Feature

Update:
Fats and oils industry changes

The following article on major changes in the fats and oils industry during the past 25 years and a view of the future was prepared by JAOCS *News Editor Barbara Fitch Haumann, who incorporated comments solicited from industry representatives . A.R. Baldwin, who served as editor for* JAOCS *for nearly 40 years, was a major contributor to this article. Others who assisted were A. Sieffert of the E.E.C. Seed Crushers' and Oil Processors' Federation (FEDIOL), oils and fats technical consultant Kurt G. Berger who is associated with the Palm Oil Research Institute of Malaysia and Arnold M. Gavin of EMI EX/IM Corp.*

Dramatic changes have occurred in the world's fats and oils industry during the past 25 years. U.S. soybeans, the major factor in world fats and oils trade in 1961, have encountered increasing competition from soybeans produced in South America as well as from palm oil, sunflowerseed and rapeseed (Tables 1 and 2). In 1961, producing countries exported raw materials to developed nations for processing; now, more and more processing is done where the raw materials are produced. In the processing sector, consolidation has led to fewer, larger companies operating on a global basis. Meanwhile, nutritional research has led to more consumer awareness—and sometimes confusion—concerning the effects of dietary fat on health.

Soybeans

U.S. soybean dominance of world oilseed trade during the 1950s and 1960s began to crack in the 1970s. U.S. embargoes on soybean exports in 1973 and 1980 led Europeans, the Soviets and the Japanese to look for alternate sources of supply. They found Brazil and Argentina willing to learn how to grow soybeans for the export market. "Basically, the Japanese and Russians said they were not going to be affected again by American embargoes of soybean exports," according to A.R. Baldwin, former director of research at Cargill Inc.

Baldwin said that three decades ago when he was in Brazil working on seed development, soybean production was less than 100,000 metric tons (MT) annually. Now, Brazil regularly produces more than 15 million MT annually. "Likewise in Argentina at that time, I couldn't even get anyone to try a two-acre experimental growing of soybeans. Now, they produce up to four million tons a year," he said.

"No one 35 years ago would have even dreamed of the large-scale production of soybeans in Brazil and Argentina, which now are major players in the soybean market. Soybeans even are being grown in Europe on a fairly large scale due to oilseed subsidies there," Baldwin added.

Fixed production costs for U.S. soybeans remain higher than those of Brazil and Argentina despite such U.S. strengths as higher crop yields and soil productivity, strong research, and favorable transportation costs, according to the report *U.S. Global Competitiveness: Oilseeds and Oilseed Products* published by the U.S. International Trade Commission (ITC). Ohio State University researcher Norman Rask has estimated total costs of producing a bushel of soybeans at $6.62 in the U.S., $5.39 in Brazil and $4.06 in Argentina.

In the world soybean market, Brazil's share of international trade has grown from 3% in 1981/82 to 14% in 1984/85; in the same time span, Argentina's market share rose from 6% to 13%. Meanwhile, the U.S. share declined from 82% to 65%. In world soybean oil markets, Argentina's share has grown from 3% in 1981/82 to 14% in 1984/85. Brazil's share has increased from 24% to 27%; the U.S. share has fallen from 27% to 20%.

Palm oil

The African oil palm "was only on the horizon 35 years ago," Baldwin said. Since then, the commercialization of African oil palms in the Southeast Asian nations of Malaysia, Indonesia and Papua-New Guinea has been a significant development, according to A. Sieffert, secretary general of the E.E.C. Seed Crushers' and Oil Processors' Federation (FEDIOL).

"Malaysia, of course, has become the major oil palm grower," Baldwin said. "The introduction of the palm mite greatly increased production, but the expectation for further increases by using clones of high-yielding plants has not materialized. As a matter of fact, I guess the oil palm cloning business has been set back to square one. We haven't begun, though, to see the end of the increase in palm production. Indonesia has lots of new plantings yet to mature."

World palm oil production averaged 1.3 million MT a year between 1958 and 1962, according to data from *Oil World*. By 1982/83, production had reached 5.9 million MT annually. This year, it is projected to be over eight MT, possibly as high as 8.5 MT.

Malaysia, Singapore and Indonesia are the three largest exporters of palm oil. Although Singapore does not produce palm oil, significant volumes of Malaysian palm oil are shipped through Singapore. Malaysia and Indonesia account for 77% of world palm oil production. Indonesian production is expected to rise sharply due to maturing area. Other producers include Nigeria, Colombia, Thailand, Papua-New Guinea, Brazil and Ecuador.

Rapeseed

Introduction of low erucic acid, low glucosinolate varieties of rapeseed has fostered a rapid expansion of planted acreage in North America and Europe that has vaulted rapeseed oil from No. 8 in world production 25 years ago to the No. 3 spot today. The former varieties

TABLE 1

World Production of Major Vegetable and Marine Oils

Oil	1961	1978/79	1987/88[a]	Relative rank			Percent of 1987/88 total
	(in million metric tons)			1961	1977/78	1987/88	
Soybean	3.28	11.70	15.50	1	1	1	29.1
Palm	1.32	4.27	8.52	7	3	2	16.0
Rapeseed	1.22	3.66	7.03	8	4	3	13.2
Sunflowerseed	2.02	4.67	7.00	4	2	4	13.1
Cottonseed	2.37	2.99	3.31	3	6	5	6.2
Coconut	1.99	2.80	2.71	5	7	6	5.1
Peanut	2.47	3.30	2.69	2	5	7	5.0
Olive	1.42	1.58	1.63	6	8	8	3.1
Fish	.62	1.20	1.41	10	9	9	2.6
Palm kernel	.42	.63	1.14	11	11	10	2.1
Linseed	.87	.74	.65	9	10	12	1.2
Corn oil	NA[b]	.44	1.13	NA[b]	13	11	2.1
Sesameseed	.40	.50	.58	12	12	13	1.1
Total	18.40	38.48	53.30				

[a]Forecast by the U.S. Department of Agriculture in February 1988.

[b]NA, not available.

Sources: U.S. Department of Agriculture's Foreign Agricultural Service, *World Oilseed Situation and Market Highlights*, February 1988, p. 15, and *Oilseeds and Products*, January 1983, p. 5. Also, *Oil World: The Past 25 Years and Prospects for the Next 25 in the Markets for Oilseeds, Oils, Fats and Meals*, ISTA Mielke GmbH, 1983, Hamburg, West Germany, and *Oil World Statistics Update 1987-1988*.

TABLE 2

World Production of Major Oilseeds

Oilseed	1960/61	1978/79	1987/88[a]	Relative rank		
	(in million metric tons)			1960/61	1978/79	1987/88
Soybeans	24.56	77.45	101.42	1	1	1
Cottonseed	18.99	23.79	29.98	2	2	2
Peanuts	9.08	17.65	19.09	3	3	5
Sunflowerseed	6.06	12.80	20.45	4	4	4
Rapeseed	4.02	10.72	22.25	5	5	3
Copra	3.43	4.38	4.49	6	6	6
Flaxseed	3.18	2.47	2.35	7	7	8
Palm kernel	.95	1.35	2.67	9	9	7
Sesameseed	1.30	1.85	2.05	8	8	9
Total	71.57	152.46	204.77			

[a]Forecast by the U.S. Department of Agriculture in February 1988.

Sources: U.S. Department of Agriculture's Foreign Agricultural Service, *World Oilseed Situation and Market Highlights*, February 1988, p. 16, and *Oilseeds and Products*, January 1983, p. 5. Also, *Oil World: The Past 25 Years and Prospects for the Next 25 in the Markets for Oilseeds, Oils, Fats and Meals*, ISTA Mielke GmbH, 1983, Hamburg, West Germany, and *Oil World Statistics Update 1987-1988*.

North America

U.S. soybean growing area peaked in 1980 at 70 million acres. In recent years, it has declined, with only 56.4 million acres harvested in 1987.

