, while in 1923 the shipments were 6,973 carloads. (Table VII.)

TABLE XII.—SEASON'S AVERAGE PRICE FOR POTATOES ON THE CHICAGO AND NEW YORK MARKET, 1921-1927. (a)

	1921.	1922.	1923.	1924.	1925.	1926.	1927.
Chicago.....	2.72	1.96	2.47	1.58	2.98	2.29	2.16
New York.....	2.57	1.43	2.83	1.45	3.01	2.34	1.95
Spread between Chicago and New York....	+ .15	+ .53	-.36	+ .13	-.03	-.05	+ .21

(a) Adapted from Table 212, United States Department of Agriculture Yearbook, 1927, p. 894.

From the standpoint of the producer the position of his supplies in relation to the consuming markets has an important bearing on the prices he receives each year. Each district is adjacent to territory to which it has an advantage in freight rates. Although the rates are not on a strictly mileage basis, distance is the principal basis for the rate structure on mid-season potatoes. This is illustrated in Table XIII and is evident from figure 11, which shows the territory to which four of the mid-season producing sections can ship to advantage. However, in 1925 Eastern Shore points, which include Virginia, Maryland and Delaware, moved approximately 23 per cent of their carloads into territory where competitors had the advantage in freight rates, while Kansas and Missouri points moved 5 per cent of their carloads into territory where the freight rate was against them.<sup>38</sup> As shown in Table VII, 1925 was a year of light shipments from the principal mid-season districts, so that there was less necessity than usual to send carloads in search of a market to freight territory which was disadvantageous. Furthermore, in 1925 the price relation between eastern markets and west-

35. Strowbridge, J. W.: Op. cit., table 6, p. 14, and table 16, p. 24.

TABLE XIII.—FREIGHT CHARGES PER HUNDREDWEIGHT IN VARIOUS PRODUCING DISTRICTS TO VARIOUS CONSUMING MARKETS. (a)

DESTINATION.	Origin.											
	Kaw valley, Topeka (Kansas)	Missouri, Orrick.....	Virginia, Onley.....	Kentucky, St. Matthews.....	Maryland, Foomoke.....	Minnesota, Osseo.....	North Carolina, Elizabeth City.....	Oklahoma, Fort Gibson.....	New Jersey, Freehold.....	Colorado, Fruita.....	Arkansas, Fort Smith.....	Nebraska, Kearney.....
Atlanta, Ga.....	99½	99½	68	53½	68	99½	58½	78	.68	1.32	.77½	.95
Baton Rouge, La.....	82	58	83½	78	89	70½	84	.71½	.77	.94	.66	.88
Birmingham, Ala.....	93½	93½	72	47½	72	75	65	.73	.72	1.26	.72½	.89
Boston, Mass.....	98	90½	41½	67	41½	74½	81	.73	1.30½	1.04	1.06	.81½
Buffalo, N. Y.....	73½	66	40½	43½	40½	50	83½	1.04	.32	1.06	.79	.88
Chicago, Ill.....	38	33½	56½	37	56½	26	79	.67	.33½	1.06	.56½	.45½
Cincinnati, Ohio.....	60½	53	49	16	49	44	93	.56½	.56½	.71	.67	.68½
Cleveland, Ohio.....	66½	59	40½	39½	40½	45	88	.49	.49	.93	.70	.74½
Columbus, Ohio.....	63½	56	44	35½	44	45½	88	.72½	.40	.99	.72½	.71½
Denver, Colo.....	53½	62½	1.37½	1.04½	1.38½	82	70	.88	.44	.96	.70	.71½
Des Moines, Iowa.....	30½	26	92½	55	92½	29½	1.50	.76	1.38½	.52	.76	.38
Detroit, Mich.....	65½	58	44	37½	44	44	88	.52	.92½	.62½	.52	.38
Fargo, N. D.....	59½	65	1.06½	83½	1.06½	28	88	.71	.44	.98	.71	.73
Fort Worth, Tex.....	73	81	1.48	97½	1.48	98	1.29	.86½	1.06½	.94½	.86½	.65
Fort Wayne, Ind.....	61	53½	51	34	51	38	1.10	.38½	1.48	.94	.38½	.97
Houston, Tex.....	87	87	1.48	97½	1.48	97	.97	.67½	.51	.93½	.69	.69
Indianapolis, Ind.....	57½	60	52½	28½	52½	1.06	1.10	.61	1.48	.94	.67	.97
Jackson, Miss.....	77½	53½	90	54	90	.40½	.97	.63½	.52½	.90	.63½	.65½
Joplin, Mo.....	27½	32½	97	61½	97	.66	.81½	.71½	.90	1.03	.61½	.88
Kansas City, Mo.....	12	.09	90	54½	90	.51	1.07	.33½	.97	.56	.33½	.50
La Crosse, Wis.....	38½	33½	77	54½	77	.38½	1.00	.38½	.90	.56	.38½	.36½
Laramie, Wyo.....	68½	83	1.46½	1.11½	1.46½	.25½	1.00	.65½	.77	.71	.65½	.47½
Lincoln, Neb.....	26	32	.93½	59	.93½	1.11	1.57	.96	1.46½	.71	.83	.68½
Little Rock, Ark.....	57½	57½	1.04	.58½	1.09	.41½	1.04½	.50½	.93½	.56	.60½	.50
Louisville, Ky.....	58	50½	56½	17	56½	.67	.66	.53	1.16	1.16	.32	.76
Milwaukee, Wis.....	38	33½	56½	40	56½	.46	.93	.64½	.90	.90	.64½	.66
Minneapolis, Minn.....	38½	44	.78	60	.78	.26	1.01½	.59½	.56½	.71	.59½	.65
Nashville, Tenn.....	74½	55	68	26	68	.07	1.05½	.65½	.78	.71	.65½	.47½
Peoria, Ill.....	33	29½	62	38½	62	.67½	.69	.59	.68	1.00	.55	.75½
Pierre, S. D.....	69½	57½	1.13	.92½	.62	.26	1.08½	.52	.62	.67	.52	.42
Pittsburg, Pa.....	73½	66	40½	40	1.13	.57½	1.38	.82	1.13	1.13½	.96	.94
Pueblo, Colo.....	53½	62½	1.38½	1.04½	1.38½	.50	.76½	.79	.39	1.06	.79	.81½
St. Louis, Mo.....	30½	.26	66	28½	66	.82	1.50	.76	1.38½	.40	.76	.52
St. Joseph, Mo.....	12	.24	90	54½	90	.30½	.74	.38½	.66	.63	.38½	.38½
Sioux City, Iowa.....	33½	.32	90	.62	.90	.38½	1.00	.38½	.90	.56	.38½	.50
Terre Haute, Ind.....	54	.46½	56½	31½	56½	.90	.32½	1.07½	.90	.56	.57½	.50
					40		1.01½	.61	.56½	.86½	.61	.62

(a) Adapted from a mimeographed report prepared by R. H. Lamb, entitled "Marketing Kaw Valley and Orrick District Potatoes, 1925-1926," issued by Market News Service of the Bureau of Agricultural Economics, Kansas City, Mo., 1927, pp. 80-82.

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ern markets, as shown in Table XII, was in favor of the eastern shippers. Although the reason for this distribution of shipments may be explained in part by a difference in quality, as will be noted later, and partly by the fact that potatoes from some of the districts were on the market slightly earlier than from others, it is evident that the several mid-season districts compete in many markets,

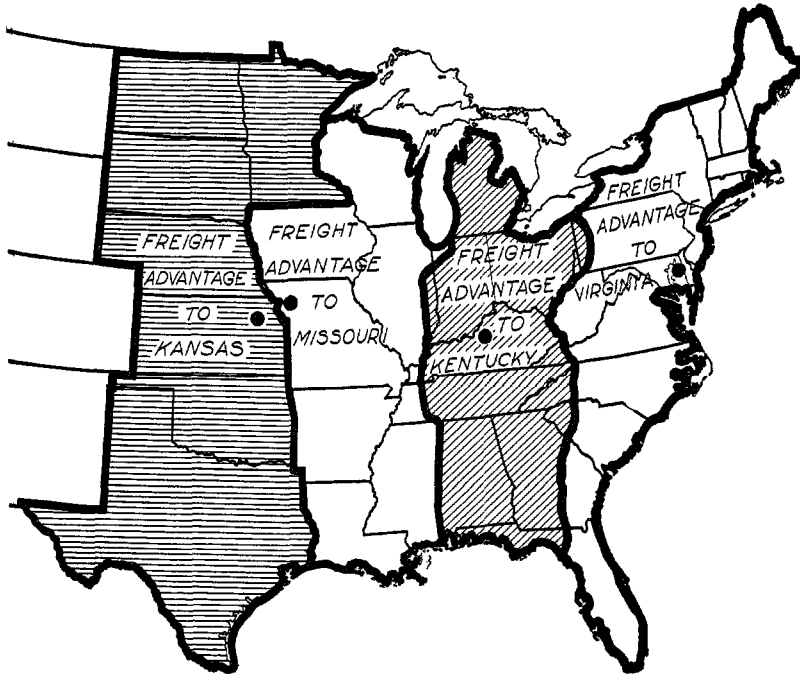


FIG. 11.—Outline map of a portion of the United States showing territory in which four of the mid-season potato districts have an advantage in freight rates.

particularly in the Middle West, with considerable cross hauling. In fact, in the year 1925 the author traced carload shipments which originated in Kansas to Toledo, Ohio, which is distinctly out of freight advantage territory. These shipments upon arrival in Toledo were sent to Chicago. It is, therefore, only in years when one section has a marked surplus or deficiency that the position of supplies become decidedly important as a factor affecting the mid-season potato market.

VI. THE INFLUENCE OF MOVEMENT TO MARKET ON PRICES

**The Seasonal Trend of Prices.**—Before considering the movement to market as an influence on the mid-season potato prices, it is of importance to consider the usual seasonal price trend.

Figure 12 was constructed from top price quotations for Kaw valley potatoes on the Chicago market as reported by the Market News Service of the Bureau of Agricultural Economics, Kansas City, Mo. (Tables XXXVII, XXXVIII, XXXIX and XL, Appendix.) The upper portion shows average prices by 10-day

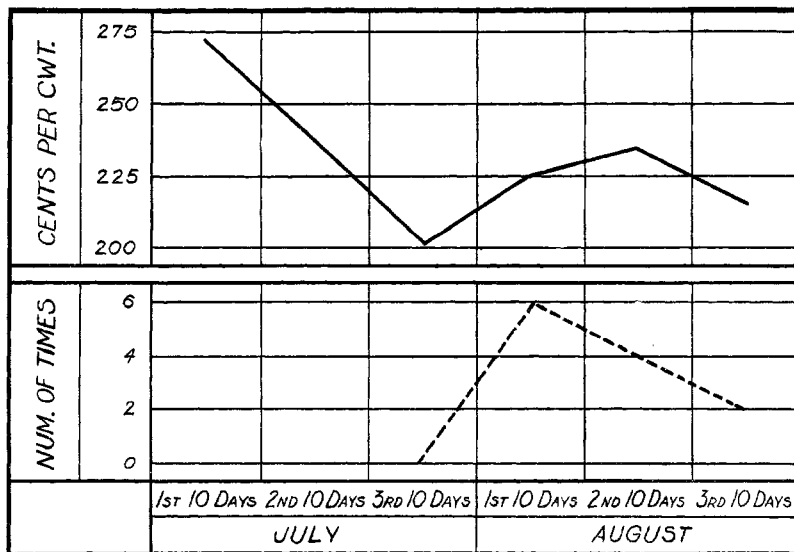


FIG. 12.—Seasonal price trend for Kansas potatoes at Chicago, 1919-1927 (1920 omitted). The lower graph shows the number of times prices in one 10-day period averaged higher than in the preceding 10-day period.

periods from 1919 to 1927 with the year 1920 omitted. The reason for the omission is that quotations on Kaw valley potatoes were not available for more than half of the 1920 season. The lower portion shows the number of times that prices in one 10-day period averaged higher than prices in the preceding 10-day period. From figure 12 it is evident that the usual seasonal price trend is downward from early July to the first part of August. However, the first part of August has been, most usually, a period of price recovery. This has happened in six of the eight years under consideration. The middle of August has shown price improvement over the first part of August about one-half the time, or four years



in eight. On the other hand, the latter part of August was usually a period of price declines, for in only two of eight years was there any price improvement. The significance of the upper part of figure 12 becomes more apparent when the lower part is taken into consideration.

**Chicago Receipts and Seasonal Price Trends.**—Figure 13 is a duplicate of the upper part of figure 12 together with the average receipts at Chicago by 10-day periods for the same period of years. From this it is apparent that the increase in receipts is the cause of the usual seasonal price decline during July. The periods of heaviest receipts are the periods of lowest prices and *vice versa*.

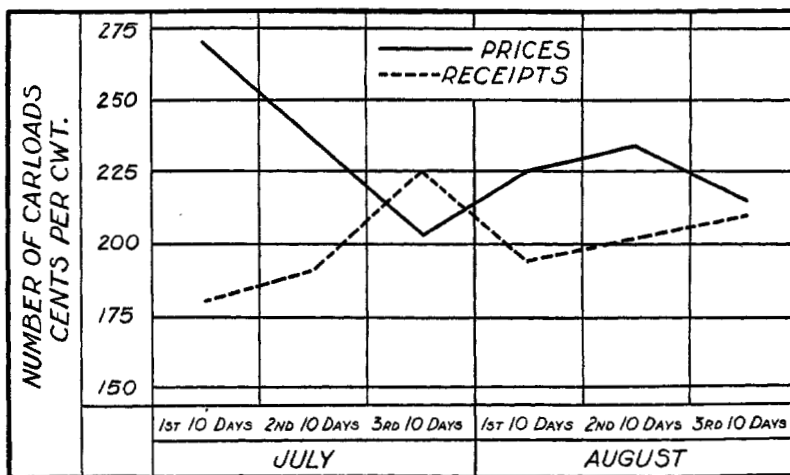


FIG. 13.—Chicago potato prices and receipts by 10-day periods during July and August, 1919-1927 (1920 omitted).

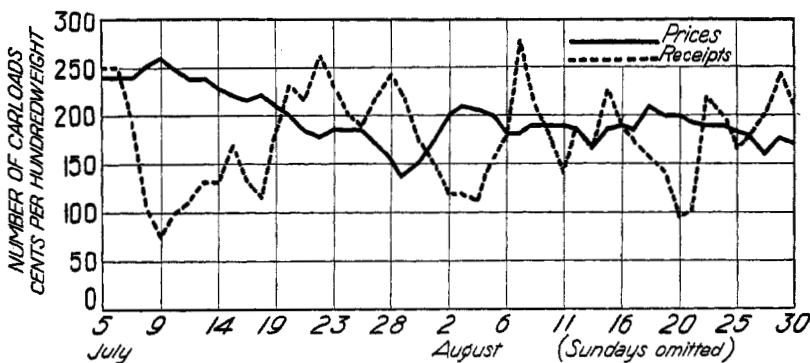


FIG. 14.—Potato receipts and prices at Chicago, July and August, 1927.

Table XXXVI in the Statistical Appendix shows the relation of receipts and prices by 10-day periods. The fact that a decrease in receipts in August does not give a price rise that corresponds to the price decline in July with an increase in receipts is no doubt due to other factors. During August the corn-belt home gardens are maturing, which lessens the demand on the commercial producing sections. Furthermore, the price declines in July tend to make dealers hesitant about purchasing beyond immediate needs.

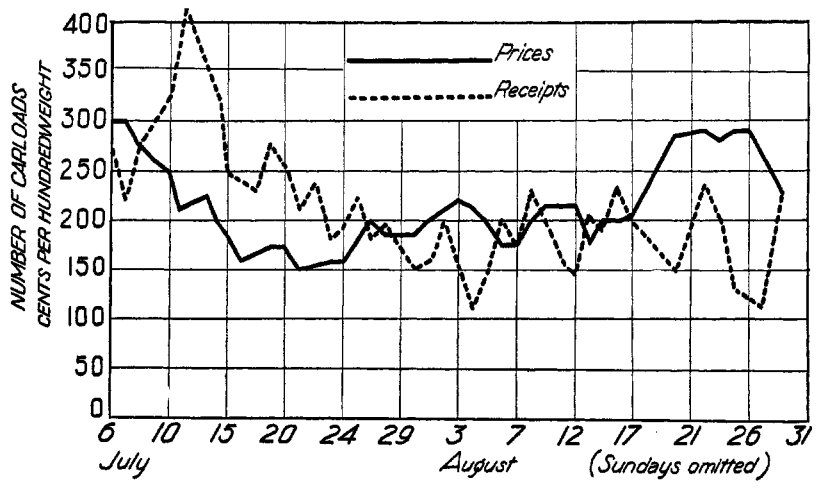


Fig. 15.—Potato receipts and prices at Chicago, July and August, 1926.

**Movement to Market and Prices.**—The Chicago market has long been regarded as an influence dominating the mid-season potato market. Shippers, commission merchants, brokers, and receivers are constantly in touch which Chicago and price quotations are based to a large extent on Chicago prices. For that reason it is of importance to study the relation of daily receipts to daily prices at Chicago.

It is a common practice among shippers to consign to Chicago if sales are not made either on an f. o. b. or delivered basis. The expression, "Potatoes without a market go to Chicago," is quite true.

Figures 14, 15 and 16 show the relation between daily receipts and prices at Chicago in 1927, 1926 and 1925. Table XXXVII, XXXVIII and XXXIX, Appendix, present this situation statistically. In the years 1925 and 1927 there was a decided correlation between daily receipts and prices at Chicago. The correlation coefficients  $-.6626 \pm .063$  and  $-.5016 \pm .072$  are significant.

However, in 1926, although there was an apparent relation in figure 15 between receipts and prices, the relation was not so marked as in 1925 and 1927. When considered from a statistical point of view there was no relation between the two. This may be explained by the fact that during the first part of the season the Chicago market was able to handle large receipts at prices corresponding to prices for light receipts at the end of the season. Such a situation tends to lower the correlation coefficient and obscure the direction of price trends in relation to market receipts. From these three figures and tables it is evident, nevertheless, that Chicago daily receipts have an important bearing on daily prices.

