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THE RECONSTITUTED POTATO CHIP

R. Brian How and Darrel L. Good

Department of Agricultural Economics

Cornell University

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Potato chips are believed to have been first made in this country about the middle of the last century, and for many years were prepared only in the home kitchen.^{1/} Commercial production did not develop to any great extent until improved peeling and frying methods became available. In 1939 the U. S. chip industry is estimated to have used only 2.1 million hundredweight of potatoes. Chip production increased rapidly during and immediately following World War II, and annual use of potatoes for chipping grew to 29.0 million hundredweight in 1950. Quantity of potatoes used for chipping reached a peak for the crop year ending June 30, 1972, of 35.1 million hundredweight but dropped about .5 million hundredweight the following year due to the smaller 1972 crop. Use of potatoes for chip production in 1972 amounted to about 11 per cent of the crop and 17 pounds per person.^{2/} Potato chip markets were first developed in the Northcentral and Northeastern States and processing plants were established close to these major markets.

Production of potato chips was the major use of potatoes for processing until the mid 1950's when rapid expansion occurred in the use of potatoes both for dehydration and for freezing. Growth in use for dehydration was spurred by the development of dehydrated flakes that provided a more acceptable reconstituted mashed potato product than earlier granules. Growth in frozen use was the result of development of the partially frozen french fried potato, the advent of fast food service facilities, and the growing use by institutional feeding systems. By the mid 1960's use of potatoes for freezing exceeded use for chipping, and 64 million hundredweight of potatoes were used for freezing in 1972.

^{1/} Talburt, William F. and Ora Smith, Potato Processing, The Avi Publishing Company, Inc., 1967.

^{2/} Potatoes and Sweetpotatoes: Production, Disposition, Value, Stocks, Utilization, 1971-72, Statistical Reporting Service, U. S. Department of Agriculture, August 1973.

Use of potatoes for dehydration grew relatively slowly after the initial introduction of potato flakes. The market during the 1960's consisted primarily of institutional and home use of flakes for reconstituted mashed potatoes. In recent years there has been an increased use of both flakes and granules for secondary manufacture of processed potato products such as puffs and reconstituted chips, and total use of potatoes for dehydration reached almost 28 million hundredweight during the 1972 crop year. Dehydration plant capacity is being expanded rapidly in the west and potato use for this purpose is expected to increase considerably by 1975.

Reconstituted potato chips such as Nabisco's Chipsters, General Mills' Chipos, Frito-Lay's Munchos, or Proctor and Gamble's Pringles have gained a substantial volume of the snack food market in the last few years. An audit of sales of regular and reconstituted chips in 19 Syracuse supermarkets in March and April 1973 revealed that sales of reconstituted chips amounted to 30.9 per cent of the retail value of the two potato products combined. The average package of regular potato chips sold during the audit period contained 9.4 ounces of chips and retailed for \$.54 or \$.057 per ounce. The average package of reconstituted chips contained 7.7 ounces and retailed for \$.57 or \$.075 per ounce. Proctor and Gamble's Pringles had the major share of the reconstituted volume in this market as a result of an aggressive promotion and advertising campaign over the previous two years. The Pringles twin pack of 9 ounces was retailing mainly at \$.69 each.

The Pringles brand was apparently named for the holder of the original patent for the reconstituting process that produces individual chips of identical size and shape. These can be stacked and sealed in a vapor-proof container to preserve flavor and protect against breakage. This product can be shipped further and stored longer economically than regular potato chips. Pringles are manufactured in Jackson, Tennessee, for distribution in the East. Recently an official of the Company stated that Proctor and Gamble would use about 6 million hundredweight of potatoes in 1973 for the manufacture of this product.^{3/} The potato flakes for this process are believed to come entirely from Idaho and Washington.

^{3/} The Packer, Kansas City, December 22, 1973

Regular potato chip manufacture, in contrast to the production of reconstituted chips and many other processed food products, has until recently been largely carried out by a large number of relatively small firms serving local markets. There has been a major concentration of potato chip plants in southeastern Pennsylvania although there have been plants in or near most major cities. The chip industry has been market oriented in location because of the bulk and perishability of the final product relative to the raw material. Few plants distribute potato chips over a market area with a radius of more than 250 miles.

Market competition and new technology have brought changes to the potato chip industry and more are expected. In the Eastern U. S., largely Pennsylvania and New York, the number of plants manufacturing potato chips as reported by the U. S. Department of Agriculture dropped from 110 in 1960-61 to 58 in 1972-73. At the same time the average volume of potatoes processed per plant increased from 55,000 hundredweight per year to 128,000 hundredweight.^{4/} Through merger or acquisition several smaller potato chip firms have become part of larger food companies and added other snack foods to their marketing line.

As long as Eastern potato chip firms require fresh potatoes in their manufacturing process potato growers in the East will have a competitive advantage over growers in other areas in supplying raw material. This advantage will exist as long as the difference in transportation costs in favor of the Eastern grower is not more than offset by higher farm production costs. But potato growers in New York and Pennsylvania cannot compete with growers in other areas in the production of potatoes for the manufacture of flakes. They are therefore vitally concerned with the prospects for regular potato chips in competition with the reconstituted product.