U.S. soybeans accounted for 65.9% of all world oilseed trade volume in 1979/80. By 1986/87, its share had dropped to 55%. In the same time span, world rapeseed doubled its share, from 5.8% to 11.8%, and soybeans produced outside the U.S. increased from 14.7% to 20.7%.

In 1986, the volume of soybeans crushed in the U.S. had more than doubled that crushed in 1960. However, in recent years U.S. oilseed-related exports have been declining. Table 3 shows USDA projections for U.S. oilseed and products exports for fiscal years 1987 and 1988.

The *1982 Census of Manufactures* counted 243 vegetable oil mills operating in the U.S. in 1982, compared with 260 in 1977. Of these, soybean oil mills had increased to 137 establishments, versus 121 in 1977; cottonseed oil mills had declined to 77 from 97 in 1977; and other vegetable oil mills had declined to 29 mills from 42 in 1977.

In January 1986, there were 73 soybean crushing mills in the U.S. operated by 13 firms with the capacity to crush a total of 115.5 million short tons daily, according to the ITC report *U.S. Global Competitiveness: Oilseeds and Oilseed Products*; of these, the four largest firms held 77% of crushing capacity. Only 29 companies still operate either crushing or refining facilities in the U.S., according to the *1987 Soya Bluebook*.

Meanwhile, in the U.S. cottonseed industry, there are a small number of highly efficient mills crushing about the same amount of cottonseed that was handled by almost 900 mills in the early part of 1900, according to industry sources. The National Cottonseed Directory of Manufacturers and Suppliers of Cottonseed Products, lists 52 cottonseed oil mills; of them, 11 are owned by Southern Cotton Oil Co., a division of ADM.

That directory lists 27 refineries that handle cottonseed oil, 26 in the U.S. and one in Canada. These refineries are owned by 14 companies. Of these, Kraft Inc.'s Anderson Clayton/Humko Products unit is listed as operating five, ADM owns four, Beatrice/Hunt-Wesson Inc. and Bunge Edible Oil Corp. each own three, and Durkee Foods and Cargill each own two. However, Kraft actually operates only four because it closed its Buena Park, California, refinery in 1986.

The NCPA list does not include other refineries owned by Central Soya, Ag Processing, Cargill, ADM, Perdue Inc. and Townsend's that do not handle cottonseed. Cargill and ADM lead the industry.

Meanwhile, the Canadian industry in 1987 crushed 1.6 million MT of canola, according to the Canola Council. From 1979/80 through 1983/84, Canada exported an average of 160,000 MT of canola oil a year. By 1986/87, these exports totaled 304,700 MT a year. Canola oil exports to the U.S. grew to 68,600 MT in 1986/87, up from 3,800 MT in 1979/80 and double the 32,200 MT exported in 1985/86. Canola oil exports to India and Pakistan also have increased substantially.

In 1987, Canada exported 320,000 MT of canola seed to Mexico, a seven-fold increase since 1984/85. The Canola Council credited the increase to canola's price competitiveness with U.S. and Argentine sunflowerseed, market development efforts by exporters and the Canola Council, a financing program offered by Canada's Export Development Corp., and growth in consumer demand.

posed potential health problems for people (high erucic acid content in oil) and animals (high glucosinolate content in meal).

Canada now plants virtually all canola (low erucic acid, low glucosinolate) varieties. The U.S. Department of Agriculture (USDA) estimates European rapeseed production will be all double-low varieties by 1991; currently, approximately 15% of the French rapeseed crop and 40% of the West German rapeseed are double-low varieties.

"Canola was a surprise development, and the Canadian government took advantage of the opportunity to develop and produce the new double-zero rape on a big scale," Baldwin said.

The U.S. Food and Drug Administration (FDA) in 1985 ruled that low erucic acid rapeseed oil could be used in food products in the U.S. The first company to act on this was Procter & Gamble (P&G), which in 1986 reformulated its Puritan cooking oil to contain 100% canola oil. The previous version had been a blend of 80% sunflowerseed oil and 20% soybean oil. In announcing the change, P&G said it was in response to marketing studies showing consumer preference for products lower in saturated fats.

"No doubt, right or wrong, there has been and still is a huge influence on the part of the promotion (both technical and popular) of polyunsaturated fatty acids (PUFA) on the oilseed industry. It was a major factor in the development of the sunflower business and canola," Baldwin noted.

In 1987, the Edible Oil Division of Bunge Corp. introduced a 100% canola salad oil and liquid shortening to its food service customers. Campbell Soup Co., which has been using canola oil to replace hardened soybean oil in its canned foods in Canada, said it was considering using canola in its U.S. operations but was waiting for FDA clearance for the term canola. Currently, package labels in the U.S. must designate canola oil as low erucic acid rapeseed oil.

Other oils

High oil sunflowerseed varieties developed from seed originally from

TABLE 3

U.S. Exports of Oilseeds and Products

Commodity	Fiscal Year 1987 (in 1,000 metric tons)	Fiscal Year 1988[a] (in 1,000 metric tons)	% Change
Soybeans	21,322	20,684	-3
Soybean meal	6,661	6,350	-5
Soybean oil	538	1,000	+86
Sunflowerseed	333	250	-25
Sunflowerseed oil	156	225	+45
Peanuts	251	260	+3
Total[b]	29,913	29,389	-2

[a]Forecast.

[b]Includes other commodities.

Source: U.S. Department of Agriculture's Foreign Agricultural Service, *World Oilseed Situation and Market Highlights*, February 1988, p. 60.

South America

Argentina's soybean production is forecast to reach a record nine million MT during 1987/88.

According to USDA, domestic crushing of oilseeds in Argentina has increased recently at an annual rate of 500,000 MT, resulting in more exports of oilseed products. During the past decade, two-thirds of Argentine oilseed production was crushed domestically and processed into oilseed products for export sale. The U.S. International Trade Commission (ITC) has credited the expansion of Argentina's oilseed crushing sector to an expanding export market, government policies promoting domestic crushing over the export of oilseeds, and direct foreign investment by multinational grain trading firms, including some based in the U.S.

In 1986, Argentina provided 22% of world meal exports and 14% of vegetable oil exports. According to ITC, Argentina's oilseed crushing plants declined from 73 in 1977 to 62 in 1986, with facilities changing from continuous mechanical presses to larger solvent extraction plants; many are "switch plants," which can crush oilseeds besides soybeans. Between 1977 and 1986, Argentina's total oilseed crushing capacity rose from 5.6 million MT to 11.5 million MT.

In Brazil, peanuts and cottonseed were the dominant oilseeds crushed through the 1960s. Since 1971, however, soybeans have accounted for the majority of oilseeds crushed and represented 90% of the crush in 1986.

Brazil's older oilseed mills gradually have been replaced by more modern and larger facilities using continuous solvent extraction. According to trade sources, there are four multinational companies operating in Brazil that also operate in the U.S. In 1977, there were 130 companies crushing oilseeds in Brazil; ITC estimated that 90 companies remained in 1987. Total crushing capacity since 1984 has been estimated at 27 million MT a year.

ITC credited the sharp expansion in Brazilian oilseed crushing capacity to government policies favoring domestic processing of soybeans and the exporting of processed products as well surging domestic soybean production.

the Soviet Union were introduced in the U.S., Argentina, Brazil, France and Spain during the early 1970s.

This introduction "changed thoughts on sunflowers around the world," Baldwin said, noting that this created a new crop in the U.S. and a "changed crop" in Argentina. "Sunflowers also suddenly appeared as viable crops in Romania, France and Spain. Sunflowerseed oil got promoted for its stability (better than safflower oil) and its high content of PUFA," Baldwin said.

Another development in the U.S. has been "the phenomenal increase in corn oil production," Baldwin said. This has been due to enzymatic processes for high fructose corn syrup and a gas tax subsidy on fuel alcohol, two factors that have led to increased corn processing.

World peanut oil (groundnut) production, meanwhile, has dropped from No. 2 25 years ago to No. 7 of the major oils. According to Baldwin, peanut oil previously was the major cooking and salad oil in France and a number of other European countries. "The peanuts came from the French colonies in Africa and the British colonies. Loss of these colonies made Europeans lose some of their loyalty to peanut oil," he noted. As a result, Europe now uses other oils as well for salad and cooking.