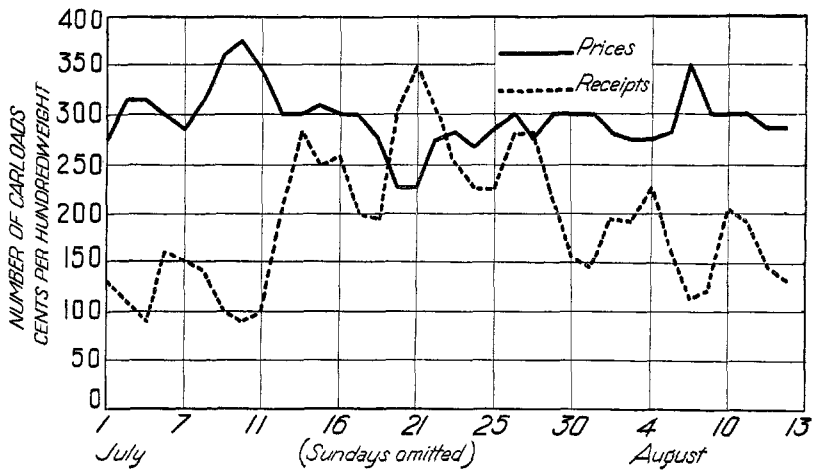


FIG. 16.—Potato receipts and prices at Chicago, July and August, 1925.

#### VII. THE INFLUENCE OF THE CHICAGO MARKET ON MID-SEASON POTATO PRICES

**Chicago Prices and Shipping Point Prices.**—The direct influence of Chicago prices on shipping-point prices is hard to measure for the reason that adequate data are lacking. Actual comprehensive sales records are hard to secure. Frequently a wide range of prices is paid at a shipping point, depending upon the location within a district, the quality and grade of the potatoes, and the particular situation in which a buyer finds himself in relation to orders he may have. Market news service reports on shipping-point prices are often misleading because of the fact that funds for this service are limited and reports must often be gathered from considerable distances. Figures 17 and 18 show a definite relation between Chicago prices and shipping-point prices in 1926. The

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shipping-point prices in figure 17 were taken from sales records collected by the author on 800 carloads sold cash-on-track by Kaw valley potato growers. (Table XV.) Here the relation between Chicago prices and shipping point prices is marked. Table XLI, Appendix, shows a correlation coefficient of  $.910 \pm .0188$  between the two. Figure 18 is constructed from data from market, news service reports. Here the relation of prices in Virginia and Chicago is quite evident, but when measured statistically there does not appear to be a close correlation. (Table XLII, Appendix.) The Virginia shipping-point market is apparently not influenced to the same extent by Chicago prices as is the Kansas shipping-point market. Nevertheless, the Chicago price dominates to a large extent the prices at Virginia shipping points, as is shown in figure 18.

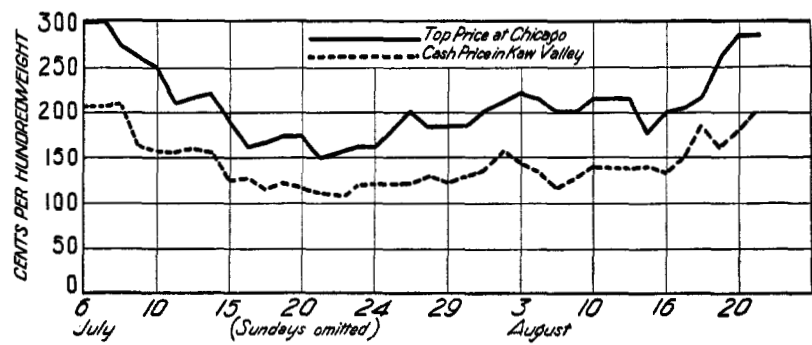


FIG. 17.—Chicago and Kaw valley potato prices, July and August, 1926.

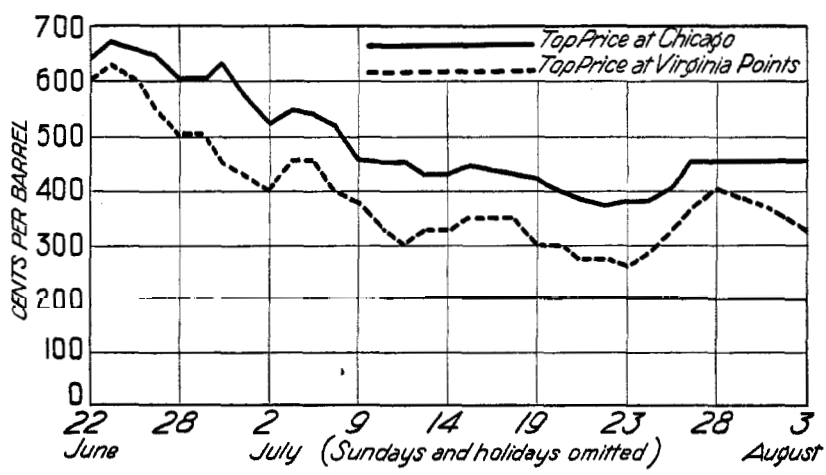


FIG. 18.—Chicago and Virginia potato prices, June, July and August, 1926.

TABLE XIV.—AVERAGE NET RETURN PER HUNDREDWEIGHT TO KANSAS POTATO GROWERS. COMPARING GRADE, SALES METHOD, AND BRAND. JULY 6 TO AUGUST 8, 1925. (a)

Date.	Cash on track, partly graded, not branded.	Cash on track, partly graded, branded.	Through local broker, partly graded, branded.	Through agent in distant market. U. S. No. 1 grade, branded.
July 6.....	\$2.25	\$2.30	\$2.30	\$2.51
7.....	2.25	.....	2.30	2.97
8.....	2.25	2.35	2.39	2.73
9.....	2.65	2.65	2.58	2.90
10.....	2.35	2.82	2.46	2.76
11.....	2.18	.....	2.42	2.70
12.....	2.25	2.35	.....	.....
13.....	2.18	2.25	2.23	2.78
14.....	2.23	2.25	2.30	2.33
15.....	2.25	2.25	2.25	2.50
16.....	2.05	2.10	1.92	2.52
17.....	1.80	2.00	2.07	1.80
18.....	.....	.....	1.98	2.20
19.....	.....	2.10	.....	2.00
20.....	.....	2.00	1.91	2.33
21.....	.....	1.85	1.85	2.32
22.....	.....	1.80	1.85	2.46
23.....	1.77	.....	1.79	2.52
24.....	.....	1.95	1.78	2.26
25.....	.....	.....	2.00	.....
26.....	.....	1.75	.....	.....
27.....	1.83	.....	1.97	2.35
28.....	2.00	2.00	2.05	2.52
29.....	2.00	2.10	1.98	2.49
30.....	2.05	.....	.....	2.25
31.....	2.10	.....	2.12	2.18
Aug. 1.....	2.15	.....	2.17	2.52
2.....	.....	.....	.....	.....
3.....	2.20	2.25	2.20	2.52
4.....	2.20	2.35	.....	.....
5.....	2.30	2.35	2.30	2.52
6.....	.....	2.35	2.35	2.82
7.....	2.40	.....	.....	2.81
8.....	2.25	.....	.....	2.61
9.....	.....	.....	.....	.....
Per cent of time each method of sales and grade was the high sale of the day.....	0.0	14.3	7.7	86.2

(a) Data from sales records of Kansas potato growers.

**Chicago Prices and Prices at Other Large Markets.** — As pointed out above, potato brokers and dealers in the various terminal markets are constantly in touch with the Chicago market. Even before the Market News Service Report of the Bureau of Agricultural Economics is released, dealers secure reports from individual firms as to the action of the Chicago market. This has a tendency to affect other large markets. In fact, this situation, together with the diversion situation already referred to in the discussion on the position of supplies, causes the Chicago market to dominate to a considerable extent the other markets. Figures 19 and 20 and Tables XLIII and XLIV, Appendix, present the relation between the Chicago market and the St. Louis market, and

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between the Chicago market and the Pittsburgh market in 1927. The correlation coefficients are  $+0.923 \pm 0.0154$  and  $+0.666 \pm 0.0663$ . They signify that there is a decided relation between Chicago daily prices and the prices at other markets. The relation is not an exact one. That is, if Chicago prices rise or fall 20 cents per hundred-weight on a certain day the other markets do not necessarily show

TABLE XV.—AVERAGE NET RETURN PER HUNDREDWEIGHT, KAW VALLEY POTATOES. COMPARING SALES METHOD, GRADE AND BRAND. JULY 6 TO AUGUST 21, 1926. (a)

Date.	Cash on track.					Local broker.		Agent in distant market.	
	Field run, not branded.	Partly graded, not branded.	Partly graded, branded.	U. S. No. 1, not branded.	U. S. No. 1, branded.	Partly graded, branded.	U. S. No. 1, branded.	Partly graded, not branded.	U. S. No. 1, branded.
July 6	\$1.90	\$2.10			\$2.18				
7	1.90	2.15			2.13		\$2.15		\$1.97
8	2.00	2.05		\$2.25	2.10		2.10		2.03
9	1.85	1.61		1.55	1.73				
10		1.60					1.74		
12		1.50			1.60		1.68		
13	1.52	1.50	\$1.75	1.75	1.58		1.61		1.79
14	1.35	1.53	1.75	1.60	1.48		1.41		2.07
15	1.15	1.25	1.30	1.35	1.25		1.35		1.40
16	1.10	1.26	1.40	1.35	1.10		1.26	\$0.90	1.06
17		1.15					1.35		
19	1.25	1.16	1.28		1.15		1.26	1.35	1.17
20	1.00	1.23	1.25		1.15		1.22	1.10	1.40
21	1.05		1.10		1.20		1.13		1.30
22	1.05		1.07				1.07		1.37
23		1.10			1.20		1.17		1.15
24					1.20		1.17		1.15
26		1.16			1.27	\$1.12	1.22		1.33
27		1.18	1.18		1.30	1.19	1.30		1.41
28	1.25	1.26	1.25		1.35	1.25	1.33		1.44
29		1.18			1.29	1.28	1.32		1.58
30		1.28			1.38	1.30	1.52		1.58
31		1.35					1.54		1.67
Aug. 2		1.55	1.55			1.60	1.64	1.60	1.70
3		1.49	1.55		1.35	1.65	1.68	1.40	1.50
4		1.38	1.25		1.45	1.96	1.43	1.50	1.52
5		1.15				1.35	1.54		1.73
6						1.20	1.51		1.48
9		1.30	1.25			1.57	1.41	1.30	1.43
10		1.33	1.35		1.52	1.46	1.41		1.55
11		1.34	1.32		1.50	1.47		1.21	1.26
12		1.29	1.30		1.50	1.60		1.29	
13			1.40			1.27			1.38
16		1.20			1.50		1.50		1.59
17		1.20			1.87		1.87	1.35	
18		1.45			2.25		2.25		
19		1.60					2.25		
20		1.80					2.15		
21		2.00	2.08						
Per cent of time method of sale was the high sale for the day	0.0%	0.0%	15.0%	17.0%	25.8%	20.0%	30.3%	9.1%	64.3%

Per cent of times U. S. No. 1 outsold partly graded..... 81.1  
 Per cent of times partly graded outsold U. S. No. 1..... 13.4  
 Per cent of times branded sacks outsold unbranded sacks for same grade and same method of sale..... 57.2  
 Per cent of times unbranded sacks outsold branded sacks for same grade and same method of sale..... 34.3

(a) Data from sales records of Kansas potato growers.

a similar action, but the periods of strength and weakness in the Chicago market are quite closely followed by the other markets. Each market may show a day or two of independent strength or weakness, but the major price swings, as shown in figures 19 and 20, are parallel.

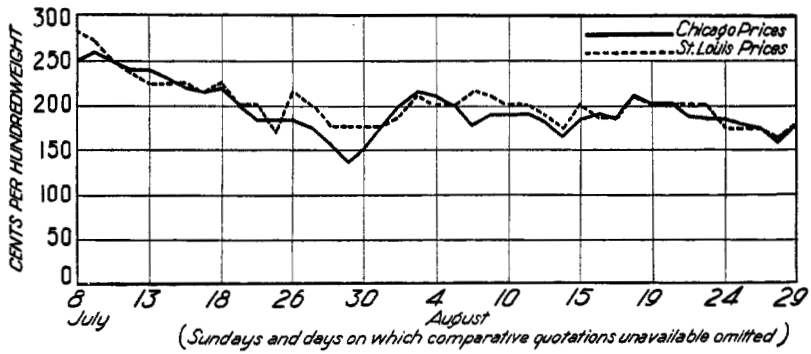


FIG. 19.—Chicago and St. Louis potato prices, July and August, 1927.

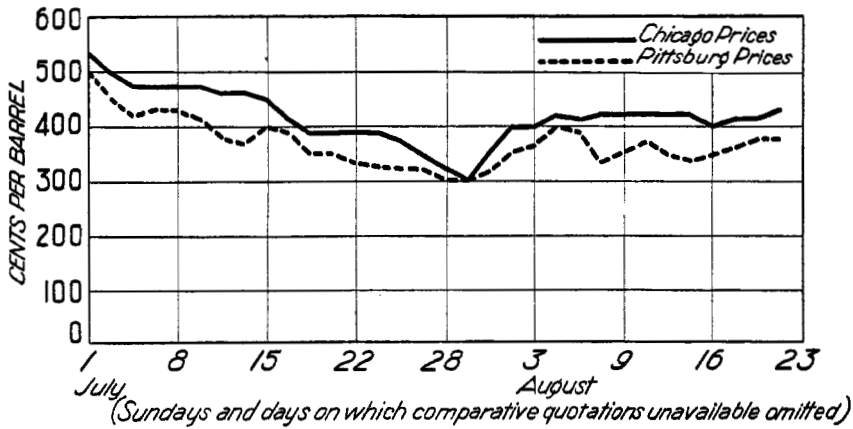


FIG. 20.—Chicago and Pittsburg potato prices, July and August, 1927.

VIII. THE INFLUENCE OF SHIPMENTS FROM THE PRINCIPAL PRODUCING SECTIONS ON CHICAGO RECEIPTS

Since the Kaw valley of Kansas, the Orrick district of Missouri, and the Eastern Shore of Virginia are the principal producing sections shipping during the major portion of the mid-season potato marketing period, the relation of the arrivals on the Chicago market from these three districts to the total receipts is worthy of consideration. Figures 21, 22 and 23 show the relation between the two, while Table XLV, XLVI and XLVII, Appendix, present the situation statistically for the years 1927, 1926 and 1925. The correlation coefficients  $.3536 \pm .084$ ,  $.3615 \pm .089$ , and  $.4236 \pm .093$  are evidence that there is a direct relation between the two and that these shipping districts are to a considerable extent responsible for the daily fluctuations in the receipts at Chicago. Their influence is realized to a greater extent when it is understood that the figures for Chicago receipts include all cars on track which are commonly termed "track holdings." Some of these are holdovers from previous days and some are partly unloaded. It is, however, not important to separate total arrivals from track holdings, because, as shown above, the total number of cars on track is a dominating influence on Chicago prices.

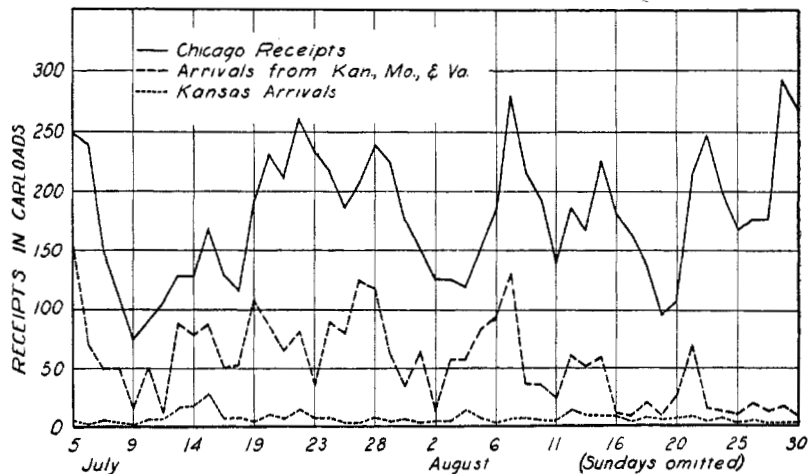


FIG. 21.—Chicago potato receipts and arrivals from Kansas, Missouri, and Virginia, 1927. (Figures include broken cars on track.)



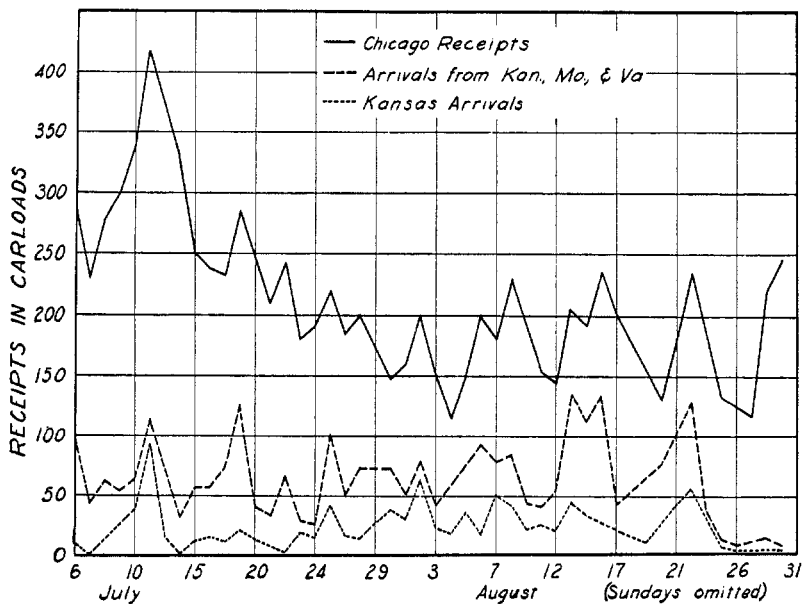


FIG. 22.—Chicago potato receipts and arrivals from Kansas, Missouri, and Virginia, 1926. (Figures include broken cars on track.)

