Economics of the Soybean Industry

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ABSTRACT

The soybean, an immigrant from China, has risen from the bottom of the U.S. agricultural crop ladder over the past 40 years to its position today of being number two. Only mighty corn is still ahead of the soybean in cash value to the American farmer. Behind this unprecedented growth of an agricultural crop were two attricutes of the soybean seed: a high content of excellent protein and a moderate content of oil useful for edible and industrial uses. Although soybean oil does not quite measure up in quality to peanut, cotton, corn and some other vegetable oils, research has modified these deficiencies to such an extent that over 50% of all the fats and oils consumed in the U.S. are soy based. The soybean has resulted in the development of a worldwide marketing and processing technology covering the seeds and its two main products. Today, soybean and its products are the most exported agricultural goods reaching, from the U.S. alone, the billion dollar level in recent years. So important has the soybean become to the American scene that it receives the active attention of almost every facet of private and public agribusiness. And the end is not in sight as the meal and oil fractions are finding their way into more and more highly sophisticated applications for human use.

HISTORY

Soybeans have been for many centuries an important and substantial crop in its native China. It was only at the beginning of the present century that soybeans began to find a place in the American scene. In its early days soybeans were grown almost entirely as a forage crop.

Until the 1940's, the U.S. was a net importer of fats and oils. As oil was almost always in demand, it was logical that in the 1920's some businesses were established to remove oil from the soybean with the meal being a by-product.

GROWTH RATE OF CROP

The advent of crushing facilities (hydraulic presses) in the 1920's helped the domestic demand for beans and so for several years we saw steady increases in the production and consumption of beans and its products. Table I shows harvested acres, yearly production, annual domestic crush and exports in thousands of bushels. The crop increased in acreage nearly 100-fold in just 40 years. Actual production in bushels went up over 200-fold in those same years. Increases in domestic crush and exports are equally fantastic.

Soybeans have indeed found a place in American agriculture.

For comparison with other crops, Table II shows recent acreages planted, of the various major crops, and their farm cash value.

On the left hand column we have the principal U.S. crops listed in descending order of dollar farmer income for 1952. Corn was number 1 and soybeans number 6 at approximately one seventh of the corn figure. Column 2 shows the harvested acres which relate to the dollar values in column 3.

The same is done for year 1960 where soybeans have moved ahead of oats and were then number 5.

By crop year 1969, the estimates indicate that soybean acreage has moved into the number 3 position while its dollar value figured at support price has surged into second place.

MEAL

The 1930's, 40's and 50's were decades which saw great advances in the science of animal nutrition. Feed/gain ratios, rates of gain and unit production costs all improved dramatically. Better formulation, antibiotics, better breeding and management were some of the factors which accounted for these improvements, but the availability of protein and especially the relatively cheap and efficient soybean protein carried the big load. It was during this period that the protein fraction became the product instead of the by-product. Recently, the value of the meal in a bushel of beans has been running about twice the value of the oil from the same bushel.

Although soybean meal is the "superman" of the animal and vegetable protein world of the U.S. feed industry it has many important competitors. Table III shows the annual consumption of various important protein sources by our domestic feed industry over the past 10 years. The pertinent points are: (a) steady growth of soybean meal; (b) static use of cottonseed meal; (c) erratic growth of fishmeal depending on fish catches; (d) consistent growth of gluten feed and meal paralelling growth of wet corn milling industry; (e) consistent increase in meat scraps in tankage usage; (f) dramatic surge of urea from last to second place among the major sources of feed protein—from 2% to 11%

[1]Presented at the AOCS-AACC Joint Protein Short Course, French Lick, Indiana, July 13-16, 1969.

TABLE I

Soybeans: U.S. Supply and Distribution[a]

Crop year beginning September 1	Acreage harvested for beans, 1,000 acres	Production, 1,000 Bu	Crush, 1,000 Bu	Exports, 1,000 Bu
1924	448	4,900	300	---
1934	1,556	23,200	9,100	---
1944	10,245	192,100	153,400	5,100
1954	17,047	341,100	249,000	60,600
1964	30,793	700,900	479,000	212,200
1965	34,449	845,600	537,500	250,600
1966	36,546	928,500	559,400	261,600
1967	39,767	976,600	576,400	266,600
1968[b]	40,659	1,079,700	600,000	300,000

[a]*The Soybean Digest*, Blue Books 1964 through 1968.
[b]Estimated.