Consolidation

Oilseed and oilseed product trade currently is carried out by a small number of large multinational agricultural conglomerates, most of which operate marketing and processing facilities in several countries, the ITC report noted.

"It wasn't surprising after many years of building many extraction and oilseed processing plants that many would become unable to stand on their own feet, especially as margins became so competitive that most crushing margins were negative. So, the stronger groups were able to acquire the less competitive," Baldwin said.

He added, "Some plants closed; others expanded. Fewer administrators and managers and sales people handled bigger volumes. The

Europe

The EEC historically has been the world's largest importer of soybeans and meal. However, EEC oilseed production soared above 11.6 million MT in 1987, almost 40% above the previous year's production level (Fig. 1).

Rapeseed has shown the largest production increases. Other European oilseed crops include sunflowerseed, soybeans, cottonseed, flaxseed and peanuts.

In 1986/87, rapeseed and sunflowerseed accounted for 45% and 38%, respectively, of European production. France produced 37% of the total EEC production in 1986/87. During the same period, oilseed crush rose 47%, from 18.4 million MT to an estimated 27.1 million MT.

Most of the EEC's original crushing facilities were designed to crush soybeans. Increased domestic oilseed production, however, has led to new plants designed to crush other types of oilseeds and the conversion of older plants to crush rapeseed or sunflowerseed as well.

The EEC oilseed crushing industry has undergone significant restructuring, with some plants closing, others sold or reorganized, and the use of joint ventures in foreign markets, according to the U.S. International Trade Commission (ITC). ITC data indicate EEC crushing capacity is 25–30 million MT annually.

EEC vegetable oil production from domestically produced and imported oilseeds reached a record 6.9 million MT in 1986/87. USDA has predicted this will climb to 7.3 million MT in 1987/88, due mainly to the larger 1987 crop. According to USDA, the EEC consumes roughly half of the soybean oil produced from its meal crush and is a net exporter of around one million MT of soybean oil a year.

EEC rapeseed oil consumption is nearly one million MT and has shown an average annual growth rate of 10% between 1981/82 and 1986/87. Rapeseed oil production has climbed nearly 20% a year during that period. EEC has targeted rapeseed exports to the Middle East and North Africa. However, European sales to this area may face competition from U.S. soybean and sunflowerseed oil marketed through the U.S. Export Enhancement Program (EEP). EEP was initiated by the U.S. to combat what it said were unfair trade practices and subsidies by the EEC.

In 1986/87, the EEC became a net exporter of sunflowerseed oil for the first time, with net exports of almost 140,000 MT. Net sunflowerseed oil exports for 1987/88 are forecast at the same level.

EEC rapeseed, sunflowerseed and soybean crops are protected by target and intervention prices, crushing subsidies and guaranteed thresholds that encourage production and ensure the purchase and processing of the product. As a result, producers receive prices two to three times higher than world prices for these commodities; due to crushing subsidies, EEC meal and oil products are sold at competitive world prices and displace imports.

However, a recent development may curb further EEC expansion of oilseed production. The EEC has announced it will begin reducing oilseed subsidies toward Maximum Guaranteed Quantities (MGQ). *Oil World* has predicted EEC oilseed plantings and production as a result will decline during the next four years. For the 12 EEC countries, the MGQ are 4.5 million MT of rapeseed, 3.2 million MT of sunflowerseed and 1.3 million MT of soybeans.

result has been a more competitive business primarily run by the large international players. The business truly is international, e.g., Cargill can crush beans or anything else in the U.S., Holland, France, Brazil, Argentina, Canada. Other big processors do likewise."

Mergers, buyouts and restructurings have led to increasing concentration of capacity in the hands of a few international companies whose operations range from seed cultivation through shipping and export to complete processing (see accompanying article). Within the U.S., this has led to fewer locations that process larger quantities of oilseeds.

The ITC report noted that U.S.-based processors are expanding their foreign investments in an attempt to escape relatively high U.S. soybean prices as well as to circumvent trade barriers. Some of the world's largest agricultural conglomerates are involved in U.S. soybean processing and in oilseed processing and marketing in the EEC and South America, according to ITC. These include Archer Daniels Midland Co. (ADM), Bunge, Cargill and Continental Grain. Unilever also is involved internationally in oilseeds, fats and oils.

Currently, Cargill owns seven vegetable oil refineries in the U.S., two in England, one in The Netherlands, one in Belgium, three in Brazil and a hardening plant in Rotterdam. ADM owns 30 oilseed crushing plants and five vegetable oil refineries in the U.S. Outside the U.S., ADM has four crushing plants (in Canada, West Germany and The Netherlands) and two refineries (in Canada and West Germany). Since 1982, ADM also has held a 45% interest in Alfred C. Toepfer International, a large commodities trading firm with headquarters in Hamburg, West Germany.

One side effect of consolidation has been loss of membership for the Tri-States Oil Mill Superintendents Association (TSOMSA), based in Memphis, Tennessee. TSOMSA and the International Oil Mill Superintendents Association (IOMSA), which serve the same industry, have been exploring a possible merger. According to the two

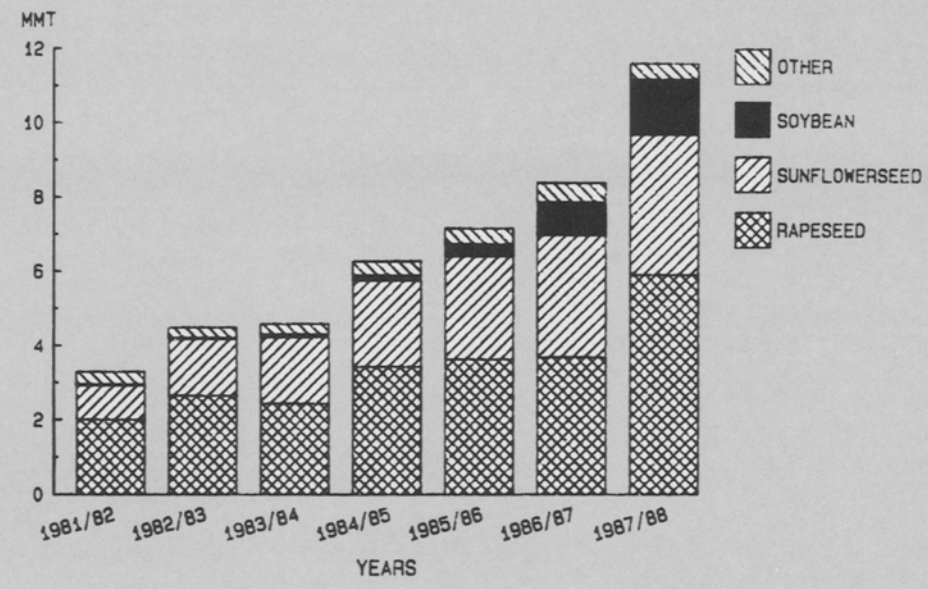

FIG. 1. EEC oilseed production, 1981/82–1987/88. EEC countries include Belgium, Luxembourg, Denmark, Ireland, France, West Germany, Greece, Italy, The Netherlands, Portugal, Spain and the United Kingdom.

Source: U.S. Department of Agriculture's Foreign Agricultural Service, *World Oilseed Situation and Market Highlights*, January 1988, p. 54.

groups, theirs is a mature industry, with only a fraction of the plants that were operating when the two groups were organized and with just a few owners.

Oilseed product trade

During the past 25 years, crushing capacity in the world has grown considerably. One development has been construction of refining facilities in the country of production, according to fats and oils consultant Kurt G. Berger. He cited Malaysia's current capacity to refine five million MT of palm oil a year as an example.