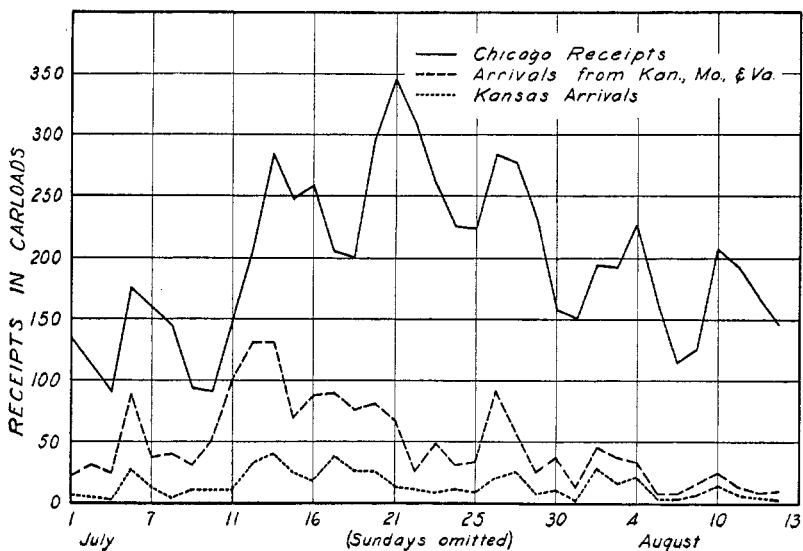


FIG. 23.—Chicago potato receipts and arrivals from Kansas, Missouri, and Virginia, 1925. (Figures include broken cars on track.)

The arrivals from Kansas were plotted in figures 21, 22 and 23 to ascertain whether or not one particular districts was responsible to a greater extent than others for fluctuations in Chicago receipts. Tables XLVIII, XLIX and L, Appendix, present correlation data for this factor. The coefficients  $.3291 \pm .111$ ,  $.5696 \pm .0783$ , and  $-.0463 \pm .085$  indicate that in 1925 and 1926 Kansas shipments were responsible to quite an extent for the fluctuations in receipts at Chicago, while in 1927 Kansas shipments were a negligible factor on the Chicago market. One reason for the small number of Kansas cars on the Chicago market in 1927 is that compulsory shipping-point inspection service went into effect in the Kaw valley in 1927.<sup>36</sup> This stimulated f. o. b. sales, which resulted in wider distribution and fewer consignments.

Although one of the districts may be responsible to a greater extent than the others for the fluctuations in receipts at Chicago in a particular year, the three districts, Virginia, Missouri, and Kansas, are to a large extent responsible every year. Since receipts at Chicago were shown to have a dominating influence on prices, and since Chicago prices were shown to influence the entire mid-season market, the problem of regulating the flow of shipments to that market is of particular importance to the mid-season producing sections.

#### IX. THE INFLUENCE OF TOTAL UNITED STATES SHIPMENTS ON DAILY CARLOAD RECEIPTS OF POTATOES AT CHICAGO

There would, of course, be little or no relation between Chicago receipts and total shipments on a particular day. However, it was thought that shipments made one, two, three, four, or five days previously might have a bearing on Chicago receipts. After several attempts to correlate these data for various years it was concluded that there is apparently little relation between the two. Figure 24, in which Chicago receipts were plotted against total United States shipments four market days previous, presents the situation in 1927. Toward the end of the season there appears to be some relation. However, Table LI, Appendix, shows no correlation from a statistical point of view. Attempts to correlate the data for other years and other periods of time prior to the receipts at Chicago yielded similar results. This seems to be contrary to what one might expect. But when it is recalled that the freight-rate structure is such that diversions of cars in transit are easily made, the lack of relation between total United States shipments and Chicago receipts a few

36. Mohler, J. C.: Kansas Potato Inspection Law. Official bulletin of the Kansas State Board of Agriculture. July, 1927, pp. 1-12.

days later is understandable. Chicago prices on a particular day frequently influence the action of shippers. If the market is strong there is a rush to ship to Chicago, and if prices are weak that market is avoided. The author has known growers who have ceased digging operations at 10 a. m. upon receipt of a wire from Chicago stating that the market was declining under heavy receipts. It appears that a period of strength in prices at Chicago attracts shipments to that market and a period of weakness causes a decided falling off of receipts with little or no relation between the total shipments from producing districts and receipts at Chicago a few days later.

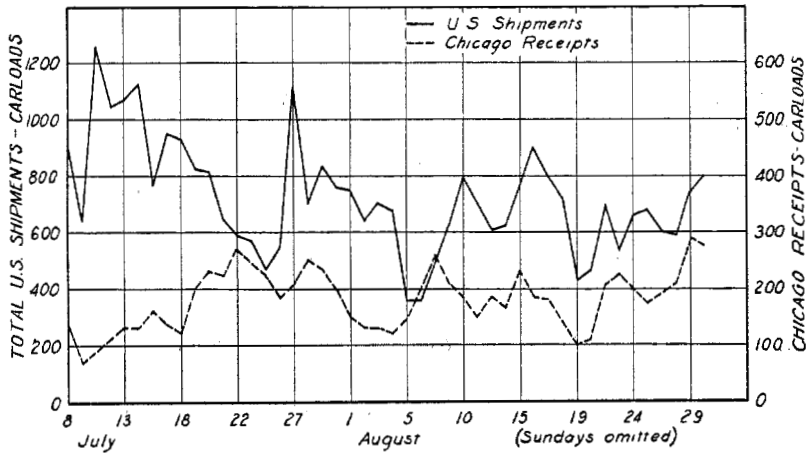


FIG. 24.—Chicago potato receipts and total United States shipments four market days previous, 1927.

### X. QUALITY AND GRADE AS FACTORS IN MID-SEASON POTATO MARKETING

Quality and grade are generally recognized as market factors of great importance. A trip through produce markets will convince anyone that such is the situation. Standard grades, which are the measure of quality, establish confidence and form a just basis for dealing. A product that must be sold on buyer's inspection, the method of sale for products of low quality, necessarily entails greater expense. Each buyer must spend his time inspecting the quality of the produce. This is an expensive procedure compared with dealing on certificate of grade furnished by a noninterested party. Consequently the promulgation and application of standard

grades has done much to eliminate costly practices in connection with the marketing processes.

The effect of quality on the general market price level is hard to measure. Given a market situation where the bulk of the product is of poor quality, it is difficult to say what the price situation would have been if the majority of the product had been of good quality or *vice versa*. It is not uncommon to see market reports stating: "Low quality is depressing market values." But how much is another question.

The best way, perhaps, to gain an idea of the effect of quality is to compare prices on various grades of the product. This can be done either through a comparison of prices at terminal markets or at shipping point. Price quotations in market reports reflect the situation quite accurately. These are available each day in the press and in the special reports issued by the Market News Service of the Bureau of Agricultural Economics of the United States Department of Agriculture and are so familiar to those interested in potato marketing as to need no discussion. Yet one does not gain so clear an idea of the effect of quality through price quotations as through personal inspections in the markets. In the survey of markets made by the author in 1925 the effect of quality was vividly impressed on him. On July 8, 1925, in Peoria, Ill., Virginia potatoes sold for \$3.25 per hundredweight. Best Kansas potatoes sold for \$3.20 per hundredweight, while poorest quality Kansas potatoes sold for \$2.25 per hundredweight. Again, on July 10, 1925, in Chicago, Virginia potatoes sold for \$4.40 per hundredweight, best Missouri potatoes \$3.75, and Kansas partly graded potatoes \$3.35. It was evident that the price difference that year was due to differences in grade. A small part was due to the difference in appearance, such as a brighter skin. Possibly 15 to 25 cents per hundredweight could be attributed to the latter, as was shown in the prices in Peoria where the grade was approximately the same.

There is usually not so great a spread between poorly graded and well-graded potatoes as in 1925. In 1927, for example, prices on Virginia potatoes at Chicago on July 22 were \$2.35 per hundredweight, best Kansas potatoes \$1.85, and poorest \$1.60. This was a spread of 75 cents per hundredweight between Virginia potatoes and poorest Kansas potatoes, while in 1925 the spread at Chicago was \$1.05. The year 1925, it will be recalled from Table VII, was a year of light shipments from the mid-season districts, while the

year 1927 was a year of heavy shipments. Furthermore, the year 1925 was a year when the mid-western districts were generally lacking in high-quality potatoes because of severe frost damage to the growing crop in the spring. It appears that the spread in price between grades varies from year to year as the quantity of the lower grades varies in proportion to the quantity of the higher grades. The Tabb Potato Service<sup>37</sup> arrived at the same conclusion in an analysis of the spread in price between Idaho Russets and Wisconsin white potatoes. The former usually command a premium over the latter on the Chicago market. In 1925 the premium on the Russets was as high as \$1.55 per hundredweight. On the other hand, during the 1926 season the premium was reduced to 40 cents a hundredweight, and on September 17, 1926, there was a slight premium on the Wisconsin Whites. "The reason," says the Tabb Potato Service, "is not difficult to find in the light of cold-blooded analysis. When the Northern states have large crops and Idaho only moderate supplies, the Russets bring large premiums, owing to the fact that certain high-class trade demands them regardless of price. When conditions are reversed, however, and Whites are in small supply, prices range very nearly the same."

Producers in a given district find that quality and grade are important as market factors. The price they receive depends to quite an extent on the quality and grade that they sent to market either as individuals or collectively. In the minds of producers the question always arises as to whether or not it will pay them to grade. Will they receive a price for their product that will justify the expense connected with grading? To gain an idea of the value of grading, questionnaires were sent to a group of Kansas potato growers for a period of three years, 1925, 1926 and 1927. Each grower was asked to report the net return that he received for each carload sold, and the date of sale. In addition, he was asked to state the grade of the potatoes; whether or not the sacks were branded; and the method of sale, whether cash on track, through a local broker, or through an agent in a distant market. The sales records were tabulated as shown in Tables XIV, XV and XVI. Each figure is an average of the carloads sold on the specific date in the manner designated in the tables.

Figures for 1925 are shown in Table XIV. Although the data are not exactly comparable because the methods of sale for partly

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<sup>37</sup>. Tabb Potato Service: Those Elusive Idaho Premiums. Market Bulletin No. 98, Tuesday, April 10, 1928, pp. 1-5.

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graded and United States No. 1 grade potatoes were different, it is apparent that graded potatoes brought a considerably higher net return than did partly graded potatoes. In 1926 the higher return to the grower for grading is again evident. In that year United States No. 1 potatoes outsold partly graded potatoes 81.1 per cent of the time, while only 13.4 per cent of the time partly graded potatoes outsold United States No. 1 potatoes. Again, in 1927, United States No. 1 potatoes outsold the combination grade (the official

TABLE XVI.—AVERAGE NET RETURN PER HUNDREDWEIGHT—KAW VALLEY POTATOES  
JULY 6 TO AUGUST 31, 1927. COMPARING SALES METHOD AND GRADE. (a)

Date.	Cash on track, grade No. 2.	Local broker, grade No. 2.	Cash on track, combination grade.	Local broker, combination grade.	Cash on track, U. S. No. 1.	Local broker, U. S. No. 1.	Through agent in distant market, U. S. No. 1.
July 6					\$1.75		
7			\$1.75		1.90		
8			1.85		1.93		
9			1.75		2.01		
11					1.79		\$2.05
12			1.63		1.76		
13			1.58		1.76		
14			1.65		1.65		
15	\$1.25		1.60		1.62	\$1.75	
16					1.63		
18					1.68		1.40
19			1.42		1.55		1.35
20	1.35		1.40		1.53		
21			1.45		1.98		
22					1.55		
23	1.15		1.33		1.43		
25			1.22	\$1.39	1.30		
26		\$1.00	1.18		1.22		
27		.88	1.30	1.26	1.25		
28		1.00	1.30		1.25		
29					1.30		
30			1.15		1.15		
Aug. 1	1.10		1.16				
2			1.35				
3			1.50				
4			1.39		1.65		
5			1.44				
6	1.13	1.25	1.30				
8	1.20		1.25				
9			1.31				
10	1.05		1.28	1.40			
11	1.20		1.25	1.20			
12			1.15				
13			1.25				
15			1.40	1.30			
16							
17							
18				1.28			
19			1.40	1.33			
20			1.35				
22			1.15	1.15			
23				1.21			
24			1.15				
25	1.05		1.00				
26			1.20				
27			1.18				
29			1.11				
30				.92			
31			1.15				

(a) Data from sales records of Kansas potato growers.  
 Per cent of times that U. S. No. 1 outsold combination grade..... 70  
 Per cent of times that combination grade outsold U. S. No. 1..... 17  
 Per cent of times that combination grade outsold U. S. No. 2..... 100

term applied to partly graded potatoes under the Kansas inspection law<sup>38</sup>) 70 per cent of the time, while combination grade outsold United States No. 1 potatoes only 17 per cent of the time.

**Quantity Discarded to Pack Desirable Grades.**—The quantity discarded to pack a well-graded product is uppermost in the minds of potato growers when contemplating the adoption of standard grades. Furthermore, a particular market situation may be such that a grower feels that he is not justified in attempting to put up a No. 1 grade. "How much do you have to throw out?" is a question universally asked.

Table XVII is a summary of records taken on the farms of several potato growers in the Kaw valley of Kansas which will give some information on this point. It shows that the quantity discarded varies from year to year and from farm to farm. The average of the three years shows that approximately 88 per cent of the crop will grade United States No. 1. In some seasons a second grade is made which is designated as No. 2. It consists of potatoes between 1<sup>5</sup>/<sub>8</sub> and 1<sup>7</sup>/<sub>8</sub> inches in diameter. Under a partial grading system these are usually included in the pack. Consequently the amount to be thrown out in order to make a United States No. 1 pack as compared with a partly graded pack can be measured quite accurately by the per cent of No. 2's shown in Table XVII.

TABLE XVII.—PORTION OF THE POTATO CROP WHICH FALLS INTO VARIOUS GRADES. (a)

Date.	GROWER.	Address.	Per cent No. 1.	Per cent No. 2.	Per cent culls.
July, 1923.....	Oliver Brothers.....	Rossville, Kan.....	87.6	9.2	3.2
August, 1923.....	Chas. Speaker.....	Kansas City, Kan.....	77.0	20.0	3.0
August, 1923.....	G. E. Kelsey.....	Topeka, Kan.....	90.7	6.1	3.2
July, 1924.....	N. V. Cochran.....	Silver Lake, Kan.....	91.0	.....	9.0
July, 1924.....	M. G. Dreyer.....	Kansas City, Kan.....	78.6	.....	21.4
July, 1927.....	F. V. Lewis.....	Lawrence, Kan.....	90.0	.....	10.0
July, 1928.....	G. E. Kelsey.....	Topeka, Kan.....	90.7	6.1	3.2
July, 1928.....	Chas. Speaker.....	Kansas City, Kan.....	88.3	.....	11.7
July, 1928.....	J. H. Corel.....	Lawrence, Kan.....	84.5	.....	15.5
Average.....	.....	.....	87.6	.....	.....

(a) Data taken at harvest time. The author wishes to express his appreciation to F. O. Blecha, C. E. Graves, A. I. Gilkison, R. L. von Trebra, and H. W. Robinson of the Extension Division of the Kansas State College for the assistance given in securing the records in Tables VII, XVIII, XIX, XX and XXI. Through the courtesy of Mr. C. E. Graves, the data in Tables XIX, XX and XXI were made available to the author.

38. Mohler, J. C.: Kansas Potato Inspection Law. Official Bulletin of the State Board of Agriculture, Topeka, Kan., 1927, p. 6.

Seasonal conditions and cultural practices are the dominating factors determining the per cent to be discarded to pack a United States No. 1 grade. Among cultural practices may be listed soil management, the selection of the variety, the employment of disease-control measures, and the use of high-quality seed. Data are at hand which show the influence of three of the factors. Table XVIII shows the effect of seed treatment for disease control as against the practice of planting untreated seed.

TABLE XVIII.—EFFECT OF SEED TREATMENT ON THE QUALITY OF POTATOES PRODUCED. (a)

(Farm of Charles Speaker, Kansas City, Kan., August, 1928.)

Treated.			Untreated.		
Per cent No. 1.	Per cent No. 2.	Per cent culls.	Per cent No. 1.	Per cent No. 2.	Per cent culls.
81.5	16.0	2.5	72.5	23.0	4.5

(a) Data taken at harvest time.

TABLE XIX.—EFFECT OF VARIOUS SEED TREATMENTS ON THE QUALITY OF POTATOES PRODUCED. (a)

(Farm of J. H. Corel, Lawrence, Kansas, 1928.)

TREATMENT.	Per cent U. S. No. 1.	Per cent culls.
Corrosive sublimate, February 2, 1928 .....	87.1	12.9
Hot formaldehyde, February 2, 1928 .....	86.0	14.0
Corrosive sublimate, March 14, 1928 .....	88.4	11.6
Hot formaldehyde, March 14, 1928 .....	83.6	16.4
Untreated .....	77.6	22.4

(a) Data taken at harvest time.

Again the influence of seed treatment on quality is apparent from Table XIX, which compares the efficiency of various treatments.

The effect of the influence of the variety on quality is shown in Table XX.

Likewise the seed strain or seed stock planted is important in determining the quality. Table XXI shows the results secured with Cobbler seed potatoes from 25 sources. The poorest seed produced 71.6 per cent of No. 1's, while the best seed produced 94 per cent of No. 1's.



TABLE XX.—EFFECT OF VARIETY ON QUALITY OF POTATOES PRODUCED. (a)

(Farm of Charles Speaker, Kansas City, Kan., 1928.)

VARIETY.	Per cent U. S. No. 1.	Per cent No. 2.	Per cent culls.
Cobbler.....	83.6	12.4	4.0
Triumph.....	74.4	17.2	8.4
Ohio.....	73.0	17.7	9.3
U. S. Seedling.....	69.9	22.5	7.6

(a) Data taken at harvest time.