TABLE II

Comparison of Major Crops: Acreage and Dollar Value[a]

Crop	1952		1960		1969	
	1,000 Acres	Dollar value	1,000 Acres	Dollar value	1,000 Acres	Dollar value[b]
Corn	82,200	$5,200,000,000	81,700	$4,600,000,000	64,400	$5,850,000,000
Cotton	25,900	2,770,000,000	17,500	2,500,000,000	12,000	2,000,000,000
Wheat	78,600	2,730,000,000	54,900	2,400,000,000	54,300	1,915,000,000
Tobacco	1,800	1,125,000,000	1,150	1,185,000,000	930	1,140,000,000
Oats	42,300	950,000,000	31,500	695,000,000	23,300	545,000,000
Soybeans	14,400	765,000,000	23,700	1,030,000,000	43,000	2,400,000,000
Barley	9,200	310,000,000	15,600	355,000,000	10,400	450,000,000
Grain sorghums	12,300	250,000,000	19,600	690,000,000	17,700	700,000,000

[a]*1965 Commodity Yearbook*, Commodity Research Bureau, Inc.; June 1969 USDA Crop Summary.
[b]Assumes all crops at support price.

of total in 11 years; (g) steady decrease in use of miscellaneous protein sources; (h) steady growth of total protein needs of the domestic feed industry.

The ones showing the best growth trends are soy and urea. Despite the forays of urea, soybean meal has maintained just a little over one half of the protein market. Urea's growth seems to have been at the expense of other than soybean protein sources. Incidentally urea, mixed 1 to 6 with corn is more or less equivalent to soybean meal for part of the protein requirements of ruminants; and is usually considerably cheaper.

In the animal food area, soybean meal may have to compete in the near future with expanded use of urea, protein from petroleum and high lysine corn.

Protein from petroleum is being commercialized with the construction of two full size plants overseas. Much research activity goes on in this area. High lysine corn is in an advanced development stage and it may establish itself as a factor in the protein market shortly.

On the other hand, some people see economic possibilities in using the vegetable proteins directly for human food instead of our present practice of feeding the vegetable protein to animals and then eating the animals. The animal is about 25% efficient in the conversion of vegetable protein to meal protein. There are a good many all vegetable meat analogs available today in which no protein is lost in the conversion steps. With most projections indicating scarcer and costlier meat, these new vegetable protein based foods may come to the fore strongly.

OIL

Vegetable oils have three principal food functions: (a) cooking medium; (b) spread such as margarine; and (c) flavor enhancer such as salad applications. Oil is a very high energy food and a certain amount is needed in the diet for good health. Nutritionists say that about 22 lb per capita per year is minimum. The variation in consumption among the world's peoples is very dramatic as evidenced in Table IV.

Soybean oil is not without its competitors as shown in Table V which shows the domestic usage of the various oils in recent years. The percentage of the total demand satisfied by soybean oil is 51%. The steady increase in soy oil consumption and the steady decrease in butter, lard and cottonseed oil usage are impressive.

Since oil is so essential to the dietary and traditional meals of most of the world's population, and with a great deal of that population consuming only a fraction of its potential, the future of all fats and oils seems most secure. There is relatively little promising activity in the area of synthetics that would, at this time, disturb the steady growth in the demand for fats and oils.

MARKETING OF SOYBEANS

From a marketing standpoint, soybeans lead an interesting life. To begin with the farmer has several options:

1. He may sell his beans to the local elevator at a firm cash price even before the seed is in the ground.
2. He may sell Chicago Board of Trade futures up to approximately one year before the seed is put in the ground if he thinks the board price is higher than will be the cash price at harvest or sometime later.
3. He may harvest and sell directly to the elevator at that time.
4. He may place the beans in storage and hold for a more favorable sale.