Government trade policies, in the U.S. and abroad, have become an important factor in oilseed and oilseed product trade. Government intervention in the form of price-support programs and import quotas or other market protection policies is commonly used. Another government policy used has been preferential tax treatment, i.e., to promote soybean meal and oil exports at lower prices than the price for soybeans from which they were processed.

"It's my impression that most countries are doing their indigenous processing and exporting oil and meal instead of oilseeds," Baldwin said.

"Export-wise, one can see a great increase in South American and East Asian shares, mainly Indonesia, Malaysia and Papua-New Guinea," Seiffert noted. "Import-wise, the shares of African countries, India, Pakistan and sometimes also Eastern block countries have soared to such an extent that they have become importing, rather than exporting, countries."

Processing technology

One development has been the widespread adoption of solvent extraction of oilseeds to separate oil from meal more efficiently than the screw-press method that previously dominated.

Other processing technology developments such as interesterification, physical refining and fractionation have become important, particularly for palm oil, Berger said.

Fractionation has become big business in Malaysia in order to take advantage of the processing incentives of the Malaysian government—a tax on export of crude oil but not on fractions, according to Baldwin.

"Another big development, of course, has been the mammoth palm oil-processing industry in Malaysia," he added. "That line of processing (refining) plants is quite impressive. A related development has been steam refining (physical refining), but, of course, that is not restricted to palm oil. The export of low-cost palm oil to India has taught the Indians how to use a new oil."

Baldwin and Berger noted other trends such as the switch of oil refining from fats and oils distributors to the crushers, and the bulk transport of edible oils. "To-

day, more than 20 million MT per year travel around the world. Malaysian palm oil now can be—and is—delivered to Western markets in a ready-to-use fully refined state," Berger said, predicting, "This will expand to other oils."

Other developments

Berger cited the development of gas liquid chromatography for analysis as an important milestone for the fats and oils industry. "As a result, it now is so easy to understand our materials. This really is a basis for many other advances," he said.

Also, margarine has become the predominant table fat, versus butter. "The quality of margarine has improved so much in this time period that it is the major table spread now," Baldwin said. He added, "Health factors have encouraged the production of high PUFA ratio margarines, light margarines and soft margarines. However, liquid margarines don't seem to be so well-accepted."

Berger pointed out that the understanding of polymorphism helped in margarine's acceptance as it allowed technologists to produce margarine that remains smooth.

Berger also noted the development of "tailor-made" fats such as cocoa butter equivalents. "This first has occurred by selective fractionation. Is the next step enzyme synthesis?"

Development of specialized food emulsifiers for use in bread, ice cream and confectioneries also has occurred, Berger said.

Dietary fat and health

A factor in recent years has been growing consumer awareness of the possible links between dietary fat and health, due directly to publicity surrounding findings that fats provide essential nutrients for good health, that polyunsaturated fatty acids (PUFA) play a role in serum cholesterol balance, and that PUFA are precursors for prostaglandins.

Companies, in turn, have used this information to promote vegetable oil versus animal fat consumption. In fact, there has been a measurable shift from saturated animal fats to polyunsaturated vegetable fats and oils, according to USDA figures (see accompanying article on trends in U.S. fats and oils consumption).

The discovery of the prostaglandins, thromboxanes, their structure, relation to essential fatty acids and their physiological effects also are seen by Berger as important milestones in research on diet and health. "Is this where we will find the ultimate answer to the control of cardiovascular disease? If so, the implications for the industry will be profound," Berger said.

Biochemical and nutritional research on the effects of various dietary fats on health continues. In

recent years, a major topic has been on the omega-3 fatty acids from marine oils as well as from other polyunsaturated fatty acids.

Meanwhile, consumers in developed nations have been urged to lower dietary cholesterol and fat intake. In 1984, a National Institutes of Health panel recommended that Americans limit their cholesterol intake to less than 300 mg per day, fat intake to 30% of total calories in their diet, saturated fat intake to less than 10% of calories, and polyunsaturated fat intake to a maximum of 10% of calories. *Nutrition and Your Health: Dietary Guidelines for Americans*, published in 1985, however, made no specific statement on the quantity of fat consumed; instead, it recommended only to avoid too much fat, saturated fat and cholesterol.

Also during the past 20 years, some research has centered on developing low-calorie materials to replace fats in foods. P&G, for instance, has spent more than 20 years testing and analyzing sucrose polyester. In 1987, P&G announced it had petitioned FDA for approval of this calorie-free fat replacement, which it named olestra, for use in shortenings, oils and salted snacks.

The next 20 years

There are a number of possible developments to watch during the next 20 years. Baldwin suggested the following:

- genetic development of plants to produce specific fats or oils. This could include cuphea for coconut oil-type fat; jojoba ("still a long way to go," Baldwin said) for high-liquid wax types; rapeseed with almost any type fat desired; meadowfoam and other sources of omega-3 fatty acids.
- an increase in the contract-growing of plants to produce these special oils.
- soybeans with low or zero linolenic acid.
- soybeans with higher yields (possibly hybrids) with broader adaptability to increase overall production.
- increased consolidation of oilseed processing.
- greatly expanding palm oil production in Indonesia and possibly also in Central and South America. Malaysia, however, will remain the major producer. "It has a big head start," Baldwin said.

Arnold M. Gavin noted that the People's Republic of China is an area to watch in the changing international fats and oils industry. During a recent trip there, Gavin viewed several plants that solvent extract, refine, hydrogenate and deodorize oils to produce quality finished products. "However, these plants are in the minority. The majority of locally produced edible oils are cold pressed. The crude oil is sold without further processing."

He added, "China's fats and oils industry is in the same stage of growth as ours was in the 1920s and 1930s. Its large population will demand increasing amounts of edible oils. At some point, they will have to increase the efficiency of their extraction plants to produce more oil. This oil will have to be further processed. It is possible China will export the crude oil and import finished products, steps which could be done today. However, they do not have the foreign exchange; if they cannot exchange commodities, they will have to upgrade their own industry," Gavin said.

Dwayne Andreas, chairman of ADM, also sees China—and Russia—as generating additional demand for oilseed products. At the National Corn Growers Association meeting in St. Louis in February, Andreas told U.S. corn growers

Asia

Before World War II, the Southeast Asian market was dominated by coconut and peanut oil. After the war, soybean oil was introduced and soon was the dominant oil used in food preparations, according to the United Coconut Association of the Philippines. More recently, palm and rapeseed oils have made inroads here.

Coconut oil's share of world oil production was 32% during the years 1948 to 1952. Currently, it is nearer 5% (Table 1).

Rapeseed crushings have risen sharply not only in the EEC and Canada but also in China and Japan. *Oil World* has predicted world rapeseed production to reach a record 23.2 million MT in 1987/88, compared with 19.8 million MT in 1986/87, 18.6 million MT in 1985/86 and 14.3 million MT in 1983/84.

One factor cited by *Oil World* was the substantial boost in rapeseed production in China to 7.4 million MT.

Meanwhile, palm and palm kernel oils can be expected to increase their share of world fats and oils production significantly between now and the year 2000, *Oil World* predicts. Currently, palm oil production represents approximately 16% of total world oil production (Table 1).

The U.S. International Trade Commission (ITC) has estimated there were 55 palm oil refining and fractionation plants in Malaysia in 1984; however, in 1985, only 37 of these were in operation. Total capacity for the 55 facilities was rated at 6.6 million MT of crude palm oil a year.

ITC noted that Malaysia's export duty encourages domestic processing of crude palm oil into higher value-added products; this has promoted the development of the local processing industry, with more than 98% of Malaysian palm oil processed domestically.

In 1985, there were a total of 229 palm oil mills in Malaysia, with the capacity to handle 7,318 MT of fruit bunches per hour. At that time, the addition of those planned and under construction brought the total to 272 palm oil mills, with capacity to handle 8,345 MT of fruit bunches per hour.

that Russian goals to boost livestock and poultry production will require more soybean meal for feed and that China will continue to use more cooking oil.