The manufacture and distribution of reconstituted chips represents a system that is becoming of increasing significance in the food industry. The food product after initial processing is stored and shipped in bulk before final processing, packaging, and distribution. By this means some of the costs of highly seasonal processing operations, and the added transportation and storage costs of the finished product can be avoided. These savings may be offset by increased costs

^{4/} Irish Potatoes: Utilization of the 1972 Crop with Comparisons, Crop Reporting Board, U. S. Department of Agriculture, Washington, D.C.

of equipment, facilities, and other processing costs necessary to the two stage operation. If savings exceed added costs the two stage process is likely to be adopted.

To assess the future prospects for growing potatoes for chipping, estimates were made of the costs involved of providing Eastern markets with both regular and reconstituted chips. By this means it was hoped to learn more of the structure of costs and the impact that rising prices might have on the relative costs of the two products.

Total delivered cost of reconstituted chips to Eastern U. S. markets were estimated at 1972 prices to have amounted to \$61.90 per hundredweight. Total delivered cost for regular potato chips under the same assumptions was \$51.60 per hundredweight (Table 1). These costs include receipt at a warehouse or distribution point in the final market but not distribution to retail outlets and costs of retailing.

The cost estimate for reconstituted chips is based on the assumption the potatoes are grown in the State of Washington and field run potatoes are processed there into potato flakes. The potato flakes are then shipped in bulk to a fabrication plant located in the East in the Scranton-Wilkes Barre area of Pennsylvania. From the fabrication plant the product is distributed to major markets on the Eastern Seaboard. The basis for the cost estimates are discussed elsewhere.^{5/}

Yield of reconstituted potatoes from potato flakes will depend on the particular processing operation. We have here assumed a plant yield of 120 per cent, reflecting the addition of other ingredients and the higher moisture content of the reconstituted product compared to the potato flakes.

Delivered costs of regular potato chips are based on the use of potatoes grown in western New York for the major raw material supply supplemented with potatoes from the Southeast during spring and summer. The weighted average raw material cost is based on the assumption that about two-thirds of the raw material will be from western New York and one-third from the Southeast.

^{5/} How, R. Brian and Darrel L. Good, The Economic Feasibility of Additional Potato Chip Processing Facilities in Western New York, Department of Agricultural Economics, A. E. Res. 74-3, April 1974, Cornell University.

Table 1
Costs of Providing Potato Chips to Eastern Markets Under Alternative Systems, 1972

	Reconstituted Potato Chips <u>6/</u>		Regular Potato Chips <u>7/</u>	
		Source of potatoes	Steuben County N Y.	Southeast U S
Farm cost per cwt.	\$ 1.71	Farm cost per cwt.	\$ 2.50	\$ 2.61
Farm to flake plant Transportation, cwt.	<u>.15</u>	Farm to plant transportation	<u>.40</u>	<u>1.50</u>
Delivered cost	\$ 1.86	Delivered cost, cwt.	\$ 2.90	\$ 4.11
Plant yield flakes, per cent	17.4	Plant yield chips, per cent	24.6	25.7
Raw material cost per cwt. flakes	\$ 10.69	Raw material cost per cwt. of product	\$ 11.80	\$ 16.00
Other processing costs	<u>11.00</u>	Weighted average raw material cost	\$ 13.20	
Total cost per cwt. flakes	\$ 21.69	Other processing costs	34.80	
Shipment to fabrication plant, cwt.	2.80	Total cost per cwt. product	\$ 48.00	
Delivered cost per cwt.	\$ 24.49	Transportation costs to market, cwt.	<u>3.60</u>	
Plant yield per cent	120	Total delivered cost	\$ 51.60	
Raw material cost per cwt. product	\$ 20.40			
Other processing costs	<u>40.00</u>			
Total cost per cwt.	\$ 60.40			
Transportation costs to market, cwt.	1.50			
Total delivered cost	\$ 61.90			

6/ Potatoes grown and processing into flakes in Washington and shipped to Scranton-Wilkes Barre, Pennsylvania, for fabrication into reconstituted chips.

7/ Potatoes grown in Steuben County, N Y and Southeast U S and shipped to Scranton-Wilkes Barre, Pennsylvania for processing into chips.

Yield of finished product will also vary depending on the quality of the raw material and the processing operation. We have assumed an average of about 4 pounds of potatoes required to produce one pound of finished potato chips. The potato chips are considered to be processed in the same location as the reconstituted potato products and shipped the same distance to final markets. Transportation costs to market for regular chips are likely to be more than double the rate per hundred-weight for reconstituted chips because of higher bulk and perishability of the product.

We can summarize the costs already itemized into essentially three categories. These are the raw material costs at the farm per hundred pounds of product, the plant operation costs including ingredients other than potatoes, and transportation costs (Table 2).