TABLE XXI.—RELATION OF VARIOUS SEED STRAINS TO QUALITY OF POTATOES PRODUCED. (a)

(Farm of Charles Speaker, Kansas City, Kan., July 6, 1928.)

SEED STRAIN NO.	Per cent U. S. No. 1.	Per cent culls.	SEED STRAIN NO.	Per cent U. S. No. 1.	Per cent culls.
1.....	93.2	6.8	15.....	87.8	12.2
2.....	93.7	6.3	16.....	89.0	11.0
3.....	90.0	10.0	17.....	84.8	15.2
4.....	90.6	9.4	18.....	90.6	9.4
5.....	88.2	11.8	19.....	84.9	15.1
6.....	95.8	4.2	20.....	90.7	9.3
7.....	85.2	14.8	21.....	82.7	17.3
8.....	88.3	11.7	22.....	90.9	9.1
9.....	90.0	10.0	23.....	91.2	8.8
10.....	90.8	9.2	24.....	72.5	27.5
11.....	94.0	6.0	25.....	71.6	28.4
12.....	92.0	8.0			
13.....	90.0	10.0	Average.....	88.3	11.7
14.....	90.0	10.0			

(a) Data taken at harvest time.

It is difficult to decide where production problems end and marketing problems begin. While the data which have been presented may be classed by some as connected with production, it has, however, an important bearing on the marketing problems. It is desirable that those who deal with production problems gain a knowledge of marketing factors, and *vice versa*. Where the two merge should be common ground.

### XI. MARKETING CONDITIONS IN THE VARIOUS PRODUCING SECTIONS

The economic conditions prevailing in the various producing sections necessarily have a bearing on the marketing problems of an industry. In some districts there is a problem of assembly and the growers who do not produce carloads must either sell their potatoes directly to a dealer or unite with other growers or an association of growers to assemble their product into the commercial trading unit.

Again in some of the districts a few dealers or growers' coöperatives dominate the situation, while in others it is every man for himself. A correspondent writes: "We are direct competitors of the Kansas growers, as our crop hits at the same time and we are quoting the same market and the same people. It is our belief that the unorganized selling of the Kansas crop has a very demoralizing effect on the markets."

To gain some idea of the conditions existing in the various producing districts, a survey of available literature was made, questionnaires were sent to potato specialists in the several states, and a personal visit was made to a few of the districts. It will, perhaps, be best to present by districts the information available.

VIRGINIA.—Sources of information: F. B. Bomberger, executive director, Del-Mar-Va Eastern Shore Association, Salisbury, Md. H. H. Zimmerley, horticulturist, Virginia Truck Experiment Station Farm, Norfolk, Va. *American Potato Journal*, August, 1927.

1. Districts shipping mid-season potatoes: Norfolk section, and Northampton and Accomac counties on the Eastern Shore of Virginia.

2. Some principal shipping points: Norfolk, Onley, Cape Charles, Exmore, Eastville, Parksley.

3. Principal variety: Cobbler.

4. Assembly conditions: The most of the growers ship carloads.

5. Per cent handled by cooperatives: About 50 per cent.

6. Names of cooperatives or selling organizations: Eastern Shore of Virginia Produce Exchange, Onley, Va. Southern Produce Company, Norfolk, Va. Peninsula Produce Exchange, Pocomoke, Md. Del-Mar-Va Eastern Shore Association (Quotation Committee).

7. Carloads handled by individual (or firm, or organization) shippers:

Shipper No. 1. . . . . 13,228 carloads.	Shipper No. 8. . . . . 310 carloads.
Shipper No. 2. . . . . 1,459 carloads.	Shipper No. 9. . . . . 198 carloads.
Shipper No. 3. . . . . 1,396 carloads.	Shipper No. 10. . . . . 130 carloads.
Shipper No. 4. . . . . 1,000 carloads.	Shipper No. 11. . . . . 116 carloads.
Shipper No. 5. . . . . 978 carloads.	Shipper No. 12. . . . . 110 carloads.
Shipper No. 6. . . . . 822 carloads.	Shipper No. 13. . . . . 58 carloads.
Shipper No. 7. . . . . 658 carloads.	

NORTH CAROLINA.—No. information. Elizabeth City leading district.

MARYLAND.—Sources of information: S. B. Shaw, chief inspector, Maryland State Department of Markets, College Park, Md.

1. Districts shipping mid-season potatoes: Worcester and Somerset counties.

2. Some principal shipping points: Pocomoke, Snow Hill, Costen, Beaver Dam, Girdletree, Queponco.

3. Principal variety: Cobbler.

4. Assembly conditions: Quite a number of growers raise carload lots. In other instances, carloads are made up from the fields of several growers.

5. Per cent handled by cooperatives: Fifty to 65 per cent.

6. Names of coöperatives or selling organizations: Peninsula Produce Exchange. Worcester County Farm Bureau Coöperative. American Fruit Growers. Atlantic Commission Company.

7. Carloads handled by individual (or firm, or organization) shippers

Shipper No. 1.....	600 to 700 carloads
Shipper No. 2.....	300 to 500 carloads
Shipper No. 3.....	125 carloads
Others .....	No information

NEW JERSEY.—Sources of information: W. H. Martin, plant pathologist, New Jersey Agricultural Experiment Station, New Brunswick, N. J. Potato Growing in New Jersey, Circular No. 140, New Jersey Agricultural Experiment Station, April, 1922. The Potato Industry in New Jersey, Bulletin No. 454, New Jersey Agricultural Experiment Station, November, 1927.

1. Districts shipping mid-season potatoes: Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Middlesex, Monmouth, Morris, Salem, Sussex, and Warren counties.
2. Some principal shipping points: Cranbury, Bridgeton, Hightstown, Robbinsville, Windsor, Prospect Plains, Freehold, Marlboro, Englishtown, Howell, Salem, and Daretown.
3. Principal varieties: Cobblers 70 to 75 per cent. Green Mountains 15 to 20 per cent.
4. Assembly conditions: The most of the growers raise carloads, but in many cases the cars are mixed, owing to the fact that a dealer might buy from a large number of growers.
5. Per cent handled by cooperatives: None. All sold by local dealers or by the growers themselves.
6. Names of cooperatives or selling organizations: None.
7. Carloads handled by individual (or firm, or organization) shippers: Majority of crop in central Jersey handled by three dealers, and by one dealer in southern Jersey.

KENTUCKY.—Sources of information : John S. Gardner, horticulturist, Agricultural Experiment Station, Lexington, Ky. R. W. Hite, manager, St. Matthews Produce Exchange, St. Matthews, Ky.

1. Districts shipping mid-season potatoes: Jefferson county. "Louisville district."
2. Some principal shipping points: St. Matthews, Prospect, Buechel.
3. Principal varieties: Cobbler, Carman.
4. Assembly conditions: Crop pooled under the St. Matthews Produce Exchange and the Buechel Produce Exchange.
5. Per cent handled by coöperatives: Eighty per cent, or more.
6. Names of coöperatives or selling organizations: St. Matthews Produce Exchange, St. Matthews, Ky. Buechel Produce Exchange, Buechel, Ky.
7. Carloads handled by individual (or firm, or organisation) shippers. Estimates :

Shipper No. 1.....	800 carloads
Shipper No. 2.....	50 to 100 carloads
Shipper No. 3.....	50 to 100 carloads

KANSAS.—Sources of information: J. C. Mohler, secretary, Kansas State Board of Agriculture, Topeka, Kan. Personal visits.

1. Districts shipping mid-season potatoes: Kaw valley—Shawnee, Jefferson, Douglas, Leavenworth, Johnson, and Wyandotte counties. Arkansas Valley—Ford, Reno, and Sedgwick counties.
2. Some principal shipping points: Rossville, Silver Lake, Topeka, Grant-

ville, Perry, Midland, Lawrence, Linwood, De Soto, Loring, Bonner Springs, Wilder, Edwardsville, and Dodge City.

3. Principal varieties: Cobblers, 95 per cent. Ohios, 4 per cent. Triumphs, 1 per cent.

4. Assembly conditions: Almost without exception, each grower raises carloads.

5. Per cent handled by coöperatives: None.

Names of coöperatives or selling organizations: None.

7. Carloads handled by individual (or firm, or organization) shippers:

Shipper No. 1.....	966 carloads.	Shipper No. 11.....	88 carloads.
Shipper No. 2.....	531 carloads.	Shipper No. 12.....	74 carloads.
Shipper No. 3.....	499 carloads.	Shipper No. 13.....	68 carloads.
Shipper No. 4.....	340 carloads.	Shipper No. 14.....	62 carloads.
Shipper No. 5.....	260 carloads.	Shipper No. 15.....	44 carloads.
Shipper No. 6.....	240 carloads.	Shipper No. 16.....	41 carloads.
Shipper No. 7.....	238 carloads.	Shipper No. 17.....	34 carloads.
Shipper No. 8.....	191 carloads.	Shipper No. 18.....	29 carloads.
Shipper No. 9.....	179 carloads.	Shipper No. 19.....	27 carloads.
Shipper No. 10.....	111 carloads.		

121 shippers, who handled from 1 to 25 cars.

MISSOURI.—Sources of information: The *Kansas City Packer*, Kansas City, Mo. W. H. Pointer, Orrick, Mo. Personal visit.

1. District shipping mid-season potatoes: Orrick district.

2. Some principal shipping points: South Liberty, Missouri City, Excelsior Springs Junction, Orrick, Camden, Henrietta, Hardin, Floyd, Atherton, Cobbler, and Courtney.

3. Principal variety: Cobblers.

4. Assembly conditions: Practically all growers raise carloads.

5. Per cent handled by coöperatives: None.

6. Names of coöperatives or selling organizations: None.

7. Carloads handled by individual (or firm, or organization) shippers: No information available. Two dealers prominent.

OKLAHOMA.—Sources of information: Marketing Bulletin, Oklahoma State Market Commission, Oklahoma City, Okla., May, 1927. Personal visit.

1. Districts shipping mid-season potatoes: Fort Gibson, Muskogee, Spiro, Webber Falls, Hugo, Idobel, Bixby, Coweta, Durant, Atoka, and Stigler.

2. Some principal shipping points: Antlers, Atoka, Bixby, Bokoshe, Boswell, Braggs, Coweta, Durant, Fort Gibson, Hugo, Muskogee, Spiro, and Stigler.

3. Principal varieties: Triumph, Cobbler.

4. Assembly conditions: Majority of growers raise carloads.

5. Per cent handled by cooperatives: Fifty per cent.

6. Names of cooperatives or selling organizations: Oklahoma Potato Growers' Association, Muskogee, Okla. Pushmataha County Farmers' Association, Antlers, Okla. Atoka County Potato Association, Atoka, Okla. Boswell Potato Growers' Association, Boswell, Okla. Union Valley Truck Growers, Stone-wall, Okla. Wister Potato Growers' Association, Wister, Okla.

7. Carloads handled by individual (or firm, or organization) shippers:

Shipper No. 1.....	500 carloads.	Shipper No. 7.....	40 carloads.
Shipper No. 2.....	500 carloads.	Shipper No. 8.....	40 carloads.
Shipper No. 3.....	100 carloads.	Shipper No. 9.....	40 carloads.
Shipper No. 4.....	100 carloads.	Shipper No. 10.....	30 carloads.
Shipper No. 5.....	50 carloads.	Shipper No. 11.....	30 carloads.
Shipper No. 6.....	50 carloads.	Shipper No. 12-17.....	25 carloads.

ARKANSAS.—No information. Fort Smith the principal district.

NEBRASKA.—No information. Kearney the principal district.

MINNESOTA.—Sources of information : A. G. Tolaas, chief, Potato Certification Division, Department of Agriculture, St. Paul, Minn. P. N. Davis, sales manager, Hollandale Cooperative Association, Hollandale, Minn. Personal visit.

1. Districts shipping mid-season potatoes: Hennepin, Anoka, Sherburne, and Freeborn counties.

2. Some principal shipping points: Osseo, Anoka, Elk River, and Hollandale.

3. Principal varieties: Ohios, Cobblers.

4. Assembly conditions: Some raise carloads. Many sell by wagon or truck load. Wagon-lot sale general adjacent to Minneapolis.

5. Per cent handled by cooperatives: Ten per cent.

6. Names of coöperatives or selling organizations: Hollandale Coöperatives Association, Hollandale, Minn.

7. Carloads handled by individual (or firm, or organization) shippers: No information available.

COLORADO.—Sources of information: W. H. Heppe, manager, Colorado Potato Growers' Association, Denver, Colo. W. H. Owen, supervisor of agriculture, D. R. G. & W. Railroad Co., Denver, Colo.

1. Districts shipping mid-season potatoes: Morgan, Weld, Delta, Mesa, Montrose counties, and San Luis Valley.

2. Some principal shipping points: Fort Morgan, Fruita, Mack, Delta, Montrose, Monte Vista, Hooper, Center, Loma, Gilcrest, Fort Lupton, Greeley, and Brush.

3. Principal varieties: Cobbler, Triumph.

4. Assembly conditions: The most of the growers ship carloads except in Mesa county, where the average acreage is about 10 acres per grower.

5. Per cent handled by coöperatives: Forty-two per cent of entire Colorado crop handled by coöperatives. Ninety per cent of Fort Morgan crop. Eighty-five per cent of Mesa county crop.

6. Names of coöperatives or selling organizations: Colorado Potato Growers' Exchange, Denver, Colo.

7. Carloads handled by individual (or firm, or organization) shippers: No information.

UTAH.—No information. Weber-Davis district the principal one.

IDAHO.—Sources of information: E. R. Bennett, field horticulturist, University of Idaho, Boise, Idaho.

1. Districts shipping mid-season potatoes: Lewiston district, King Hill district, and Canyon county.

2. Some principal shipping points: Caldwell, Nampa, and Wilder.

3. Principal varieties: Cobblers, Idaho Rural (Chas. Downing), Triumph.

4. Assembly conditions: The most of the growers are carload shippers. In some cases dealers buy wagonloads and make up carloads.

5. Per cent handled by coöperatives: No coöperatives handling mid-season potatoes.

6. Names of coöperatives or selling organizations: None.

7. Carloads handled by individual (or firm, or organization) shippers: No information.

WASHINGTON.—No information. Yakima and Walla Walla districts the principal districts.

CALIFORNIA.—Sources of information: H. G. Zuckerman, potato grower and dealer, Berkeley, Cal.

1. Districts shipping mid-season potatoes: Los Angeles, Shafter, Stockton, Colma, Salinas.

2. Some principal shipping points: San Fernando, Redlands, Riverside, Weed Patch, Wasco, Stockton, San Francis, and Colma.

3. Principal varieties: White Rose, British Queens, Burbank, Garnet Chili.

4. Assembly conditions. Los Angeles district, 80 per cent of the growers raise carloads; the remainder are small growers. Other districts raise carloads.

5. Per cent handled by coöperatives: None.

6. Name of coöperatives or selling organizations: None.

7. Carloads handled by individual (or firm, or organization) shippers: No information.

It is apparent that there is a wide range of conditions under which the mid-season potato crop is produced and marketed in the various sections. These conditions are pertinent in an analysis of market factors, and an understanding of them is necessary for any plan of improvement in marketing conditions. It has been pointed out above that the rate of movement to market is a factor affecting the market. The underlying factors affecting the rate of movement are no doubt the conditions existing in the various producing sections. If an attempt should be made to control the flow to market, one should know what existing agencies may be utilized in the control. If there is a workable set-up in a district it should take a dominant part. Where agencies are lacking the type of agency best suited to the conditions needs careful attention. The conditions as described in the various districts are drawn upon in the following discussion on possible means of improving the situation.

## XII. THE NEEDS OF CONSUMING SECTIONS

**Areas Consuming Mid-season Potatoes.**—Nearly every state in the Union is a consumer of mid-season potatoes, and practically every producing district makes shipments within the borders of the state in which it is located, as well as to adjoining states. This has been shown graphically by Strowbridge.<sup>39</sup> The Southern states use potatoes from the mid-season districts after their early crops are exhausted, and the Northern states purchase mid-season potatoes prior to the harvest of their late crops.

39. Strowbridge, J. W.: *Op. cit.*, pp. 14, 91, 24.

**Shifts in Demand.**—The needs of the areas consuming mid-season potatoes are influenced by the size of the crop in these areas. Some potatoes are produced in every state, and these are in many cases produced in home gardens. The volume of this production may assume considerable proportion. For instance, in 1927 Iowa produced 6,396,000 bushels of potatoes, while Kansas produced 5,390,000 bushels.<sup>40</sup> Yet Iowa is not important as a commercial potato producer and is a deficiency area. Furthermore, when the home gardens ripen, there is a lessened demand for potatoes from the commercial districts. Another factor influencing the demand is the relative earliness or lateness of the movement from the early and late districts. If the early districts move their crops to market earlier and at a faster rate than is usual they become consumers of mid-season potatoes at an earlier date, and vice versa. Similarly, if the late districts are ahead of season they at times become competitors of the mid-season districts rather than consumers of the mid-season product. The weekly summaries issued by the Market News Service of the Bureau of Agricultural Economics give information on the movement with comparisons for previous seasons, and should be studied carefully by those engaged in the marketing of the mid-season crops. Unfortunately these shifts in demand do not lend themselves to statistical measurement. The best that can be done to gauge them is to consider the factor of total United States production as already suggested under the discussion on supplies, and to study current information on the rate of movement to market as shown by the weekly Market News Service reports.

**Relative Constancy of Demand for Potatoes.**—Potatoes are one of the main sources of starch in the American diet. As already pointed out, they are one of the cheapest sources of human energy. Swanson<sup>41</sup> states that the starch in potatoes has the same caloric value as starch from wheat flour, and that potatoes are rich in vitamin B. These facts are not generally known among consumers of potatoes, but the demand for potatoes is relatively constant. Consumers do not change their diet to a marked degree whether potatoes are cheap or expensive. Consequently a slight shortage or deficiency in supplies is soon reflected in prices. Working<sup>42</sup> has shown that general business conditions, except to the extent to which

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40. United States Department of Agriculture Yearbook, 1927, p. 883.