As world markets for oilseeds and oilseed products increase, market shares for soybeans and soybean products will decline, ITC predicted. Between 1980 and 1986, world oilseed meal consumption increased 2.5% annually; soybean meal consumption, however, grew only 0.8% a year. For the same time period, world vegetable oil consumption grew 4.5% a year; soybean oil consumption's growth rate was only 1.4%.

The report also predicted world oil demand will grow more quickly than meal demand. "The relatively high growth of oil demand will benefit U.S. soybean producers less than European rapeseed and sunflowerseed producers because soybeans have proportionately smaller oil content and a higher meal content than either rapeseed or sunflowerseed," ITC pointed out, adding that palm oil producers might benefit the most "as oil markets are paramount to them."

Oil World editor Siegfried Mielke has predicted that India, China and Russia will be major factors in the demand picture for oilseeds and oilseed products in the coming decade. Russia, he noted, has emerged as an importer of oilmeals, a trend that probably will continue. China and India, meanwhile, likely will need to continue to import fats and oils. Key suppliers for these regions, he said, will be Malaysia, Indonesia, Argentina, the U.S. and Brazil.

Milestones

A flurry of changes, including mergers and purchases, mainly in the soybean industry has occurred during the past five years. Some of these changes have included the following. Note: This information was provided in part by the U.S. International Trade Commission report *U.S. Global Competitiveness: Oilseeds and Oilseed Products* and from news previously published in *JAOCS*.

1983

Partial merger of three farmers' cooperatives—Boone Valley Cooperative Association, Farmland Industries and Land O'Lakes—to form **Ag Processing Inc.**

Esmark Inc. acquires **Hunt-Wesson.**

1984

Seaboard Corp. acquires **Central Soya Co. Inc.'s** poultry processing division, a large buyer of soybean meal.

Unilever U.S. acquires **Beatrice Food's Shedd Margarine Group,** a large buyer of soybean oil.

Archer Daniels Midland Co. (ADM) acquires a soybean mill and elevator owned by **Continental Grain Co.**

Central Soya acquires **Procter & Gamble's Victory Soya Mills Ltd.** unit in Canada. **Central Soya** also starts up its **third edible oil refinery,** a facility in Bellevue, Ohio.

A.E. Staley Manufacturing Co. and **CFS Continental Inc.** merge. Later, Staley announces the formation of **Staley Continental Inc.,** a holding company consisting of the two merging firms as operating companies.

Ralston Purina acquires **ITT's Continental Baking Co.**

Hunt-Wesson is acquired by **Beatrice Foods** from **Esmark Inc.,** and the company is renamed **Beatrice/Hunt-Wesson Inc.**

1985

In early 1985, **Ralston Purina** sells six of its seven soybean mills to **Cargill Inc.** The seventh, in Memphis, is closed permanently. This gives Cargill a total of 20 soybean mills in the Midwest and Southeast U.S. Ten days after this transaction is finalized, **Staley Continental** announces it is selling its soybean milling and protein-concentrate business, including four mills in Illinois, Ohio, Indiana and Missouri, and a mill and oil refinery in Iowa to **Independent Soy Processors Inc.,** which includes **ADM** as a shareholder. The mills then are leased to and are operated by ADM.

Shamrock Holdings, a Disney family controlled firm, acquires controlling interest in **Central Soya Co. Inc.,** previously publicly held.

Ag Processing Inc. constructs its first edible oil refinery to add to its six soybean crushing facilities. The refinery is adjacent to Ag Processing's crushing facility in St. Joseph, Missouri.

Perdue Inc. and **Townsend's,** a competitor of Perdue, each build a **soybean refinery.** Perdue's is constructed at its Salisbury, Maryland, site; Townsend's builds its refinery in Millsboro, Delaware.

Tiger Oats, a South African-based firm, acquires 71% of the shares of **National Sun Industries,** which operates an oilseed crushing facility in Enderlin, North Dakota. The remaining shares are held by **Universal Seeds & Oil Products Inc.** of London, England.

By late 1985, only **15 U.S. soybean processors** remain, with **ADM** and **Cargill** possessing 55% of the processing market, according to a report in the Dec. 1, 1985, issue of *Food Industry Futures.*

1986

Cargill acquires **Continental Grain Co.'s** soybean crushing, oil refinery and bulk handling operations in Liverpool, England.

Unilever U.S. acquires **J.J. Filbert Inc.,** a producer and distributor of margarines and salad-related products from **Central Soya.**

Central Soya, meanwhile, acquires the **Staley Continental** produce line of soy proteins, marketed in U.S. and world markets.

Because of low oilseed crushing margins, **Unilever PLC** sells two West German oilseed mills and a soybean facility in Europoort, The Netherlands, accounting for over half of the firm's total European milling capacity, to **Archer Daniels Midland (ADM).** The transaction provides ADM with its first crushing facilities in Europe. The Europoort facility in Holland is the world's largest soybean crushing plant; the West German operations include an oilseed crushing facility in Spyck and an oilseed and vegetable oil refinery in Hamburg.

Unilever purchases **Anderson Clayton & Co.'s** entire operations in Brazil and Mexico (**Anderson Clayton S.A.** in Brazil and **Anderson Clayton & Co. S.A.** in Mexico). The operations include 10 vegetable oilseed crushing facilities, a vegetable oil refinery, two gins and eight edible food processing plants (one of which was leased). The Brazilian operations processed and exported cottonseed and soybean products. **Anderson Clayton** then underwent a restructuring in the hopes of avoiding a buyout, but was purchased by **Quaker Oats Co.** by the end of 1986.

Kraft Inc. closes its Buena Park, California, refinery.

For the second year in a row, *Forbes* magazine ranks **Cargill** as the largest private company in the U.S. **Continental Grain,** a New York-based commodity trading firm, is ranked third, with **Beatrice Foods** in fourth place.

1987

Early in 1987, **Central Soya** and **Bunge Corp.** announce that Central Soya will buy seven Bunge soybean mills. However, the arrangement is called off after Central Soya is unable to obtain the necessary consents for financing the purchase.

Gold Kist Inc., a farmers' cooperative, sells a soybean crushing facility in Valdosta, Georgia, to **ADM.** In early 1987, **ADM** closes the **soybean crushing operations** at the Champaign, Illi-

nois, facility obtained by a group of ADM investors, organized as the **Independent Soy Processors Co.**, from A.E. Staley Co. in 1985.

Central Soya Co. Inc. buys a feed mill in Carhaix, France. **Central Soya** also announces it will undertake a multimillion dollar expansion of its **soy protein business** at the firm's Gibson City, Illinois, facility.

Ferruzzi Agricola Finanziario of Italy buys **Central Soya** from **Shamrock Holdings.**

Kraft Inc. buys the **Anderson Clayton Foods Division** from the **Quaker Oats Co.** This adds two oil refineries—in Sherman, Texas, and Jacksonville, Illinois—to Kraft's holdings, bringing Kraft's total to four refineries.

Beatrice announces it is interested in selling a number of units, including **Beatrice/Hunt-Wesson Inc.**

ADM, in its 1987 annual report, announces that both its Windsor, Canada, and Hamburg, West Germany, plants process canola oil. Meanwhile, its **Southern Cotton Oil Co.** division has experimented with rice bran crushing at its North Little Rock, Arkansas, facility and is ready to enter rice bran crushing on a commerical scale. ADM said rice bran produced at its rice mill in Weiner, Arkansas, will be crushed at the North Little Rock facility.

Cargill increases capacity at its Wichita, Kansas, edible oil refinery. Later in the year, **Cargill** closes the Louisville, Kentucky, soybean processing plant, which it acquired from **Ralston Purina** in 1985. **Cargill** also purchases **Producers Cotton Oil** in Fresno, California.

1988

Bunge Corp. closes "indefinitely" its Jackson, Mississippi, soybean crushing facility, previously owned by **Anderson Clayton & Co.**

Central Soya Co. expands capacity at its Bellevue, Ohio, de-oiled lecithin processing facility, with completion of the project scheduled for August. **Central Soya** also announces it will buy **Louisville Edible Oil Products and Gold Brands**, a vegetable oil refinery and packaging plant in Louisville, Kentucky.