Table 2
Summary of Costs of Alternative Potato Chip Systems, 1972

	Reconstituted Chips	Regular Potato Chips
Raw material required, lbs.	480	400
Raw material cost	\$ 8.21	\$ 10.16
Plant costs including other ingredients	49.13	34.80
Transportation, raw material	\$ 3.06	\$ 3.04
finished product	1.50	3.60
	\$ <u>4.56</u>	\$ <u>6.64</u>
Total delivered cost	\$ 61.90	\$ 51.60

This reveals that the production of regular potato chips is more efficient in the use of raw material but the higher farm cost of potatoes results in a higher potato cost per hundred pounds of finished product. Processing costs for the production of regular potato chips in a modern efficient plant are believed to be substantially less than for the reconstituted potato products which require a two stage processing operation and a fairly elaborate manufacturing operation at the second stage.

Transportation costs for the raw material are about the same for reconstituted chips as for regular potato chips even though the transportation of raw material for the reconstituted product involves moving potatoes from farm to flake plant and then shipping flakes from flake plant to point of fabrication. The higher cost for transporting regular potato chips to market is responsible for the higher total transportation cost for this system.

We may wonder how it is possible for reconstituted products to gain a substantial share of the snack food market when system costs apparently exceed those of regular potato chips. Several factors may be responsible for this situation.

The system costs do not include distribution to retail outlets and retail margins. Reconstituted products have been distributed through chain or voluntary group warehouses whereas regular chips are distributed mainly by jobbers or distributors direct to the retail outlet. Costs of distribution may be higher for regular chips.

Margins and prices particularly for the reconstituted product may not reflect costs at this stage in the introduction of the product when extensive promotion and advertising programs were being used to merchandise these brands.

Some consumers may be willing to pay a premium for reconstituted potato chips because they prefer the flavor, texture, or convenience of the new product.

The effect of cost differences may be obscured at least temporarily by other factors but in the longer run are bound to have an impact on the competitive position of the two classes of product. Changes in the spread in costs due to a possible differential effect of rising prices will provide an additional market advantage to the favored product.

To assess the longer run competitive position of these two classes of products, estimates were made of the costs of providing Eastern markets with regular and reconstituted chips in the year 1975. These cost estimates were based on changes in input prices between 1972 and 1974 and changes anticipated next year. Table 3 summarizes the assumptions made in calculating total system costs for 1975.

The three largest components of potato production costs are seed, fertilizer and power and machinery costs. Since 1972, fertilizer prices have doubled. Shortages are expected to remain through 1975

keeping prices at least at current levels. Due to shortages, potato seed prices have more than tripled in some areas. Increased supplies in 1974 should put downward pressure on these prices for 1975, but they are estimated to remain above 1972 levels. The price of gasoline and other petroleum products are not expected to decline, resulting in substantial cost increases over 1972.

Table 3
Estimated Changes in Selected Potato
Production, Transportation and Processing Costs: 1972-1975

Item	Percentage Increase 1972-1975
	%
Production Costs	
Seed	100
Fertilizer	100
Power and machinery	50
Capital	
Western, N. Y.	13
Washington	13
Southeast	33
Land	20
All other	20
Transportation Costs	
Rail	25
Truck	35
Processing costs	20

Rail transportation rates have increased 15 per cent and truck rates 25 per cent since 1972. Continued cost pressures on the transportation industry indicates increasing rates through 1975.

These assumptions result in estimated potato production cost increases of \$.72 per hundredweight in Washington, \$.98 in Steuben County, New York and \$1.41 in the Southeastern U. S. by 1975. Cost of transporting potatoes from the farm to the processing plant increase by \$.05 per hundredweight in Washington, \$.14 in Steuben County, New York and \$.53 in the Southeastern U. S. The rate for dehydrated

flakes from Washington is an estimated, \$3.50 per hundredweight, an increase of \$.70. From 1972 to 1975 the cost of transporting the finished product to market is estimated to increase by \$.53 per hundredweight for reconstituted chips and \$1.26 for regular chips.

The 1975 total system cost estimates are summarized in Table 4. Total delivered costs are estimated to increase by 24 per cent for reconstituted chips and by 27 per cent for regular chips by 1975. The absolute difference in delivered costs for these two products will increase from \$10.30 per hundredweight pounds in 1972 to \$12.19 in 1975.

Table 4
Summary of Costs of Alternative Potato Chip Systems, 1975

Item	Reconstituted Chips	Regular Potato Chips
Raw material required, lbs.	480	400
Raw material cost	\$ 11.64	\$ 14.64
Plant costs, including other ingredients	59.00	41.76
Transportation, raw material	\$ 3.84	\$ 4.08
finished product	2.03	4.86
total	<u>5.87</u>	<u>8.94</u>
Total delivered cost	\$ 76.53	\$ 65.34

Our analysis indicates that regular potato chips manufactured under the latest technology may continue to enjoy a lower total delivered cost compared to reconstituted chips in Eastern markets. Admittedly our estimates, especially for processing costs, are based on incomplete data and may not reflect the operation of any individual firm. Even so there appears to be continuing opportunity for Northeast growers of potatoes for chipping and for chip processors to maintain or expand their markets providing they can keep their production costs from increasing more rapidly than costs in other areas.