41. Swanson, C. O.: *Wheat Flour and Diet*. The Macmillan Co., New York, 1928, pp. 135, 177.

42. Working, Holbrook: *Factors determining the Price of Potatoes in St. Paul and Minneapolis*. Technical Bulletin, No. 10, Minnesota Agricultural Experiment Station, October, 1922, pp. 4, 22, 26.

they are reflected in the general price level, have little or no effect on the price of potatoes. Hence potatoes are a commodity for which the demand is relatively inelastic, and as a consequence supplies, their position, rate of movement to market, and quality and condition are the dominating factors in determining prices.

### XIII. THE INFLUENCE OF QUALITY AND GRADES ON DEMAND

Consuming areas are always interested in the quality and grade of the product purchased. Consequently it is of utmost importance to a district to grow and pack high-quality potatoes. If a producing section wishes to have access to a broad market it must pack its output to meet the demands of the consumer. Here there is a conflict of interest between producing areas, for it would be to the advantage of one district to have another excluded from competitive trade territory by reason of the poor quality it put up. From the standpoint of the poor-quality territory, however, it would be detrimental, because it would narrow the outlet for its product.

The influence of proper grading as a means of extending the market outlet for the Kansas potato crop was shown by the author in 1925.<sup>43</sup> Before the adoption of standard grades the marketing area was confined almost entirely to five states, while after the adoption of grades the marketing area was enlarged to include fourteen states.

Potatoes of inferior quality are usually handled by speculative dealers rather than by dealers with an established trade. The speculative dealer is in and out of the market as he sees a chance to make money. On the other hand, the dealer with an established trade is a constant buyer. He purchases the best available with which to supply and keep his customers. Naturally it is to the advantage of the producer to pack a high-quality product if he wishes to have a constant market through the established dealer. The individual producer is often at a disadvantage in this respect, because the consuming trade rarely knows individual producers. It knows the districts, and perhaps a dealer or two in the districts, but seldom comes in contact with the individual. Consequently a buyer judges the product of the entire district by the first shipment purchases. If grades are not established and he secures a poor shipment he will cease to be a purchaser from that district if he can possibly get supplies from another territory. Thus every producer in a given district has a common interest in the quality of the product that is sent to market from his district.

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43. Stokdyk, E. A.: *The Value of Extension Organization*. Op. cit., pp. 7-8.



#### XIV. MEANS OF IMPROVING THE MID-SEASON MARKETING SITUATION

The foregoing analysis of factors influencing the mid-season potato market might be left to stand without a discussion of means of improving the situation. Those engaged in potato production and marketing are constantly endeavoring to improve the situation. They have their capital tied up in the industry. The producer has invested in potato production his machinery and equipment as well as his technical skill gained by years of experience and study. Anyone who doubts the importance of the latter factor need only visit some of the progressive potato growers. He will be astonished at the knowledge the growers possess of chemistry, entomology, plant pathology, biology, and nutrition. He will realize that it is a science as well as an art to produce potatoes. Similarly those engaged in the marketing of potatoes have invested in trade connections, good will, equipment, and technical knowledge. It is not easy for an established producer or marketing agency to shift to other lines of endeavor.

Several proposals have been advanced to improve the potato marketing situation. Some of them contain considerable merit, others are visionary. Some call for group action, and others for individual action. The various proposals may be discussed under the headings similar to those used in connection with the foregoing discussions on supplies.

##### LIMITATION OF SUPPLIES OR PRODUCTION CONTROL

One of the first proposals made to improve the market for agricultural products was a reduction-of-acreage campaign. Hibbard<sup>44</sup> has traced the results of the attempts made in the South by the cotton growers. He quotes a Farmers' Union leader as saying: "Whenever we tell the farmer to plant less cotton they plant more." One of the older residents of Kansas related to the author an attempt to control broom-corn acreage in his vicinity. "At the meeting," he says, "everyone agreed to cut down his acreage of broom corn, but that night there wasn't a pint of broom-corn seed to be bought in town, and the acreage was bigger than ever." The reason lies in the obvious fact that the individual's interest is different from that of the group as a whole. The grower will reason that if other growers are going to cut down their acreage prices will be high, and

<sup>44</sup>. Hibbard, B. H.: *Marketing Agricultural Products*. D. Appleton & Co., New York, 1921, pp. 244-245.

by putting in a few acres more he will be able to pay off his mortgage.

Proposals to plow up a portion of the crop to enhance the value of the remainder are in the same class as reduction of acreage campaigns. Here, again, the individual's interest is at variance with the group interest.

A more comprehensive plan to limit acreage was recently proposed at a potato growers' conference which the author attended. It was proposed that the federal government list the acreage of every potato grower in the United States and from year to year decide how much each one should alter his acreage. Such a plan assumes that all the land adapted to potatoes is now planted in potatoes, and that only those engaged in potato production at the present time would be potato growers another year. To put it into effect the federal government would be obliged to regulate every acre of every crop, as well as to state which land should be cultivated and which should not. Granting that the majority would agree to such a plan, one would have a tremendous job to enforce it. It would call for government control such as was never known.

"Intentions to plant" reports issued by the Bureau of Agricultural Economics of the United States Department of Agriculture are production-control methods of rather recent origin. However, their full significance has not yet been apprehended. Furthermore, there are in many cases no adequate agencies set up to spread the information contained in these reports. Again the fact that the "intentions reports" are of rather recent origin has caused producers to wonder how the reports will influence actual plantings. Too much emphasis might take the form of an acreage-reduction campaign and have the effect of increasing acreage.<sup>45</sup> It must be recognized that acreage reduction, no matter by what means accomplished, will not always act as a production regulator. Although, as was shown in figure 3, there is a close relation between acreage and production, yet in three years of the eight under consideration the trend in production moved in an opposite direction from the trend in acreage. The seasonal factors of temperature and moisture have an effect on total production which cannot be measured prior to the planting of the crop.

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45. The "intentions to plant" reports have been remarkably accurate. In 1923 the intention report was within 2.6 per cent of the actual acreage planted in the United States. In 1924 it was within 2 per cent of the actual acreage; in 1925, 3.3 per cent; in 1926, 3.3 per cent; in 1927, 2 per cent; and in 1928, 2.1 per cent. Every potato grower should avail himself of these reports. They may be secured from the Bureau of Agricultural Economics at Washington, D. C., or the National Potato Institute, H. B. Tabb, executive secretary, 9 South Kedzie Ave., Chicago, Ill., or from the Department of Agricultural Economics, Kansas State College, Manhattan, Kan.

Other proposals to limit the total supply which have come to the author's attention are those which deal with the limitation of supplies after the crop is produced by the application of grading rules. In 1928 the suggestion was made that potato growers be urged to use a two-inch screen rather than the usual inch and seven-eighths screen. This, it was thought, would help to diminish the supplies on the market. No doubt it would if everyone would keep the small potatoes at home. Yet it is apparent that should prices become favorable these would move to market. A more far-reaching proposal recently suggested by a correspondent is that a federal regulation be passed which would describe the various grades of potatoes that would be permitted to move in interstate commerce each year. For instance, if the crop were reported to be 467 million bushels, only grade No. 1 should be permitted to move, while if the crop were 367 million bushels, grades No. 1 and No. 2 should be permitted to move. Let us grant for the moment that such a regulation were put into effect and sustained by the courts as legal. What would happen? If all the potato-producing districts were as far from the center of population as the Western states the regulation might be enforced, for few potatoes would be hauled by trucks from that distance. However, since many districts are near the centers of population such a regulation would have the effect of stimulating the trucking of potatoes and the bootlegging of potatoes of inferior grades across state boundaries. Likewise there would soon be an increase in acreage of potatoes near the cities, for such a regulation, if enforced, would assure the growers in the immediate vicinity a good price for all their potatoes every year. Those dependent on moving their crops by rail would be forced out of the business.

But it is doubtful if such a procedure would be held legal, and no doubt soon be attacked if put into effect. One district, in a particular year, might have an extremely low-quality product. A strict grading regulation would prohibit it from shipping outside of the state. Would growers stand by and watch a competing district move its crop to market without action? They might be granted special privileges in view of their situation, but would growers in other districts then be satisfied? If A could ship No. 2's, B would want to have the same privilege. Furthermore, growers in a small state, as Maryland, dependent on an outside market for sale of their potatoes, would have little chance in comparison with growers in a big state, as New York, where home-grown supplies of good and poor quality could be consumed.

Limitation of supplies by restriction of acreage or by restriction of shipments involves so many complications that it is well nigh impossible of accomplishment. The individual's interest is too diverse from that of the group as a whole. As long as land can be utilized for the production of various crops, producers will be guided by prices in planning their operations. Unfortunately the majority are persuaded in their choice of crops by prevailing prices rather than prospective prices. Consequently periods of overproduction and underproduction of individual commodities are constantly recurring. Potato producers are not alone in this dilemma. Producers of other agricultural commodities face the same situation. The best possibility of correcting the maladjustment is the study of production trends and prices by individuals or groups of individuals. It is unlikely that a perfect adjustment will ever be reached. Under the existing organization of the agricultural industry it is doubtful whether individuals or groups can or will arrive at the proper balance in production, with prices satisfactory to all or the majority of the producers. But if some individuals or groups who are in a position either to expand or contract their production by an increase or decrease in acreage will study and act on information regarding prospective acreage as reported in "intentions to plant" reports, they will have some influence in correcting the swings of overproduction and underproduction.

**CONTROL OF THE MOVEMENT TO MARKET**

Attempts to control the movement to market in the marketing of fruits and vegetables have usually been made by cooperative associations. This purpose was not defined as one of the objectives of the organization in their early history, nor to-day in the case of independent local associations. Other objectives, such as lowering both assembly costs and the margins between prices received at the local market and prices received at the wholesale market, were foremost. Gradually, as independent associations federated, control of the flow of the product to market and the avoidance of market gluts and famines became more important. Individuals and groups of individuals, acting without knowledge of the operations of one another, could not avoid excessive competition in particular markets. As shown in the case of mid-season potatoes, this results in overloading certain markets at times, producing unprofitable prices in case one market is a dominating or key market. It is little consolation to a small producer to see the price recover after he has

sold on a low market. On the other hand, the dealer who is in the market every day loses on the low market but gains on the advance. Producers, therefore, become interested in the flow to market and also in the practice of pooling shipments over a period of time to spread their risks on market fluctuations. Naturally the cooperative operating on a pooling principle offers such possibilities.

**POSSIBILITIES AND LIMITATIONS OF COOPERATIVE ASSOCIATIONS**

In the marketing of the mid-season potato crop coöperatives play an important part, as was shown in the survey of conditions in various producing sections. In Virginia, Maryland, Kentucky, Oklahoma, and Colorado, coöperative associations are existent which handle a considerable portion of the crop. Some of them perform the function of assembly and others merely act as sales agents for individual carload producers. Data are not available to determine whether or not the coöperatives have functioned in these capacities more efficiently than private agencies in each of the districts in which they are located. It is reasonable, however, to assume that they have performed these functions satisfactorily, otherwise they would not continue to receive the support of the producers. In some of the districts with which the author is familiar, where coöperatives are nonexistent, there is no problem of assembly since practically every producer is a carload producer and the sales method through private agencies is regarded as satisfactory. Where assembly problems are important, and where private agencies have taken wide margins, coöperatives are important to potato producers. Again where individuals are unable to stand the financial risk of disposing of their product on a falling market the pooling practice has been an aid in spreading their risk.

In the field of the control of movement to market, potato coöperatives working alone have not been able to make a satisfactory showing. Their volume has been too limited and it is doubtful if they will ever secure sufficient tonnage to make possible effective control of the flow to market. The reason is found in several circumstances. In the first place, some of the larger producers in several districts have built up trade connections which they are unwilling to surrender. They operate on a scale large enough to withstand market fluctuations, and may be classed as producer dealers. In the second place, many producers are financed by private agencies, and are not free to join coöperative associations. Furthermore, some producers are connected by blood or friendship

with private dealers, which fact enjoins them from becoming members. Lastly, but not least in importance, many are indifferent or antagonistic to coöperative associations.

It is easy enough to state that individuals should submerge their interests for the benefit of the whole, but putting it into effect is quite a different matter. The opposition of established private agencies to coöperatives is undying. This is not difficult to understand. The private agency has certain intangible assets in its trade connections, good will, and going business value, which a coöperative tends to destroy. Few coöperatives have recognized such a value attached to a private agency, and most have not reached the point where they are willing to buy out the private agency and pay for the values which they seek to obtain.

**POSSIBILITIES AND LIMITATIONS OF CLEARING HOUSE ASSOCIATIONS**

The realization of the fact that coöperatives have not been able to secure control of enough of the product to regulate the movement to market has led to a form of coöperation on a larger scale which includes not only the producers, but also distributors. This is the clearing-house association. Most of the associations originated in the Western states, in California, Washington, and Idaho. The plan was first put into operation in marketing the Walla Walla prune crop, according to Spangler.<sup>46</sup> Shippers reported their sales to the clearing house and worked out a plan of distribution. The results were: (1) A tendency to stabilize the market; (2) a closer working relationship between growers and shippers in the same section, and growers and shippers in other sections; (3) more even and wider distribution of the product; (4) better advertising; and (5) more satisfaction to the growers.<sup>47</sup> Sherman<sup>48</sup> reports similar results with clearing-house associations in California. His description of the Clearing House Association of the Gravenstein Apple Growers is as follows:

Growers are signed for a period of fifteen years with the privilege of withdrawal at stated annual intervals after two years. Separate growers' units are formed according to the selling agency through which they wish to market; that is to say, the members of each cooperative form a separate unit, and those growers wishing to deliver and market through the John Brown Fruit Company form another unit and so on. Each unit elects a director of the central organization. These directors are given very broad powers, but it is

46. Spangler, R. L.: Report of Sales and Consignment Committees. The Coöperative Marketing Journal, March, 1928, p. 50.

47. Ibid. P. 51.

48. Sherman, Wells A.: Unifying the Commodity Industry. Three California Examples. The Coöperative Marketing Journal, March, 1928, pp. 41-48.

provided that the total vote of directors representing commercial units shall at no time exceed the total vote of directors representing cooperative units.

The clearing house is made a part of the general scheme and is composed of representatives of the different selling agencies together with an equal number of growers appointed by the directors of the central body. The selling agents are also signed up for fifteen years with privilege of withdrawal after two years, and can handle only fruit of members. Growers may withdraw from one unit and join another if they so desire, but they can market their fruit only through a clearing-house member.

Now as to actual operations of the clearing house. The two outstanding features are distribution and price regulation. Through the courtesy of the railroad companies, we first had a statement prepared showing the final destination of Gravensteins shipped during the past five years, which enabled us to determine the approximate capacity of all previously developed markets. Thus we were able to decide in advance the number of cars allowed to be shipped to any one market. No restrictions were placed on the number of cars sold f. o. b. of any market, but after that market's allotment had been filled, no shipper was permitted to make additional shipments on consignment or for delivered sale:

Each shipper makes a confidential report to the secretary of cars shipped, giving car number, destination, grade, and whether sold or rolled. These reports are combined and tabulated by the secretary daily and reported to the clearing house, so that each member knows the total number of cars shipped, how many to each market, and whether sold or consigned.

Now as to another important provision; that is, an established minimum f. o. b. price. The contract provides as follows: Minimum f. o. b. prices shall be set from time to time by authority of the directors of the central, after conferring with the clearing-house board and taking into consideration the recommendations of clearing-house members representing two-thirds of the tonnage, and no f. o. b. sales shall be made by any unit at a lower price than this minimum. The board of directors may make such differential as it may deem proper between sales made for cash paid at or before shipment as against other types of sale.

It will be noted that the most of the clearing-house associations are located in the far West. Furthermore, these associations handle a crop whose production is confined to a rather small area in the United States. However, a form of the clearing-house association is in operation in the field of potato marketing in the Eastern states. It will be of particular interest to those interested in potato marketing to examine it.

The Eastern Shore Farmers' Association, also called the Del-Mar-Va Eastern Shore Association, was organized in 1927. Its principal activities are directed toward establishing minimum price quotations rather than regulated distribution. Its primary object as described by Bomberger<sup>49</sup> is the "restriction and restraint of a

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49. Bomberger, F. B.: Quotation Committee, Eastern Shore Farmers' Association. *Co-operative Marketing Journal*, March, 1928, p. 85.

highly destructive competition among selling organizations interested primarily in getting their respective shares of the selling business, apparently without much regard for the selling price at which the commodity was to be sold.”

The destructive competition referred to by Bomberger is apparent to those familiar with the marketing of the mid-season crop. A vivid instance came to the attention of the author in 1928. On Wednesday, July 25, 1928, the author witnessed growers at Topeka, Kan., making sales of United States No. 1 potatoes for 50 cents per hundredweight. The same day, at Lawrence, Kan., he found growers selling the same grade of potatoes for 35 cents per hundredweight; this in spite of the fact that the growers at Lawrence have a lower freight rate to the principal consuming markets than the growers at Topeka. Such a situation places the selling agencies at Lawrence in a position to underquote the Topeka agencies and results in a destructive competition.

The plan of the Eastern Shore Association is best described in their articles of agreement:<sup>50</sup>

This is to certify, that we, the undersigned farmers of the Eastern Shore of Virginia, Maryland, and Delaware, do hereby associate ourselves to establish an association for the purpose and under the name hereinafter mentioned, set forth as follows:

First—The name of this association is to be: “The Eastern Shore Farmers’ Association.”

Second—Its principal office shall be located at some convenient point or place on the Eastern Shore.

Third—The purposes for which the association is formed are as follows:

1. To improve the marketing conditions on the eastern shore of Virginia, Maryland, and Delaware.
2. To stimulate a normal and healthful demand for our produce among the buyers abroad and make intelligent distribution of the farmers’ products among all the markets available.
3. To get for the farmers the best prices obtainable under market conditions existing at the time their produce is offered for sale.

Fourth—The affairs of the association shall be managed and controlled by a board of managers, who shall hold office for one year, consisting of two from each of the several magisterial districts of Accomack and Northampton counties, Virginia, except the islands district in Accomack county, and two from each of the counties of Worcester, Somerset, and Wicomico, in Maryland, and two from Sussex county, in Delaware. The managers shall be elected by the farmers in each magisterial district and counties aforesaid, who are members of the association. One member of said board shall be elected as chairman and one member as secretary-treasurer. All of said managers shall serve

50. Eastern Shore Farmers’ Association. Articles of Agreement and By-Laws. February 6, 1928, pp. 1-6.



without compensation except the secretary-treasurer. The managers shall be elected annually in the manner aforesaid.