Capital City Products Co. of Columbus, Ohio, and **Karlshamns AB** of Sweden announce they will merge, with Karlshamns buying all of Capital City Products' stock.

The **Feruzzi** group acquires major interests in the French firm **Lesieur**, the largest edible oil producer in France, and in the Spanish firm **Koipe**, a leading Spanish oil firm.

Feature

A user's view of the oil industry

The following are excerpts from a talk given by Chester L. Miller, vice president of commodities purchasing for Frito-Lay Inc., at the 37th annual Oilseed Processing Clinic held March 14-15, 1988, in New Orleans, Louisiana.

Not too many years ago, the predominant oil in the U.S. snack food industry, as well as in many others, was cottonseed oil. It has been especially preferred in the snack food industry because of its desirable flavor stability. In fact, for many years, it was the "gold" standard at Frito-Lay for many products.

At Swift Edible Oil Co. in the 1970s, there were two lines of shortening offered for the bakery and institutional markets. One was a premium line, in quality attributes and price, and was made from 100% cottonseed oil. The standard line of shortening at that time is virtually the only product available today, and now is made principally from soybean oil.

Soybean oil products have improved significantly over the years. Today, soybean oil products, from a quality standpoint, are difficult to improve upon. The fishy taste image is gone forever. The quality improvements in soybean oil have affected cottonseed oil use in the U.S. It wasn't too many years ago that winterized cottonseed oil was the predominant oil in the grocery stores. To my knowledge, only one refiner packs retail cottonseed salad oil today. It also is true in the salad dressing and mayonnaise industry. All switched to hydrogenated-winterized soybean salad oil.

These events began taking place in the late 1960s and 1970s, and today many of those former hydrogenated-winterized soybean oil users now use refined, bleached and deodorized soybean oil.

If recent cotton production trends continue, cottonseed oil will become a specialty oil of diminishing importance. In the past 20 years, cotton acreage has fluctuated between 14.5 million and 9.5 million acres planted. It appears that acreage will remain in a range of 10 million to 14 million acres.

U.S. cottonseed oil production in 1914 was almost double the 1987/88 forecast. Since 1914, the highest production occurred in 1953, at just over two billion pounds; the lowest production occurred in 1983 at 777 million pounds.

Meanwhile, soybean oil production was only 279 million pounds in 1937 compared with almost two billion pounds of cottonseed oil (Fig. 1). Soybean oil did not crack the one billion mark until 1942 and didn't reach two billion pounds until 1950. From that point, the progression of soybean oil has been substantial. Production doubled in the 1940s, and it almost doubled in the 1950s and again from 1960-1970. However, it now appears soybean oil production has leveled at 11 billion to 13 billion pounds.

This history provides a good background for understanding and

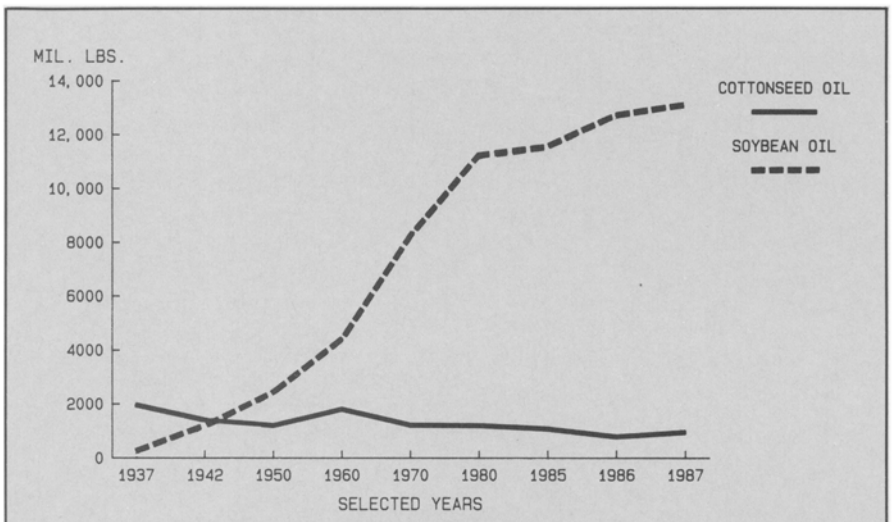

FIG. 1. U.S. cottonseed oil and soybean oil production.

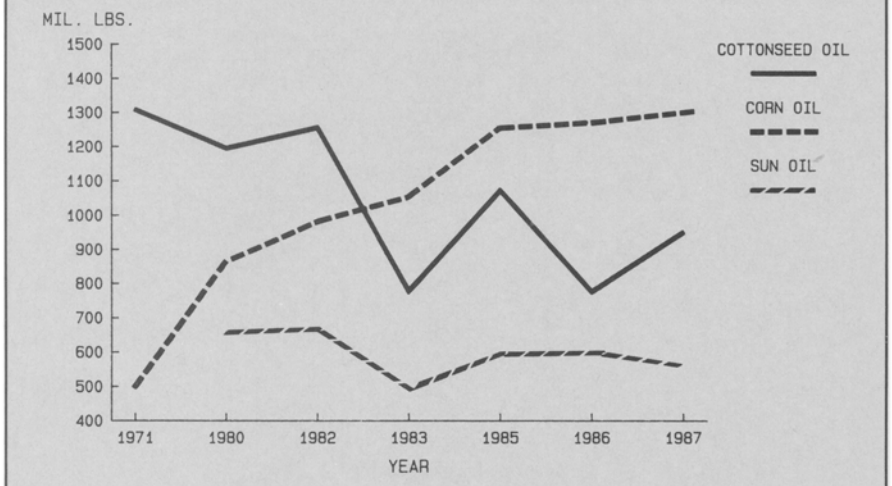

FIG. 2. U.S. oil production.

reflecting on the transition in vegetable oil usage over the past 30 years, particularly in the U.S. Our markets and the oil selection process have become even more complex since the early 1970s.

Other quality U.S.-produced vegetable oils have experienced a meteoric rise in production and importance, and now compete daily for a share of the business. Corn oil production (Fig. 2), for instance, grew 73% between 1971 and 1980 and increased another 45% between 1980 and 1985. If government sugar programs remain the same, and world sugar prices don't substantially increase, the demand for corn sweeteners could push corn oil production to two billion pounds by 1990.

A rather startling statistic is that corn oil production has exceeded that of cottonseed oil for the past three years and will no doubt do so again during the 1987/88 season (Fig. 2).

U.S. sunflowerseed oil, meanwhile, has grown from zero production in 1971 to a steady 500 million to 600 million pounds annually. The interesting thing about sunflowerseed oil is that it's truly an oilseed crop, yielding about 40% oil compared with a 17%–20% oil range for soybeans and cottonseed.

Another important development has been rapeseed oil, or in the case of Canadian double-zero seed varieties, canola oil. While there still is very little grown in the U.S., it has been creeping into the product stream from Canada.

Also, what has been happening around the world must be considered by users of vegetable oils who deal in global markets with global relationships. It's no secret that growth in some oilseeds has been rather staggering.

In South America, the growth in soybean oil production has been nothing short of phenomenal over the past 20 years. The numbers in Figure 3 represent soybean oil production in Brazil and Argentina only. This has grown from 680 million pounds in 1971 to more than eight billion pounds projected for their 1988/89 season. It becomes very clear why U.S. soybean oil exports have fallen from a high of 2.7 billion pounds in 1979 to 1.2 bil-

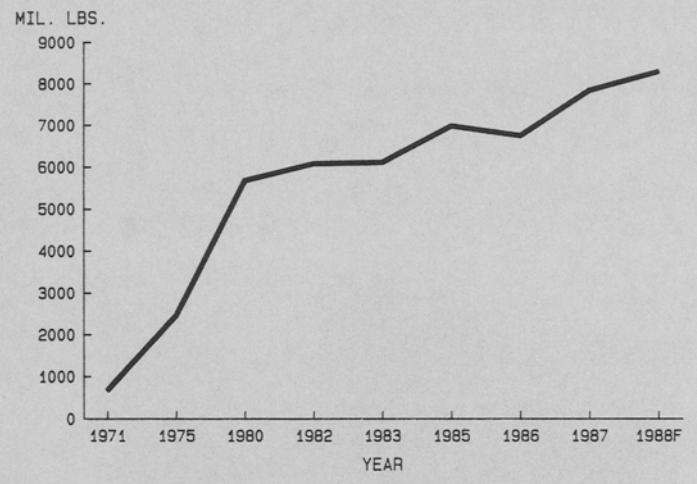

FIG. 3. South American soybean oil production.