TABLE III

Protein Consumption by Domestic Feed Industry in Thousands of Tons[a]

Year	Soybean meal	Cottonseed meal	Fish meal	Gluten feed & meal	Tankage & meat scraps	Urea S.B.M. equiv.	Others[b]	Total
1957	7,962	2,097	409	1,030	1,388	300	1,733	14,919
1958	8,938	2,198	518	1,046	1,480	400	1,605	16,185
1959	8,450	2,330	448	1,142	1,664	500	1,387	15,921
1960	8,837	2,498	545	1,098	1,695	640	1,510	16,823
1961	9,232	2,622	622	1,237	1,760	750	1,355	17,578
1962	9,556	2,585	655	1,285	1,837	960	1,316	18,194
1963	9,138	2,696	737	1,368	1,940	1,170	1,285	18,334
1964	9,236	2,680	625	1,406	1,932	1,350	1,257	18,486
1965	10,274	2,563	627	1,481	1,961	1,500	1,230	19,636
1966	10,820	1,755	827	1,486	2,068	1,800	1,133	19,889
1967	10,758	1,465	1,063	1,515	2,059	2,100	1,082	20,042
1968[c]	11,200	2,000	750	1,500	2,100	2,400	1,095	21,045

[a]*The Soybean Digest*, Blue Books 1964 through 1968.
[b]Includes linseed, peanut and copra meal dried and other milk products.
[c]Estimated.

TABLE IV

Per Capita Consumption of Fats and Oils by Country[a,b]

Country	Pounds per year	Vegetable oil, %
United States	45.4	41.8
Belgium-Luxemburg	64.9	40.3
Italy	37.0	79.1
Denmark	59.4	29.0
Japan	10.5	76.3
U.S.S.R.	22.6	51.6
East Germany	58.1	38.6
China (Mainland)	6.2	70.1
Argentina	34.5	66.0
India	8.4	100.0
Korea	1.7	52.4

[a]*Agricultural Commodities*, Projections for 1975 and 1985, Vol. 2.

[b]Average per capita requirement for a balanced diet is 22 lb per year.

5. He may place the beans under a price support loan or purchase agreement which he will redeem when and if the cash price ever exceeds the loan value.

6. He may sell the cash beans at harvest and then buy Chicago Board of Trade futures if he feels that the board price of beans will improve as time goes on.

7. He may deliver the beans to the local elevator and sell them on the "basis" which means at some predetermined differential to a particular futures option month. Whenever he feels that the particular futures option is at its highest level he then sells for cash at the predetermined differential to the board.

The country elevator is usually the second handler of the bean crop and he has all the options which the farmer has except for the availability of the support price loan.

The beans usually leave the country elevator for shipment to the processor, the exporter or to a terminal elevator operator who later will sell to the processor or exporter. Most of the above mentioned options are open to these people also with the exception of the price support loan.

Exports of soybeans will run in the neighborhood of 300,000,000 bushels in 1969. As these beans are almost entirely sold for dollars, the beneficial effects on our balance of trade is obvious. Soybean meal also enjoys a fine dollar market overseas with this year's exports probably in the area of 3,000,000 tons. In total, soybean and soybean products exports have been earning approximately one billion dollars annually.

Roughly twice as many beans are crushed domestically as are exported or about 600 million bushels in the 1968 crop year. The balance of the crop is used for seed or goes into storage for the surplus account. Most trade sources expect this carryover to be in the heighborhood of 300 million bushels at the end of this crop year with the expectation that the crop now in the ground will add substantially to this carryover.

POTENTIAL PROBLEMS FOR SOYBEANS

There is a price support program for soybeans. Lately there has been a problem of selling the products of the total soybean crop at prices which recover costs. The result is a continuin build-up of stocks. As can be seen from the usage figures, soybeans themselves have no inherent value except as seed. One way or another, they must be processed before they can be used.

The Government in recent years has followed a policy of increasingly higher soybean support prices which tends to restrict usage of its products and at the same time to encourage the development of all manner of oilseed crops around the world. Also encouraged was the development of the urea based materials which today is the second largest source of protein for domestic formula feeds.