Fifth—The board of managers shall appoint a quotation committee consisting of three members selected in the following manner: One member from two nominations submitted by the Eastern Shore of Virginia Produce Exchange, one member from two nominations submitted by the Peninsula Produce Exchange, and one member from two nominations submitted by the independent agencies or dealers on the Eastern Shore of Virginia, Maryland, and Delaware. If any of the nominations submitted by the aforesaid organizations are not acceptable to the board of managers, then the respective organizations shall make additional nominations. In the event the aforesaid organizations shall fail or refuse to make said nominations, then said committee shall be elected by the board of managers in such manner as may seem best and most advisable. Said committee shall be paid and receive such compensation as the board of managers may determine. No member of the quotation committee, after having accepted appointment on the said committee, shall be affiliated or on the pay roll of any affiliated dealer or dealers. The salary and expenses of said committee, also the necessary expenses of the secretary-treasurer's office, shall be borne and paid by the several agencies on the Eastern Shore of Virginia, Maryland, and Delaware, in proportion to the amount of business done by them respectively. The duties of the quotation committee shall be :

1. To issue quotations daily on the sale of Irish and sweet potatoes, together with any other farm produce which the board of managers decide should be similarly supervised, taking into consideration the several brands and grades under which said potatoes and other products are marketed. The several marketing agencies and dealers affiliated and handling the produce of the members of this association shall grade and sell the said produce under three brands. The first, or best, brand shall meet the requirements of United States No. 1 or better. The second brand shall be such as fail to meet the United States No. 1 and superior to the grade known as United States No. 2. The third brand shall be equal to such grade as is machine graded and generally known as "gear wheel." All potatoes failing to meet these grades shall be under plain cover. All marketing agencies affiliated with this association shall have three cover brands representing the above grades, and shall register same with the quotation committee.

2. To issue such rules and regulations as shall seem most advisable governing the loading and distribution of said potatoes, and other products, and to exercise a general supervision over the marketing of and payment for said potatoes and other products on the Eastern Shore of Virginia, Maryland, and Delaware. The place of meeting and manner and method of procedure shall be left to the discretion of the quotation committee.

Sixth—Each exchange and the several independent agencies or dealers shall furnish promptly to the quotation committee the name of any buyer or dealer who, without sufficient and justifiable cause, has refused to live up to and observe his or its contract, and no further sales shall be made to said unsatisfactory buyer by any cooperative exchange or independent dealer, or their

representatives, till said buyer is ordered reinstated by said quotation committee.

Seventh—The several marketing agencies on the Eastern Shore of Virginia, Maryland, and Delaware, handling the produce of the members of this association, shall enter into and acknowledge a bond in the penalty of twenty-five hundred dollars (\$2,500) payable to the aforesaid association, and with such surety as the board of managers shall determine, and on condition that they will not sell, nor offer to sell, nor quote Irish or sweet potatoes, or such other produce as the board of managers may decide to supervise, at less than the price named by the aforesaid quotation committee, without the knowledge and consent of said committee, nor will they, secretly or otherwise, misrepresent No. 1 produce as being of inferior grade (whether done verbally or by misuse of an inferior cover brand) in order to move such produce at a less price than that named by the price-quoting committee for No. 1 goods; nor will they violate any regulation as to embargoes and loadings; nor offer for sale, or sell to any firm or corporation as may be designated by the quotation committee as unsatisfactory buyers; and, in addition to said bond, if any of the said marketing agencies on the Eastern Shore of Virginia, Maryland, and Delaware, sell, or offer to sell, or quote any potatoes or other products for less than the price named by the said quotation committee, or violate any of the provisions of this bond, without the knowledge and consent of said committee, said marketing agency or dealer so violating the agreement shall be refused any information by said quotation committee, and the fact of such violation shall be published in all the papers on the Eastern Shore of Virginia, Maryland, and Delaware.

Eighth—The several marketing agencies and dealers handling the produce of members of this association shall be required to render to the secretary-treasurer of this association, on the first day of each and every month, and as often thereafter as required by the quotation committee or the secretary-treasurer of this organization, a sworn statement of his or its financial standing.

Ninth—A commission of 5 per cent on the gross sales shall be charged by the several marketing agencies for selling Irish and sweet potatoes, and other products, with a minimum charge of 15 cents per barrel and a maximum charge of 25 cents per barrel, which said commission charge shall include all brokerage and expenses incident to selling said crops, except demurrage and team track storage.

Tenth—The several marketing agencies shall be required to adopt a uniform account of sales to be prepared by the quotation committee, which shall show date of loading, date of sale, and the price returned, less itemized deductions.

Eleventh—We further certify and agree, as evidenced by our signing this certificate and agreement and thereby becoming members of this association, that we shall abide by and support the provisions of this agreement, and further that we shall market our produce through the marketing agencies or dealers who subscribe and conform to the requirements of this association, and further, that we will not patronize or support any marketing agency or dealer who does not subscribe and conform to the requirements of this association. We further agree that if we violate any provisions of this agreement, in addition to the other penalties prescribed, we shall forfeit to said organiza-

tion the sum of 25 cents for each package shipped or sold to any dealer or agency not affiliated with this organization, which said amount shall be considered liquidated damages. We hereby waive our homestead exemption as to this obligation. This agreement shall be effective for a period of one year and continuously thereafter from year to year, except that any member may resign by written notice to the secretary of this association during the month of November in any year.

Twelfth—This agreement shall not be binding unless the farmers in the counties aforesaid, representing 85 per cent of the acreage to be planted in Irish and sweet potatoes, shall sign this agreement on or before January 17, 1928. The board of managers shall be the judge as to whether a representation of 85 per cent of the acreage has been secured.

Given under our hands this the — day of —, — 192—.

(Signed) \_\_\_\_\_

The clearing-house association is wider in its scope than the co-operative association applied to potatoes has been. It aims to regulate the flow and distribution to certain markets and to establish minimum price quotations. To accomplish this purpose it is necessary to gain control of most of the product. Some associations feel that an 85 per cent control is adequate, while others place the figure at 90 per cent.<sup>51</sup> It is apparent, however, that a large portion of the crop must be controlled before the objects can be accomplished. At the outset, then, a limitation of the clearing-house association is the proportion of the crop that it can get under its control. It is also evident that clearing-house associations cannot accomplish the full results desired if competing districts are not in accord and in cooperation with the program. In a given district a clearing-house association can only control the flow to market to the territory where it has a distinct freight advantage with negligible competition from other districts. In the territory in which the districts compete the cooperation of the various districts is necessary. However, it is to the advantage of each district to regulate the distribution of its product in the territory in which it has little competition rather than to kill the market in that territory by excessive shipments.

A question at once arises. What would become of the product in excess of the quota for each market if all the districts were marketing under the system of clearing-house associations, these associations cooperating in the distribution of the crop to the various markets? In other words, suppose it were found that Chicago could handle 200 carloads daily, Cincinnati 100, Cleveland 50,

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51. Spangler, R. L.: Report of Sales and Consignment Committees, Coöperative Marketing Journal, March, 1928, p. 49.

Fort Worth 30, and so on, what would become of the excess if there were carloads loaded in the various districts in excess of the requirements of each of the consuming markets? In such a case the shipments to each market would be increased. Instead of 200 going to Chicago, 210 or 220 would be sent there, and a similar increase would be made to other markets. This is the method employed by existing clearing-house associations. Such a procedure has a better effect than the present method of dumping all the excess on one particular market, or, worse still, on the key market. In fact, a key market should be kept undersupplied rather than oversupplied.

The operation of a clearing house confined to one or two districts would necessarily be limited in its scope to noncompetitive territory. It would be impossible under such a plan to sustain prices much above the levels in competitive territory, because the problem would at once arise as to who should be allowed to ship his product to the advantageous territory and who should ship to the competitive territory. Shipments might be restricted to sales made f. o. b., but if returns from these sales were much above those realized from sales to competitive territory, those who were unable to make sales would soon become dissatisfied. This would result in withdrawal from the association or violation of agreements. Nevertheless, a clearing-house association can perform a definite function by preventing a demoralization of the market in the territory in which it has a natural advantage because of proximity.

The minimum quotation plan operated either in connection with a clearing-house association which regulates shipments, or without connection with such an association, has decided advantages. At first glance, such a plan appears as price-fixing. An analysis of it shows that it is not price-fixing, but an attempt to stabilize the market. The quotation committee, after making a survey of the market situation, determines a minimum price. If the committee found that the product will not sell at that price, the price must be, and is, lowered to a point where it will sell. This is far from price-fixing. The advantage of such a procedure is apparent, however, for each shipper lowers or raises his minimum price at the same time, which fact tends to stabilize the market. The author is familiar with the operation of such a procedure in a small way. In some of the producing districts with which he is acquainted, one or two dealers establish the market for the day in that territory. Buyers and sellers agree on sales during the day, but the price is

stated as "at the market" as established by the controlling dealers in the evening. This has resulted in better relations between buyer and seller, and has improved the local market. The minimum-quotation plan is an attempt to apply the same procedure to districts as a whole.

The success of a clearing-house association and minimum-quotation plan depends primarily on the producers. If they join and stay with an organization that is operated on this basis, dealers will be forced to join or will not be able to secure volume enough of the product to do a profitable business. Dealers or associations of producers who take into consideration the welfare of the producers have nothing to fear by joining a clearing-house or minimum-quotation plan. Their welfare is dependent upon the success of the producer. Their field of service is not in the least restricted by such an organization. The minimum quotation does not prohibit sales at higher prices but leaves the selling agency free to secure any advantage that may accrue to it through service, good will, and trade connections.

**POSSIBILITIES AND LIMITATIONS OF "ESTIMATE OF ARRIVALS" SERVICE**

In the marketing of live stock the Market News Service of the Bureau of Agricultural Economics issues an estimate of arrivals for the leading markets a day in advance. Shippers who are near these markets are then in a position to judge whether, on a particular day, the market is likely to be overloaded with supplies, or whether the market will be short of its usual supplies, and can make their shipments accordingly. Likewise in the case of shipments of several fruits and vegetables, which originate on the Pacific coast, the Market News Service makes estimates from three to four days in advance, of the number of carloads that will arrive on certain eastern markets. With this information at hand shippers can avoid shipping to an overloaded market by diverting the carload before it reaches that market.

Such a service applied to the marketing of the mid-season potato crop would no doubt be highly advantageous. Estimates, if made three to four days in advance, and corrected daily to show diversions and additional billings, would be a distinct aid to shippers in assisting them to prevent market gluts and famines. A shipper having an unsold car rolling to market could better afford to divert it to a market having indications of being undersupplied than to consign it to one which was likely to be oversupplied.

The success of such a service for the mid-season potato market would be dependent upon the coöperation of shippers. In the estimate of arrivals of live stock, the empty cars ordered give a good indication of the arrivals. On the other hand, cars ordered for the shipment of potatoes give little indication of the loadings, and no indication of the destination to which the carload will be shipped when loaded. In the case of shipments of produce from the Pacific coast the time that elapses between shipment and arrival on the eastern market is ample to allow the Market News Service to obtain a list of destinations from railroad reports. But in the case of mid-season potato shipments there is often only a few days between the movements from shipping point and arrival at destination. By the time records were secured from railroad reports, tabulation made, and dissemination effected, the information would be of little value. Consequently the coöperation of shippers in reporting billings and diversions promptly would be necessary.

**COMBINED PLAN FOR IMPROVING THE SITUATION**

Several of the proposals for improving the situation, discussed above, have some merit. A solution may therefore lie in a combination of them in a comprehensive plan.

The foundation of any plan will necessarily depend on the producers. Their wishes will determine the direction of any action that may be taken. Their understanding of the factors affecting the market and the possibilities and limitations of adjusting the factors is of prime importance.

From the foregoing analysis it appears that there are possibilities for improving the situation by regulating the distribution to various markets and minimizing price fluctuations through uniform price quotations. To accomplish this the first step would appear to be the organization of producers in a given producing district into strong units. This may be accomplished by the extension of existing coöperative associations, the formation of new associations, or the grouping of growers around strong private agencies which have demonstrated an interest in the welfare of the producer and are performing the functions of assembly and sales satisfactorily. The coöperative has several advantages in the formation of local units where the growers may be classed as small growers, and where the problem of assembly is important. Furthermore, where growers are desirous of operating under a pooling plan the coöperative is the logical plan of organization.

The next step would be the organization of the local units, both coöperative and private, into a clearing-house association, where it is obvious that one coöperative cannot secure control of most of the product in a producing section. The field of such an organization would be the distribution of shipments to the various markets and the maintenance of minimum-price quotations in accordance with market conditions. It is evident that such an organization would be dependent on the strength of the local units and the support of producers. Consequently the stronger the local units the better the chance for success. The plan of operation has been discussed above and needs no further elaboration.

The clearing-house association, with the information it has on the shipments of its members, would be in a position to coöperate with the Market News Service in an "estimate of arrivals" service. The success of such a service would be dependent upon the extent to which clearing-house associations or exclusive coöperatives were organized in the various districts.

The ideal would be a clearing-house association or an exclusive coöperative existent in each of the producing districts. By acting together in the distribution of their product to key markets and in avoiding market gluts and cross hauling, they could greatly improve the situation. This would necessitate a superorganization which might be termed a clearing house of clearing-house associations.

Such a plan might be termed idealistic. However, a start has been made by the biggest of the mid-season producing districts, the Eastern Shore of Virginia. Other districts have become interested in it, and it is clearly within the range of possibility that such an organization may become an actuality in the near future.

**STATISTICAL APPENDIX**

In the foregoing discussion reference has been made to statistical calculations and tables. Since these are rather uninteresting to the average reader and the tables were presented graphically, it was thought best to separate the statistical part from the main discussion. For those who are interested in the sources of information, the methods of computation, and the results for particular data, the following is included.

**THE CORRELATION COEFFICIENT**

In calculating the correlation coefficient the formula suggested by Ayres has been used:

$$r = \frac{\sum xy - \frac{\sum x \cdot \sum y}{N}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{N}\right) \left(\sum y^2 - \frac{(\sum y)^2}{N}\right)}}$$

$x$  and  $y$  are the variables and  $N$  the number of cases.

The probable error of the coefficient was calculated by the formula suggested by Odell: P. E. = .6745  $\frac{1-r^2}{\sqrt{N}}$  where  $r$  is the correlation coefficient

and  $N$  the number of cases. This formula does not hold, however, when the number of cases is small, because from 30 cases down the size of the errors increases more rapidly than  $\frac{1}{\sqrt{N}}$ . Calculations were made using four-place logarithmic tables.

**STANDARD DEVIATION**

The standard deviation was calculated by the formula  $\sigma = \sqrt{\frac{\sum d^2}{N}}$  where  $d^2$  is the square of the differences of each case from the mean and  $N$  is the number of cases.

**REGRESSION COEFFICIENT AND ESTIMATING EQUATIONS**

The regression coefficient was calculated by the formula  $y = \frac{r\sigma_y}{\sigma_x} x$ , where  $x$  and  $y$  are the variables and  $\sigma_y$  and  $\sigma_x$  are the standard deviation of  $y$  and  $x$ , respectively. Similarly,  $x = \frac{r\sigma_x}{\sigma_y} y$ . The estimating equation then becomes

$Y - My = R_{yx}(X - Mx)$ , where  $Y$  is the value of the variable  $y$  that is to be estimated,  $My$  is the mean of the  $y$  variables,  $R_{yx}$  is the regression coefficient of  $y$  on  $x$ ,  $X$  is the known value of the variable  $x$ , and  $Mx$  is the mean of the variable  $x$ . In like manner:  $X - Mx = R_{xy}(Y - My)$ , where  $R_{xy}$  is the regression coefficient of  $x$  on  $y$ .



**PARTIAL CORRELATION COEFFICIENTS, MULTIPLE REGRESSION, AND ESTIMATING EQUATIONS**

The partial correlation coefficients were calculated by the formulas:

$$r_{12.3} = \frac{r_{12} - r_{13}r_{23}}{\sqrt{(1-r_{13}^2)(1-r_{23}^2)}}$$

$$r_{13.2} = \frac{r_{13} - r_{12}r_{23}}{\sqrt{(1-r_{12}^2)(1-r_{23}^2)}}$$

$$r_{23.1} = \frac{r_{23} - r_{12}r_{13}}{\sqrt{(1-r_{12}^2)(1-r_{13}^2)}}$$

where  $r_{12.3}$  is the partial correlation coefficient of  $x_1$  and  $x_2$  with  $x_3$  eliminated;  $r_{13.2}$  is the partial correlation coefficient of  $x_1$  and  $x_3$  with  $x_2$  eliminated; and  $r_{23.1}$  is the partial correlation coefficient of  $x_2$  and  $x_3$  with  $x_1$  eliminated; and  $r_{12}$ ,  $r_{13}$ ,  $r_{23}$  are the correlation coefficients of  $x_1$  and  $x_2$ ,  $x_1$  and  $x_3$ ,  $x_2$  and  $x_3$ , respectively.

The multiple regression equation used is as follows:

$$x_1 = r_{12.3} \frac{\sigma_1 \sqrt{1-r_{13}^2}}{\sigma_2 \sqrt{1-r_{23}^2}} x_2 + r_{13.2} \frac{\sigma_1 \sqrt{1-r_{12}^2}}{\sigma_3 \sqrt{1-r_{23}^2}} x_3$$

where the symbols used are those given above in connection with standard deviation, correlation coefficient, and partial correlation coefficient equations.