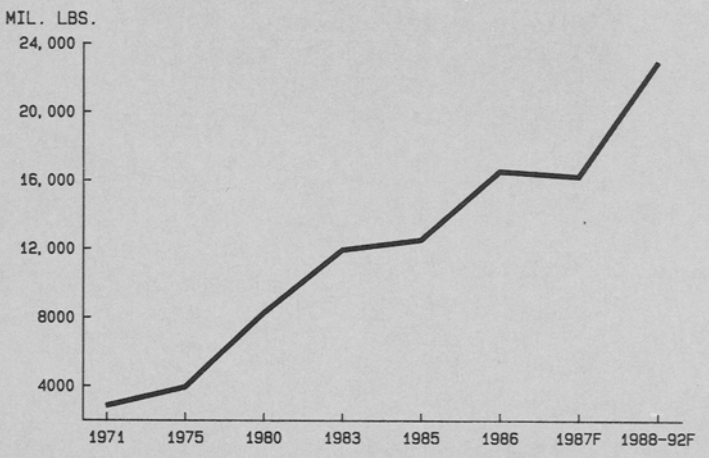

FIG. 4. World palm oil production. Forecasted average production, 1988–1992, *Oil World*.

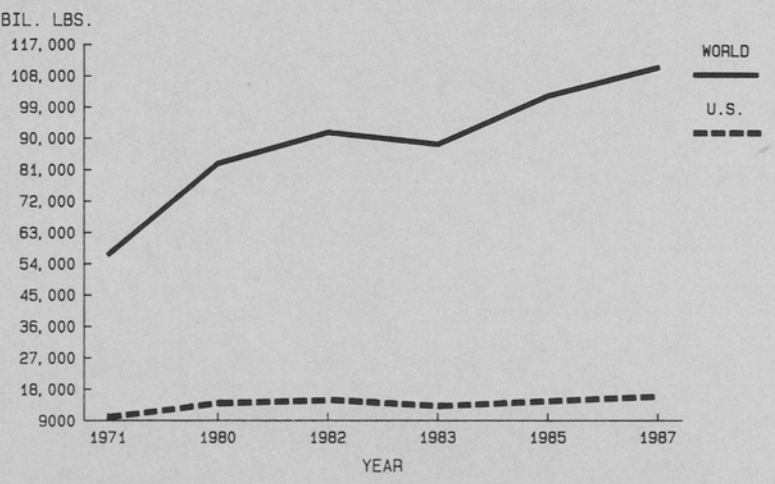

FIG. 5. Oil production, world vs U.S.

lion pounds in the just-completed oil year.

The next large area of increase is palm oil (Fig. 4). Production increases in palm oil have been phenomenal, to say the least. There is little doubt that palm was an overwhelming factor in U.S. and world oil price declines during 1985–1987. Based on current production forecasts, palm oil will be a factor for many years to come.

One thing that is quite apparent is change, and this will continue. Oil supply is shifting, both in the U.S. and in the world. In the U.S., corn oil has more than taken up the slack as cottonseed oil has declined. Sunflowerseed oil has seemingly become a fixture in the U.S.

Will rapeseed/canola become an economically viable crop in the U.S.? Will the U.S. become a residual supplier after palm and South American oils, rather than the dominant role enjoyed in the past? Will world oil continue to trade off of U.S. soybean oil futures, or will U.S. oil prices key off of palm or South America? Shall we trade oil in the future, the same as today?

These are some of the questions food processing users are asking.

A look at the overall picture leaves little doubt that palm oil and South American oils will play increasingly important roles in world oil supplies, price directions and pricing determination. World production has closely mirrored the increases seen in palm and South America.

Since 1971, total world production has increased by about 94%. U.S. production, however, is losing ground compared with world production (Fig. 5). In 1971, when world production was just over 56 billion pounds, the U.S. represented 18%, or around 10 billion pounds. Since 1971, the U.S. share of the market has dropped from 18% to about 14% in 1987.

Feature

Trends in U.S. fat and oil consumption

This article was prepared by Robert L. Rizek, Nancy R. Raper and Katherine S. Tippett of the U. S. Department of Agriculture's Human Nutrition Information Service (HNIS), Hyattsville, Maryland. Rizek is director of the Nutrition Monitoring Division, Raper is a nutritionist in the Diet Appraisal Research Branch, and Tippett is a home economist in the Food Consumption Research Branch.

Data series from the U.S. Department of Agriculture (USDA) provide information on the trends in U.S. fat and oil consumption. USDA's "disappearance" data, for instance, show the potential of the U.S. food supply for meeting the population's energy and nutrient needs if no foods are lost between the wholesale or retail level and actual ingestion. Data collected from individuals show the eating practices of men, women and children of different ages and how their diets relate to certain nutritional recommendations.

Food supply data

Use of fats and oils—edible oils, butter, margarine, lard, shortening and edible beef fat—in the U.S. increased from 49 pounds to 67 pounds per capita between 1950 and 1985 (Table 1). During this period, marked changes occurred in the types of fats and oils used, including a distinct trend toward greater use of vegetable fats in place of animal fats.

Edible oils are used mainly as salad and cooking oils or in the manufacture of food products such as mayonnaise, salad dressing or other commercially prepared foods. Use of edible oils tripled between 1950 and 1985, from eight pounds to 25 pounds per capita. Increased use of oils reflects a number of factors: growth in the availability of soybean oil at competitive prices; new hydrogenation methods that allowed the manufacture of all-vegetable shortening; increased use of vegetable oil margarines; growth of the fast food industry, which uses oils in frying; increased use of commercially prepared foods, many of which are prepared in or contain added oil; and a preference by consumers for vegetable oils over animal fats.

Among the edible oils used as salad and cooking oils, soybean oil has replaced cottonseed oil as the primary oil. The proportion of edible oils represented by soybean oil has increased from one-fourth in 1950 to more than three-fourths in 1985. In addition, soybean oil has become the predominant oil used in shortening and margarine. In 1985, soybean oil accounted for almost two-thirds of the fats and oils used in the manufacture of shortening and over 80% of that used in margarine.

Margarine has replaced butter as the primary table fat. Use of butter declined from 11 pounds to five pounds per capita between 1950 and 1985. In contrast, margarine use increased from six pounds to 11 pounds. This increase can be attributed to a number of factors: the relatively low price of margarine compared with butter; improvements in the quality of margarine; and the increased availability of inexpensive oils, mainly soybean oil, that are used in margarine manufacture.

A shift also has occurred in the per capita use of lard and shortening for cooking. Direct use of lard declined from 13 pounds in 1950 to two pounds in 1985. Shortening use has doubled over the past 25 years. Per capita use of shortening, including small amounts of lard and edible beef fat used in its manufacture, increased from 11 pounds to 23 pounds between 1950 and 1985. Although direct use of lard has declined, indirect use rose to four pounds from one pound between 1950 and 1968, but declined thereafter to about one pound in 1985.

Data on direct use of edible beef fat are available beginning in 1979. Direct use of this fat increased from less than one pound to two pounds per capita between 1979 and 1985, primarily reflecting use by the restaurant industry. Indirect use of edible beef fat as an ingredient in shortening and margarine also has increased from less than one pound to four pounds per capita between 1950 and 1985.