In 1967 the build-up of soybean stocks in this country began. By the springs of 1969, it was obvious that a carryover of 300,000,000 bushels from the 1968 crop would exist. Storage and interest costs on such a quantity of beans amounts to a large figure. It was obvious that something had to be done to arrest this trend. One possibility was to put on acreage controls and to maintain the $2.50 support price. The cost of the cotton crop dropping over the past 25 years to 25% of its former acreage and the attendant ills under a similar policy caused real concern among many interested parties. Since soy protein and oil are so prominent in the total world picture, a U.S. price support on beans amounted to a price support for all the oil seeds producers around the world as we were the only ones willing to keep a part of our crop off the market whereas virtually all other nations sell at whatever price is needed to force consumption or to discourage production, or both.

After much debate, a decision was made to reduce the loan price for the 1969 bean crop from $2.50 to $2.19 per bushel. Despite the beneficial effects of making the end products—oil and meal—more competitive, it appears that our carryover next year will be added to.

The farmers are unhappy with the lower support price as it so directly affects their net income. Would they be better off in the long run with less acres at a higher price? The cotton story would indicate that the health of the crop could be destroyed. The matter finally comes down to this: does the U.S. want to assume the posture of residual supplier of protein and oil to the world with the resulting control and storage problems or should this country produce only for consumption? How this situation is answered is going to have a tremendous impact worldwide.

Another threat to the health of the soybean industry

TABLE V

Food Fats and Oils: Domestic Use in Millions of Pounds[a]

Year	Soybean oil	Butter	Lard	Cottonseed oil	Others[b]	Total	Soybean oil, %
1959	3,376	1,373	2,003	1,299	773	8,824	38.3
1960	3,329	1,380	1,969	1,461	911	9,050	36.8
1961	3,540	1,400	1,982	1,352	967	9,241	38.3
1962	3,624	1,332	1,904	1,347	1,063	9,270	39.1
1963	4,058	1,399	1,786	1,407	1,289	9,939	40.8
1964	4,069	1,291	1,780	1,555	1,195	9,890	41.1
1965	4,687	1,193	1,676	1,590	1,272	10,418	45.0
1966	4,837	1,086	1,781	1,157	1,387	10,248	47.2
1967	5,086	1,176	1,834	1,090	1,394	10,580	48.1
1968[c]	5,600	1,200	1,800	900	1,400	10,900	51.4

[a]April 1969 *Fats & Oils Situation*, Economic Research Service.

[b]Includes corn, olive, peanut and safflower oil and edible tallow.

[c]Estimated.

centers around a proposal by the European Economic Council's to place a $60 per ton tax on soy oil and a $30 per ton tax on soy meal consumed within the EEC. It would appear that this would not only reduce soy meal exports to EEC but also soybeans. This issue is apparently not yet resolved but could have a profound effect on the U.S. soy industry.

Another potentially serious problem for soybeans is the problem of being able to compete for acreage. Over the years corn and wheat yields have been increased dramatically by hybridization, fertilizer usage and many other farm management practices. Not so with soybeans who seem to be stuch at a national average figure of 25-26 bushels per acre. As all costs of farming rise, increased yields are needed if soybeans are to compete for land usage as there does not seem to be much spring in the price area. The fact that a few selected farmers have been able to obtain yields of over 100 bushels per acre on 5 acre test plots encourages the idea that soething better than a national average of 25 bushels per acre can be accomplished with the tools at hand.

Increased urea usage, protein from petroleum or gas and high protein cereal grains represent threats to the future prosperity of soybeans. All appear to have substantial or even devastating potential insofar as soybean meal is concerned. On the other hand, no one can be sure that even a small part of the potentials will ever be developed. In general, the world is short of protein and the prospects are for even a greater shortage.

OBSERVATIONS

Petroleum based proteins appear to be on the threshold of practicality and they could present severe competitive problems for natural proteins.

Urea-type chemicals have already heavily invaded the protein area of our animal feed industry with no let-up in sight.

High lysine corn and other new high protein cereals have the potential to reduce protein requirements from conventional sources.

The tact which the U.S. government takes in the soybean area, however, may be more important to the ultimate health of the industry than any of the competitive factors.

The production of high quality meat analogs directly from natural proteins is growing fast.

The total world needs for both fats and oils and protein seem so great in the near future that it would seem to be a good guess that all possible sources will continue to find a good demand.

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