The estimating equation then becomes:

$$X_1 - Mx_1 = Rx_{1x_2.x_3} (X_2 - Mx_2) + Rx_{1x_3.x_2} (X_3 - Mx_3)$$

where  $X_1$  is the value of the variable  $x$  to be estimated

- $Mx_1$  is the mean of the variable  $x_1$
- $Rx_{1x_2.x_3}$  is the regression coefficient of  $x_1$  on  $x_2$  and  $x_3$
- $X_2$  is the known value of the variable  $x_2$
- $Mx_2$  is the mean of the variable  $x_2$
- $Rx_{1x_3.x_2}$  is the regression coefficient of  $x_1$  on  $x_3$  and  $x_2$
- $X_3$  is the known value of the variable  $x_3$
- and  $Mx_3$  is the mean of the variable  $x_3$

TABLE XXII.—CORRELATION OF ACREAGE AND PRODUCTION IN THE PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET. (a)

X = Acreage		Y = Production	
X	Y	X	Y
179,080.....	20,607	193,520.....	19,672
188,860.....	22,429	190,000.....	22,254
187,270.....	16,766	187,240.....	28,493
210,180.....	30,640	204,010.....	25,259

$$r = +.645$$

(a) Data from Tables III and IV.

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TABLE XXIII.—CORRELATION OF PRODUCTION IN THE PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET AND SHIPMENTS FROM THESE DISTRICTS. (a)

		X = Production (000 bushels)			
		Y = Shipments (Carloads)			
X	Y	X	Y		
20,607.....	30,477	19,672.....	27,689		
22,429.....	36,406	22,254.....	30,180		
16,766.....	28,281	28,493.....	40,139		
30,640.....	37,494				
r = +.888					

(a) Data from Tables IV and VII.

TABLE XXIV.—STANDARD DEVIATION OF PRODUCTION IN THE PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET. (a)

x	d	d <sup>2</sup>
16,766.....	-62	3,844
19,672.....	-33	1,089
20,607.....	-24	576
22,254.....	-7	49
22,429.....	-6	36
M <sub>x</sub> 22,980.....	0	0
28,493.....	+5	25
30,640.....	+77	5,929
		11,548
$\sigma_x = \sqrt{\frac{11,548}{7}} = 4,060$		

(NOTE.—M<sub>x</sub> was a calculated mean and not an item in the data, hence N is 7 instead of 8 as one might assume from the data in Table XXIV. The same is true of the calculations of σ in succeeding data.)

(a) Data from Table III.

TABLE XXV.—STANDARD DEVIATION OF SHIPMENTS FROM THE PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET. (a)

y	d	d <sup>2</sup>
27,689.....	-53	2,809
28,281.....	-47	2,209
30,180.....	-28	784
30,477.....	-25	625
M <sub>y</sub> 32,952.....	0	0
36,466.....	+35	1,225
37,494.....	+45	2,025
40,139.....	+72	5,184
		14,861
$\sigma_y = \sqrt{\frac{14,861}{7}} = 4,609$		

(a) Data from Table VII.

Calculations of regression coefficient and estimating equation for data in Tables XXIII, XXIV and XXV:

$$\begin{aligned}
 r &= +.888 \text{ from Table XXIII} \\
 \sigma_y &= 4,609 \text{ from Table XXV} \\
 \sigma_x &= 4,060 \text{ from Table XXIV} \\
 M_y &= 32,952 \text{ from Table XXV} \\
 M_x &= 22,980 \text{ from Table XXIV} \\
 &\quad (.888) \quad (4,609) \\
 \text{Then } y &= \frac{\quad}{4,060} x
 \end{aligned}$$

$$\begin{aligned}
 y &= 1.008 x \\
 Y - M_y &= 1.008 (X - M_x) \\
 Y - 32,952 &= 1.008 (X - 22,980) \\
 Y &= 1.008 (X - 22,980) + 32,952 \\
 Y &= 1.008 X + 9,789
 \end{aligned}$$

TABLE XXVI.—CORRELATION OF TOTAL UNITED STATES PRODUCTION AND SHIPMENTS FROM DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET. (a)

$X = \text{Production (000,000 bus.)}$ $Y = \text{Shipments}$			
	X	Y	
	362.....	30,477	323.....
	453.....	36,406	354.....
	416.....	28,281	406.....
	422.....	37,494	27,889
			30,180
			40,139
$r = +.675$			

(a) Data on total United States production from United States Department of Agriculture Yearbook, 1927, Table 202, p. 882. Data on shipments from Table VII.

TABLE XXVII.—CORRELATION OF TOTAL UNITED STATES PRODUCTION AND PRODUCTION IN THE PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET. (a)

$X = \text{U. S. production (000,000 bus.)}$ $Y = \text{Mid-season production (000,000 bus.)}$			
	X	Y	
	362.....	20,607	323.....
	453.....	22,429	354.....
	416.....	16,766	406.....
	422.....	30,640	19,672
			22,254
			28,493
$r = +.359$			

(a) Data from Tables IV and XXVI.

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TABLE XXVIII.—STANDARD DEVIATION OF TOTAL UNITED STATES POTATO PRODUCTION, 1921-1927. (a)

U. S. production (000,000 bus.)	<i>d</i>	<i>d</i> <sup>2</sup>
323.....	-68	4,624
354.....	-37	1,369
362.....	-29	841
<i>M</i> 391.....	0	0
407.....	+16	256
416.....	+25	625
422.....	+31	961
453.....	+62	3,844
		12,520

$$\sigma = \sqrt{\frac{12,520}{7}} = 42.3$$

(a) Data from Table XXVI.

Calculation of partial correlation coefficients, multiple regression equation, and estimating equations for data in Tables XXIII, XXIV, XXV, XXVI, XXVII and XXVIII:

With carload shipments designated as 1;  
 mid-season production as 2; and  
 total United States production as 3

The values determined are:

- $r_{12} = +.888$  from Table XXIII
- $r_{13} = +.675$  from Table XXVI
- $r_{23} = +.359$  from Table XXVII

then—

$$r_{12.3} = \frac{.888 - (.675)(.359)}{\sqrt{(1-.675^2)(1-.359^2)}}$$

$$r_{12.3} = +.938$$

$$r_{13.2} = \frac{.675 - (.888)(.359)}{\sqrt{(1-.888^2)(1-.359^2)}}$$

$$r_{13.2} = +.829$$

$$r_{23.1} = \frac{.359 - (.888)(.675)}{\sqrt{(1-.888^2)(1-.675^2)}}$$

$$r_{23.1} = -.707$$

Then with the values determined:

$r_{12} = .888$	$r_{12.3} = .938$	$\sigma_1 = 4,609$	$M_1 = 32,952$
$r_{13} = .675$	$r_{13.2} = .829$	$\sigma_2 = 4,060$	$M_2 = 22,980$
$r_{23} = .359$	$r_{23.1} = -.707$	$\sigma_3 = 42.3$	$M_3 = 391$

The regression equation becomes:

$$x_1 = .938 \frac{4,609 \sqrt{1-.675^2}}{4,060 \sqrt{1-.359^2}} x_2 + .829 \frac{4,609 \sqrt{1-.888^2}}{42.3 \sqrt{1-.359^2}} x_3$$

$$x_1 = .842x_2 + 44.4x_3$$

And the estimating equation becomes:

$$X_1 - 32,952 = .842(X_2 - 22,980) + 44.4(X_3 - 391)$$

$$X_1 = .842X_2 + 44.4X_3 - 3,757$$

TABLE XXIX.—CORRELATION OF PRODUCTION IN THE PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET AND AVERAGE PRICES PER HUNDRED FOR POTATOES AT CHICAGO. (a)

$X$ = Production (000 bus.) $Y$ = Average price at Chicago			
$X$	$Y$	$X$	$Y$
20,607.....	151	19,672.....	180
22,429.....	112	22,254.....	141
16,766.....	147	28,493.....	133
30,640.....	106		
$r = -.665$			

(a) Data from Tables IV and V.

TABLE XXX.—CORRELATION OF CARLOAD SHIPMENTS FROM THE PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET AND AVERAGE PRICE PER HUNDRED FOR POTATOES AT CHICAGO. (a)

$X$ = Shipments $Y$ = Average price at Chicago			
$X$	$Y$	$X$	$Y$
30,477.....	151	27,689.....	180
36,406.....	112	30,180.....	141
28,281.....	147	40,139.....	133
37,494.....	106		
$r = -.779$			

(a) Data from Tables V and VII.

TABLE XXXI.—CORRELATION OF CARLOAD SHIPMENTS FROM ALL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET AND AVERAGE PRICE PER HUNDRED FOR POTATOES AT CHICAGO. (a)

$X$ = Shipments $Y$ = Average price at Chicago			
$X$	$Y$	$X$	$Y$
38,769.....	151	40,870.....	180
46,906.....	112	43,669.....	141
39,477.....	147	53,167.....	133
47,451.....	106		
$r = -.603$			

(a) Data from Tables V and VII.

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TABLE XXXII.—STANDARD DEVIATION OF AVERAGE PRICES FOR POTATOES AT CHICAGO, 1921-1927. (a)

Price	<i>d</i>	<i>d</i> <sup>2</sup>
106.....	-33	1,089
112.....	-27	729
133.....	-6	36
<i>M</i> 139.....	0	0
141.....	+2	4
147.....	+8	64
151.....	+12	144
180.....	+41	1,681
		3,747

$$\sigma = \frac{\sqrt{3,747}}{7} = .231$$

(a) Data from Table V.

Calculation of regression coefficient and estimating equation for data in Tables XXV, XXX and XXXII:

- $r = -.779$  from Table XXX
- $\sigma_y = 4,609$  from Table XXV
- $\sigma_x = .231$  from Table XXXII
- $M_y = 32,952$  from Table XXV
- $M_x = 1.39$  from Table XXXII

Then—

$$y = \frac{(-.779)(.231)}{4,609} x$$

$$y = -.0000383x$$

$$Y - 139 = -.0000383(X - 32,952)$$

$$Y = -.0000383X + 2.65$$

TABLE XXXIII.—CORRELATION OF TOTAL UNITED STATES PRODUCTION AND JULY-AUGUST AVERAGE PRICE OF POTATOES AT CHICAGO. (a)

<i>X</i> = Total U. S. production (000,000 bus.)		<i>Y</i> = Average price at Chicago	
<i>X</i>	<i>Y</i>	<i>X</i>	<i>Y</i>
362.....	151	323.....	180
453.....	112	354.....	141
416.....	147	406.....	133
422.....	106		
$r = -.809$			

(a) Data from Tables V and XXVI.

TABLE XXXIV.—CORRELATION OF CARLOAD SHIPMENTS FROM THE PRINCIPAL DISTRICTS SUPPLYING THE MID-SEASON POTATO MARKET AND AVERAGE PRICE PER HUNDRED FOR POTATOES AT CHICAGO. (a)

X = Shipments. Y = Average price at Chicago (b)			
X	Y	X	Y
30,477.....	189	27,689.....	182
36,406.....	124	30,180.....	150
28,281.....	161	40,139.....	146
37,494.....	104		
r = -.714			

(a) Data from Table VII and United States Department of Agricultural Yearbook, 1927, Table 212, p. 894.

(b) Reduced to a 1910-1914 basis, using values in Table VI.

TABLE XXXV.—CORRELATION OF TOTAL UNITED STATES PRODUCTION AND JULY-AUGUST AVERAGE PRICE OF POTATOES AT CHICAGO. (a)

X = Total U. S. production Y = Average price at Chicago			
X	Y	X	Y
362.....	189	323.....	182
453.....	124	354.....	150
416.....	161	406.....	146
422.....	104		
r = -.662			

(a) Data from Tables XXVI and XXXIV.

Calculation of partial correlation coefficients, multiple regression equation, and estimating equations from data in Tables XXV, XXVI, XXVIII, XXX, XXXII and XXXIII:

With price designated as 1;  
 carload shipments as 2; and  
 total United States production as 3

The values determined are:

$$r_{12} = -.779 \text{ from Table XXX}$$

$$r_{13} = -.809 \text{ from Table XXXIII}$$

$$r_{23} = +.675 \text{ from Table XXVI}$$

then—

$$r_{12.3} = \frac{-.779 - (-.809)(.675)}{\sqrt{(1-.809^2)(1-.675^2)}}$$

$$r_{12.3} = -.537$$

$$r_{13.2} = \frac{-.809 - (-.779)(.675)}{\sqrt{(1-.779^2)(1-.675^2)}}$$

$$r_{13.2} = -.612$$

$$r_{23.1} = \frac{+.675 - (.779)(.809)}{\sqrt{(1-.779^2)(1-.809^2)}}$$

$$r_{23.1} = +.122$$

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Then with the values determined:

$$\begin{array}{llll}
 r_{12} = -.779 & r_{12.3} = -.537 & \sigma_1 = .231 & M_1 = 1.39 \\
 r_{13} = -.809 & r_{13.2} = -.612 & \sigma_2 = 4,609 & M_2 = 32,952 \\
 r_{23} = +.675 & r_{23.1} = +.122 & \sigma_3 = 42.3 & M_3 = 391
 \end{array}$$

$$x_1 = -.537 \frac{.231 \sqrt{1-.809^2}}{4,609 \sqrt{1-.675^2}} x_2 + -.621 \frac{.231 \sqrt{1-.779^2}}{42.3 \sqrt{1-.675^2}}$$

$$\begin{array}{l}
 x_1 = -.0000211x_2 + -.00284x_3 \\
 X_1 - 1.39 = -.0000211(X_2 - 32,952) + -.00284(X_3 - 391) \\
 X_1 = -.0000211X_2 + -.00284X_3 + 3.196
 \end{array}$$

TABLE XXXVI.—CORRELATION OF AVERAGE PRICES AND AVERAGE RECEIPTS AT CHICAGO BY 10-DAY PERIODS. (1919-1927 EXCEPT 1920.) (a)

	X	Y
X = Average receipts		
Y = Average prices		
First 10 days of July.....	182	271
Second 10 days of July.....	192	236
Third 10 days of July.....	226	200
First 10 days of August.....	170	224
Second 10 days of August.....	175	234
Third 10 days of August.....	211	214

$$r = -.4137$$

P. E. not calculated, for the number of cases is too small.

(a) Data compiled from Market News Service reports of the Bureau of Agricultural Economics, Kansas City, Mo., except 1920, for the reason that reports on Kaw valley prices at Chicago for more than half of the period are not available, 1919-1927. See Tables XXXVII, XXXVIII, XXXIX and XL.



TABLE XXXVII.—CORRELATION OF CHICAGO RECEIPTS AND PRICES, 1927. (a)

		X = Receipts including broken cars on track Y = Top price for Kaw valley potatoes					
		X	Y				
July	5.....	251	240	Aug.	1.....	150	175
	6.....	242	240		2.....	124	200
	7.....	196	240		3.....	122	215
	8.....	141	250		4.....	113	210
	9.....	71	260		5.....	155	205
	11.....	88	250		6.....	184	180
	12.....	112	240		8.....	278	180
	13.....	132	240		9.....	215	190
	14.....	131	230		10.....	190	190
	15.....	167	220		11.....	142	190
	16.....	131	215		12.....	187	185
	18.....	116	220		13.....	163	165
	19.....	184	210		15.....	227	185
	20.....	229	200		16.....	184	190
	21.....	213	185		17.....	164	185
22.....	260	180	18.....	137	210		
23.....	232	185	19.....	97	200		
25.....	215	185	20.....	104	200		
26.....	183	185	22.....	215	190		
27.....	205	175	23.....	230	185		
28.....	243	155	24.....	195	185		
29.....	222	135	25.....	167	180		
30.....	176	150	26.....	176	175		
			27.....	203	160		
			29.....	290	175		
			30.....	265	170		

$r = -.5016 \pm .0721$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo., 1927.

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TABLE XXXVIII.—CORRELATION OF CHICAGO RECEIPTS AND PRICES, 1926. (a)

X = Receipts including broken cars on track  
 Y = Top price for Kaw valley potatoes

	X	Y		X	Y
July 6.....	291	300	Aug. 2.....	198	210
7.....	229	300	3.....	157	220
8.....	275	275	4.....	111	215
9.....	300	260	5.....	147	200
10.....	336	250	6.....	200	175
12.....	415	210	7.....	180	175
14.....	331	220	9.....	229	200
15.....	253	190	10.....	189	215
16.....	235	160	11.....	156	215
17.....	231	165	12.....	145	215
19.....	276	175	13.....	205	175
20.....	245	175	14.....	190	200
21.....	208	150	16.....	234	200
22.....	241	155	17.....	198	205
23.....	179	160	20.....	147	285
24.....	190	160	23.....	237	290
26.....	218	180	24.....	196	280
27.....	181	200	25.....	130	290
28.....	198	185	26.....	121	290
30.....	146	185	27.....	112	275
31.....	160	200	30.....	218	225

$r = -.0208 \pm .104$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo., 1926.

TABLE XXXIX.—CORRELATION OF CHICAGO RECEIPTS AND PRICES, 1925. (a)

		X = Receipts including broken cars on track		Y = Top price for Kaw valley potatoes		
		X	Y	X	Y	
July	1.....	136	275	Aug. 1.....	195	280
	2.....	108	315	3.....	194	275
	3.....	90	315	4.....	229	275
	6.....	173	300	5.....	163	280
	7.....	159	285	6.....	111	350
	8.....	145	315	7.....	123	300
	9.....	95	360	10.....	205	300
	10.....	91	375	11.....	192	300
	11.....	101	345	12.....	142	285
	12.....	208	300	13.....	131	285
	14.....	283	300			
	15.....	246	310			
	16.....	254	300			
	17.....	204	300			
	18.....	199	275			
	20.....	293	225			
	21.....	347	225			
	22.....	311	275			
	23.....	257	280			
	24.....	226	265			
	25.....	225	285			
	27.....	283	300			
	28.....	280	275			
	29.....	229	300			
	30.....	158	300			
	31.....	150	300			

$$r = -.6626 \pm .063$$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo., 1925.