Individual intake data

USDA's 1985 Continuing Survey of Food Intakes of Individuals included information collected on food and nutrient intakes from a sample of women 19 to 50 years of age. Women who provided four days of intake information had a mean daily fat intake of 63 grams. More than one-third of the total came from saturated fatty acids, more than one-third came from monounsaturated fatty acids, and about one-fifth came from polyunsaturated fatty acids. Fat intakes varied widely. Ten percent of the women surveyed had total fat intakes at or below 33 grams per day, and 10% had fat intakes at or above 96 grams.

The percentage of food energy provided by fat declined from 41% in a similar survey in 1977/78 to 37% in 1985. Some of the difference can be attributed to changes in food selections, such as a shift from whole milk to low-fat milk and increased use of foods containing carbohydrates, such as grain products and sweetened beverages. Some of the difference may be attributable to changes in the way data were collected, such as increased use of probes in 1985 about the intake of fat on meat, skin on poultry and fat with vegetables. Also, the nutrient data base was updated between the two surveys to reflect additional analytical data and foods as marketed in the mid-1980s.

Some people suggest that answers may have been biased toward lower fat consumption in 1985 because of the increased recognition that reduced dietary fat is desirable, combined with the increased probing about fat by interviewers. However, we believe the additional probing used in 1985 gave fat esti-

TABLE 1

U.S. Food Supply: Quantities of Fats and Oils Available for Consumption Per Capita[a]

Year	Butter	Margarine	Shortening	Lard[b]	Edible beef fat[b]	Oils
1950	10.7	6.1	11.0	12.6	0	8.5
1955	9.0	8.2	11.5	10.1	0	10.5
1960	7.5	9.3	12.5	7.5	0	11.4
1965	6.4	9.7	14.2	6.3	0	14.1
1970	5.3	10.9	17.3	4.6	0	17.7
1975	4.7	11.0	17.0	2.9	0	19.9
1980	4.5	11.4	18.2	2.6	1.1	22.5
1985	4.9	10.7	22.8	1.8	1.9	25.1

[a]In pounds.
[b]Excludes use in margarine and shortening.

mates that are superior to those in 1977 because we learned more about the fat-related characteristics of foods eaten. The 1985 data also include information not obtained in 1977 on the type of fat used in food preparation. This information is necessary for estimating the intake of fatty acids and cholesterol. We expect results from our newest survey, the NFCS 1987, will show even further declines in fat intake because of recent changes in fat trim on meats at the retail level.

Food away from home and snacks often are blamed for diets that are high in fat and low in vitamins and minerals, but the survey data indicate that food obtained and eaten away from home contributes worthwhile amounts of most nutrients and provides only a slightly higher proportion of energy and energy-providing nutrients than of vitamins and minerals. In 1977, food obtained and eaten away from home provided 22% of women's energy intake, 22% of their fat intake, and 18%–21% of their vitamins and minerals. In 1985, food away from home provided 28% of energy intake, 29% of fat intake, and 25%–27% of women's vitamin and mineral intake. In both 1977 and 1985, snacks provided smaller proportions of fat than of food energy. Snacks, not surprisingly, tended to be disproportionately high in carbohydrates.

In 1985, USDA and the U.S. Department of Health and Human Services published the *Dietary Guidelines for Americans*. One of the recommendations made to the American public was to avoid too much fat, saturated fat and cholesterol. No quantitative guidelines were established. However, groups have suggested specific levels of intake for individuals. Although USDA does not endorse these quantitative goals, it is interesting to see how women's diets fare relative to the goals. In 1985, of the women reporting four days of intake, only 12% had total fat intakes that furnished the less than 30% of calories suggested by the American Heart Association (AHA) and the National Cancer Institute. Only 33% were below the 35% mentioned by the Food and Nutrition Board. Only 10% met the AHA goal of less than 10% of calories from saturated fat. Preliminary results show that these lower fat diets also are lower in calcium, iron and zinc. While this does not mean that low-fat, nutritious diets can't be planned, it cautions us that guidance on how to reduce fat in diets also must emphasize getting needed nutrients, or, as was the case with these women, nutrient levels may be adversely affected.

In 1985, foods from four food groups provided most of the fat intake by women. These are the meat, poultry and fish group, the grain products group, the milk and milk products group, and the fats and oils group. Meat and grains were the two most important groups. The meat, poultry and fish group, which includes fat in food mixtures that have meat, poultry and fish as a main ingredient, provided about 31% of women's total fat intake; the grain products group, also including mixtures that were mostly grain, provided 22%.

The two most important sources of saturated fatty acids are the meat and milk groups; for monounsaturated fatty acids, they are the meat and grains groups; and for polyunsaturated fatty acid, they are the grain and fats and oils groups.

Feature

More fats and oils in EEC animal feed

The following article was prepared by Brian M. Rutherford, president of European Association of Animal Feed Manufacturers (FEFAC) and former chief buyer for BOCM Silcock. Rutherford joined the European animal feed industry in 1951.

In the early 1950s, there was virtually no inclusion of liquid fats and oils in animal feed in Europe. In the United Kingdom, raw materials were decontrolled from government management in 1953. Dairy rations were formulated with corn, rice bran, corn residue, copra cake, undecorticated cotton cake, decorticated cotton cake and niger cake. Pig rations contained corn, corn germ, linseed cake, groundnut meal, meat meal and 0.25% codliver oil. Poultry pellets, meanwhile, contained corn, rice bran, groundnut meal, linseed meal, fish, blood and 0.5% codliver oil.

Codliver oil was added for its vitamin A content. Some years later, this was replaced by synthetic vitamin A. Obviously, the oil gave some energy to the rations, but in those days, there was a significant percentage inclusion of oil-bearing raw materials including oil cakes rather than extracted meals. The other interesting factor in the early 1950s was that there was very little soybean meal used in Europe. That market developed during that decade as U.S. soybean production grew.

As the 1950s progressed, so did knowledge of nutrition and economic values. Tallow then was formulated into animal feed for its energy value. Deliveries were made in drums, and the industry was still highly labor intensive. In the 1960s, fat-inclusion levels still were small. However, drum deliveries had given way to bulk delivery, although bulk storage was small. The size of the bulk tanks varied from 7 to 18 metric tons (MT).

In those years, there was an expansion in the variety of oils and fats used. Palm oil and fatty acids from palm and fish oils began to find acceptance due to their nutritional make-up and price. As the years passed, linoleic acid was found to increase egg size. As a result, use of fats and oils increased to include soybean oil, sunflowerseed oil and corn oil. Over the years, the animal feed industry has searched for usable raw material by-products and oil and fat by-products so that today, the range and blends of oils and fats used are extensive.

Over the past 25 years, the use of liquid oils and fats in animal feed has increased dramatically. In 1962, the use was estimated at 50,000 MT; by the early 1970s, it had risen to 600,000 MT. In 1975, it was 695,000 MT, and by 1980, it was just over 800,000 MT. Use by the European Economic Community's 12 countries reached 1.011 million MT in 1986. Note, however, that the esimated figures for the earlier years probably are lower than actual use because such use was not recorded or was added into other statistical categories.

The increased use of oils and fats has occurred across the whole range of animal feeds. However, ever higher levels are added to high-performance pig and poultry feed due to the higher nutrient density of the rations being produced for the improved strains of stock that need less food but more concentrated feed for each unit of production. These higher levels have been added by fat spraying techniques both into and onto the animal feed pellets.

Developments in the coming years largely will depend on the relative prices of raw materials and their energy component and on the continued increase in the nutrient density of pig and poultry rations.

A limiting factor is the development of technology to get more oil in or on the pellet; this will require more work.

Internationally, feed manufacturers and their fat suppliers in the future will scour the market for by-product oil from such sources as catering establishments and processed human food manufacturers because there should be no products wasted in this era. More attention also will be given to blends of oils and efforts to mix one oil with another to get the best fatty acid profile at the least cost.

The longer-term development, which will be dependent on relative cost, is for oils and fats to be split into discrete fatty acids which can be used and blended as appropriate for human food or animal feed.