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TABLE XL.—DATA ON DAILY PRICES AND RECEIPTS AT CHICAGO, 1919-1924. (a)

Date.	1924.		1923.		1922.		1921.		1920.		1919.	
	Receipts...	Prices.....	Receipts...	Prices.....	Receipts...	Prices.....	Receipts...	Prices.....	Receipts...	Prices.....	Receipts...	Prices.....
July 1.....	272	2.60	*	*	*	*	*	*	*	*	*	*
2.....	258	2.50	174	*	*	*	*	*	*	*	*	*
3.....	243	2.45	*	*	176	2.65	*	*	*	*	*	*
4.....	*	*	*	*	*	*	*	*	*	*	*	*
5.....	*	*	238	*	197	2.35	180	1.90	*	*	*	*
6.....	*	*	228	*	239	2.65	202	1.90	*	*	*	*
7.....	240	2.15	*	*	189	2.70	171	1.90	*	*	*	*
8.....	200	2.20	*	*	*	*	149	1.95	*	*	*	*
9.....	208	2.15	244	3.00	*	*	*	*	*	*	*	*
10.....	217	2.15	258	2.75	168	2.50	*	*	*	*	110	3.75
11.....	192	2.00	233	2.90	162	2.25	148	1.75	*	*	*	*
12.....	215	1.80	215	3.00	155	2.25	121	1.75	*	*	67	3.75
13.....	*	*	210	2.60	131	1.95	96	1.75	*	*	*	*
14.....	308	1.60	*	*	148	2.35	175	2.15	*	*	129	3.80
15.....	267	1.60	*	*	*	*	139	2.15	*	*	*	*
16.....	248	1.60	271	2.35	*	*	*	*	74	6.80	*	*
17.....	260	1.70	285	2.50	110	2.00	*	*	93	6.05	131	3.70
18.....	210	1.65	254	2.25	128	1.65	173	1.90	*	*	135	3.75
19.....	174	1.75	171	2.10	157	2.15	242	1.75	127	6.25	*	*
20.....	*	*	176	1.90	117	2.00	240	1.55	163	5.90	*	*
21.....	174	1.70	*	*	154	2.05	222	1.55	118	5.10	*	*
22.....	209	1.50	*	*	*	*	202	1.50	124	4.90	233	3.30
23.....	198	1.45	316	1.35	*	*	*	*	87	5.00	*	*
24.....	256	1.35	236	1.50	306	1.75	*	*	173	4.50	205	3.00
25.....	239	1.50	201	1.70	366	1.60	183	1.50	*	*	194	3.15
26.....	*	*	152	2.00	358	1.35	225	1.50	177	3.50	129	3.25
27.....	*	*	123	2.35	344	1.50	*	*	151	*	*	*
28.....	295	1.40	*	*	301	1.40	238	1.50	169	4.00	*	*
29.....	277	1.45	*	*	*	*	*	*	179	4.10	*	*
30.....	283	1.50	268	2.00	*	*	*	*	*	*	*	*
31.....	284	1.45	210	1.75	220	1.25	*	*	*	*	127	3.10
Aug. 1.....	276	1.30	165	1.85	187	1.20	257	1.60	*	*	132	3.10
2.....	*	*	126	2.15	178	1.10	272	1.50	125	3.50	87	3.25
3.....	*	*	144	2.25	182	1.20	259	1.50	99	3.75	*	*
4.....	298	1.30	*	*	181	1.15	195	1.75	89	3.85	115	3.50
5.....	223	1.35	*	*	*	*	196	1.85	108	4.25	109	3.90
6.....	162	1.55	220	2.15	*	*	*	*	102	3.65	75	4.25
7.....	130	1.60	*	*	167	1.25	*	*	*	*	51	4.50
8.....	141	1.50	221	2.15	143	1.30	194	2.75	*	*	46	4.85
9.....	*	*	150	2.10	143	1.70	210	3.25	136	3.25	42	5.00
10.....	*	*	*	*	113	1.20	165	3.25	122	3.40	*	*
11.....	147	1.45	*	*	94	1.25	146	3.25	121	3.25	68	4.50
12.....	197	1.50	*	*	*	*	124	2.95	105	3.40	105	3.35
13.....	180	1.60	300	2.20	*	*	*	*	118	3.25	119	3.90
14.....	144	1.50	255	2.10	150	1.25	*	*	*	*	*	*
15.....	193	1.45	225	2.10	200	*	115	3.60	*	*	102	3.80
16.....	*	*	203	2.25	219	*	117	*	*	*	86	*
17.....	*	*	183	2.40	193	*	91	3.00	*	*	*	*
18.....	290	1.45	*	*	166	*	131	3.25	*	*	116	*
19.....	187	1.40	*	*	*	*	107	3.50	*	*	183	*
20.....	276	1.35	208	2.60	*	*	*	*	*	*	*	*
21.....	236	1.35	271	2.40	125	*	*	*	*	*	*	*
22.....	194	1.35	184	2.40	114	*	220	3.00	*	*	*	*
23.....	*	*	124	2.50	116	*	275	2.00	175	*	*	*
24.....	*	*	114	2.75	119	*	*	*	150	*	*	*
25.....	291	1.35	*	*	98	*	310	2.25	118	*	249	*
26.....	299	1.35	*	*	*	*	100	*	*	*	208	*
27.....	227	1.35	155	*	*	*	*	*	107	*	243	*
28.....	223	1.35	235	*	174	*	*	*	96	*	240	*
29.....	213	1.25	241	*	227	*	300	*	*	*	231	*
30.....	*	*	231	*	200	*	300	*	*	*	156	*
31.....	*	*	*	*	290	*	283	*	104	*	*	*
Totals.....	10,244	.....	8,428	.....	7,805	.....	7,453	.....	*	*	*	*
Average.....	228	1.61	211	2.25	181	1.77	191	2.18	*	*	*	*

(a) Data compiled from daily Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo., 1919-1924.  
\* Indicates no data available. Reports not issued on Sundays, holidays, some Saturdays, and frequently price quotations not given.

TABLE XLI.—CORRELATION OF CHICAGO PRICES AND KAW VALLEY PRICES, 1926.

		X = Chicago prices (a)				Y = Kaw valley prices (b)	
		X	Y			X	Y
July	6.....	300	206	Aug.	2.....	210	155
	7.....	300	206		3.....	220	146
	8.....	275	210		4.....	215	136
	9.....	260	163		5.....	200	115
	10.....	250	160		9.....	200	128
	12.....	210	155		10.....	215	140
	13.....	215	162		11.....	215	139
	14.....	220	154		12.....	215	136
	15.....	190	126		13.....	175	140
	16.....	160	124		16.....	200	135
	17.....	165	115		17.....	205	154
	19.....	175	121		18.....	220	185
	20.....	175	116		19.....	260	160
	21.....	150	112		20.....	285	180
	22.....	155	106		21.....	285	204
	23.....	160	115				
	24.....	160	120				
	26.....	180	122				
	27.....	200	122				
	28.....	185	128				
	29.....	185	124				
	30.....	185	133				
	31.....	200	135				

$$r = +.910 \pm .0188$$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo., 1926.

(b) Data from sales records on 800 carloads sold cash-on-track by Kaw valley potato growers, 1926.

TABLE XLII.—CORRELATION OF CHICAGO PRICES AND EASTERN SHORE OF VIRGINIA PRICES, 1926. (a)

		X = Chicago prices				Y = Eastern Shore of Virginia prices		
		X	Y			X	Y	
June	22.....	640	600	July	17.....	440	350	
	23.....	675	625		19.....	435	300	
	24.....	665	600		20.....	425	300	
	25.....	650	550		21.....	400	275	
	28.....	600	500		22.....	385	275	
	29.....	600	500		23.....	375	265	
	30.....	625	450		24.....	380	285	
	July	1.....	625		425	26.....	380	325
		2.....	575		400	27.....	400	375
		6.....	525		450	28.....	450	400
7.....		550	450	30.....	450	390		
8.....		540	400	31.....	450	375		
9.....		515	375	Aug. 2.....	450	350		
10.....		460	325	3.....	450	325		
12.....		450	300					
13.....		450	325					
14.....		430	325					
15.....	435	350						
16.....	445	350						

$$r = +.1134 \pm .117$$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo., 1926.

TABLE XLIII.—CORRELATION OF CHICAGO PRICES AND ST. LOUIS PRICES, 1927. (a)

		X = Chicago prices Y = St. Louis prices			
	X	Y		X	Y
July 8.....	250	285	Aug. 1.....	175	175
9.....	260	275	2.....	200	185
11.....	250	250	3.....	215	210
12.....	240	235	4.....	210	200
13.....	240	225	5.....	205	200
14.....	230	225	8.....	180	220
15.....	220	225	9.....	190	210
16.....	215	215	10.....	190	200
18.....	220	225	11.....	190	200
20.....	200	200	12.....	185	190
21.....	185	200	13.....	165	175
23.....	185	170	15.....	185	200
26.....	185	215	16.....	190	185
27.....	175	200	17.....	185	185
28.....	155	175	18.....	210	210
29.....	135	175	19.....	200	200
30.....	150	175	20.....	200	200
			22.....	190	200
			23.....	185	200
			24.....	185	175
			25.....	180	175
			26.....	175	175
			27.....	160	165
			29.....	175	175
			30.....	170	160

$$r = +.923 \pm .0154$$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo.

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TABLE XLIV.—CORRELATION OF CHICAGO PRICES AND PITTSBURGH PRICES, 1927. (a)

		X = Chicago prices				Y = Pittsburgh prices	
		X	Y			X	Y
July	1.....	525	500	Aug.	1.....	350	315
	5.....	500	450		2.....	400	350
	6.....	475	415		3.....	400	365
	7.....	475	425		4.....	425	400
	8.....	475	425		5.....	415	390
	11.....	475	410		8.....	425	335
	12.....	465	385		9.....	425	350
	13.....	465	375		10.....	425	365
	15.....	455	400		11.....	425	350
	18.....	415	390		12.....	425	340
	20.....	390	350		16.....	400	350
	21.....	390	350		17.....	410	365
	22.....	390	335		18.....	410	375
	25.....	390	325		22.....	425	375
	26.....	380	325				
	27.....	350	325				
	28.....	325	300				
	29.....	300	300				

$$r = +.666 \pm .0663$$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo., 1927.



TABLE XLV.—CORRELATION OF CHICAGO RECEIPTS AND ARRIVALS FROM KANSAS, MISSOURI, AND VIRGINIA, 1927. (a)

		X = Receipts including broken cars on track		Y = Arrivals from Kansas, Missouri, and Virginia		
		X	Y	X	Y	
July	5	251	162	Aug. 1	150	63
	6	242	68	2	124	14
	7	196	49	3	122	57
	8	141	48	4	113	58
	9	71	13	5	155	81
	11	88	51	6	184	95
	12	112	7	8	278	129
	13	132	81	9	215	34
	14	131	78	10	190	36
	15	167	86	11	142	21
	16	131	47	12	187	61
	18	116	50	13	163	49
	19	184	105	15	227	55
	20	229	83	16	184	9
	21	213	58	17	164	4
	22	260	82	18	137	18
	23	232	33	19	97	5
	25	215	92	20	104	22
	26	183	77	22	215	63
	27	205	124	23	230	16
	28	243	116	24	195	12
	29	222	59	25	167	8
	30	176	34	26	176	18
				27	203	7
				29	290	13
				30	265	2

$$r = +.3536 \pm .084$$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo.

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TABLE XLVI.—CORRELATION OF CHICAGO RECEIPTS AND ARRIVALS FROM KANSAS, MISSOURI, AND VIRGINIA, 1926. (a)

		X = Receipts including broken cars on track		Y = Arrivals from Kansas, Missouri, and Virginia			
		X	Y	X	Y		
July	6.....	291	98	Aug. 2.....	198	107	
	7.....	229	39		3.....	157	38
	8.....	275	67		4.....	111	48
	9.....	300	56		5.....	147	64
	10.....	336	65		6.....	200	93
	12.....	415	118		7.....	180	78
	14.....	331	36		9.....	229	81
	15.....	253	57		10.....	189	41
	16.....	235	57		11.....	156	39
	17.....	231	70		12.....	145	54
	19.....	276	123		13.....	205	132
	20.....	245	40		14.....	190	106
	21.....	208	27		16.....	234	130
	22.....	241	68		17.....	198	37
	23.....	179	33		20.....	147	73
	24.....	190	25		23.....	237	130
	26.....	218	98		24.....	196	32
	27.....	181	47		25.....	130	12
	28.....	198	71		26.....	121	5
	30.....	146	71		27.....	112	19
	31.....	160	46		30.....	218	14
					31.....	245	2

$$r = +.3615 \pm .089$$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo.

TABLE XLVII.—CORRELATION OF CHICAGO RECEIPTS AND ARRIVALS FROM KANSAS, MISSOURI, AND VIRGINIA, 1925. (a)

		X = Receipts including broken cars on track		Y = Arrivals from Kansas, Missouri, and Virginia			
		X	Y	X	Y		
July	1.....	136	20	Aug. 1.....	195	44	
	2.....	108	34		3.....	194	38
	3.....	90	23		4.....	229	35
	6.....	173	118		5.....	163	6
	7.....	159	38		6.....	111	6
	8.....	145	43		7.....	123	17
	9.....	95	31		10.....	205	23
	10.....	91	46		11.....	192	8
	11.....	101	64		12.....	172	4
	12.....	208	127		13.....	142	5
	14.....	283	126				
	15.....	246	66				
	16.....	254	88				
	17.....	204	88				
	18.....	199	75				
	20.....	293	78				
	21.....	347	68				
	22.....	311	31				
	23.....	257	47				
	24.....	226	31				
	25.....	225	36				
	27.....	283	95				
	28.....	280	54				
	29.....	229	18				
	30.....	158	37				

$$r = +.4236 \pm .093$$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo.

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TABLE XLVIII.—CORRELATION OF CHICAGO RECEIPTS AND KANSAS CARS ON THE CHICAGO MARKET, 1927. (a)

		X	Y			X	Y
		X = Receipts including broken cars on track					
		Y = Arrivals from Kansas					
July	5.....	251	1	Aug.	1.....	150	0
	6.....	242	0		2.....	124	1
	7.....	196	3		3.....	122	0
	8.....	141	1		4.....	113	12
	9.....	71	0		5.....	155	3
	11.....	88	4		6.....	184	1
	12.....	112	5		8.....	278	6
	13.....	132	14		9.....	215	6
	14.....	131	20		10.....	190	4
	15.....	167	27		11.....	142	4
	16.....	131	5		12.....	187	11
	18.....	116	6		13.....	163	4
	19.....	184	3		15.....	227	4
	20.....	229	11		16.....	184	4
	21.....	213	5		17.....	164	1
	22.....	260	15		18.....	137	6
	23.....	232	5		19.....	97	3
	25.....	215	4		20.....	104	4
	26.....	183	1		22.....	215	7
	27.....	205	4		23.....	230	3
	28.....	243	5		24.....	195	4
	29.....	222	3		25.....	167	1
	30.....	176	4		26.....	176	3
					27.....	203	2
					29.....	290	1
					30.....	265	0

$r = -.0463 \pm .085$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo.

TABLE XLIX.—CORRELATION OF CHICAGO RECEIPTS AND KANSAS CARS ON THE CHICAGO MARKET, 1926. (a)

		X = Receipts including broken cars on track			
		Y = Arrivals from Kansas			
	X	Y		X	Y
July 12.....	415	91	Aug. 2.....	198	63
15.....	253	12	3.....	157	24
16.....	235	27	4.....	111	7
17.....	231	26	5.....	147	37
19.....	276	43	6.....	200	17
20.....	245	27	7.....	180	50
21.....	208	9	9.....	229	39
22.....	241	7	10.....	189	17
23.....	179	21	11.....	156	23
24.....	190	13	12.....	145	15
26.....	218	43	13.....	205	43
27.....	181	13	14.....	190	40
28.....	198	10	16.....	234	75
30.....	146	35	17.....	198	22
31.....	160	26	20.....	147	20
			23.....	237	55
			24.....	196	20
			25.....	130	8
			26.....	121	3
			27.....	112	9
			30.....	218	12

$$r = +.5696 \pm .0783$$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo.

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TABLE L.—CORRELATION OF CHICAGO RECEIPTS AND KANSAS CARS ON THE CHICAGO MARKET, 1925. (a)

		X = Receipts including broken cars on track		Y = Arrivals from Kansas			
		X	Y	X	Y		
July	6.....	173	29	Aug. 1.....	195	27	
	7.....	159	10		3.....	194	16
	8.....	145	3		4.....	229	20
	9.....	95	12		5.....	163	3
	10.....	91	11		6.....	111	4
	11.....	101	13		7.....	123	7
	12.....	208	33		10.....	205	8
	14.....	283	36				
	15.....	246	23				
	16.....	254	15				
	17.....	204	36				
	18.....	199	29				
	20.....	293	28				
	21.....	347	17				
	22.....	311	13				
	23.....	257	8				
	24.....	226	10				
	25.....	225	8				
	27.....	283	21				
	28.....	280	26				
	29.....	229	8				
	30.....	158	15				

$r = +.3291 \pm .111$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo.

TABLE LI.—CORRELATION OF CHICAGO RECEIPTS AND TOTAL U. S. SHIPMENTS FOUR MARKET DAYS PREVIOUS, 1927. (a)

X = Total U. S. shipments four market days previous to time of Chicago receipts

Y = Receipts at Chicago including broken cars on track

X		Y	
July 2	1,092	July 8	141
5	625	9	71
6	1,266	11	88
7	1,035	12	112
8	1,065	13	132
9	1,129	14	131
11	762	15	167
12	933	16	131
13	900	18	116
14	824	19	184
15	814	20	229
16	645	21	213
18	585	22	260
19	564	23	232
20	448	25	215
21	545	26	183
22	1,109	27	205
23	690	28	243
25	831	29	222
26	760	30	176
27	738	Aug. 1	150
28	643	2	124
29	706	3	122
30	669	4	113
Aug. 1	354	5	155
2	347	6	184
3	490	8	278
4	649	9	215
5	790	10	190
6	687	11	142
8	596	12	187
9	630	13	163
10	771	15	227
11	883	16	184
12	713	17	164
13	573	18	137
15	421	19	97
16	466	20	104
17	684	22	215
18	526	23	230
19	627	24	195
20	650	25	167
22	597	26	176
23	574	27	203
24	729	29	290
25	800	30	265

$$r = -.226 \pm .094$$

(a) Data from Market News Service Reports of the Bureau of Agricultural Economics, Kansas City, Mo.

