Economics of Sunflower Oil Production and Use in the United States

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Abstract

U.S. consumption of fats and oils over the past decade increased at an annual rate of 2.8% and in 1970 reached an all-time high of 18 billion pounds. About two thirds of U.S. consumption is in food products. Salad and cooking oils, shortening, and margarine account for the major share of food oil use. Sunflower oil is well suited for these uses, especially for salad and cooking oils, and margarine, owing to its stable qualities and high ratio of polyunsaturated fatty acids to saturated fatty acids.

With yields averaging around 1250 lb./acre and prices at 3–4 cents/lb., sunflowers have not been competitive with established crops in the southern states during the past few years. Returns from sunflowers in the Red River Valley, where yields have averaged around 1000 lb, appear to be more competitive with established crops than in the southern states. Some farmers in the South have achieved yields of 2000 lb. or more per acre and this seems to indicate that yields could be improved with better management. This analysis indicates that yields of 1600–2000 lb./acre, at a price of 4 cents/lb. for the seed, should permit sunflowers to compete with corn, soybeans, wheat and sorghum in a number of farming areas. As experience is gained in growing the crop and higher yielding hybrid seed is better adapted to the available region, sunflowers should become a more significant factor in the U.S. farm economy.

Sunflowers are second only to soybeans among the world's leading oilseed crops. They achieved this position by deposing peanuts as "number two" in 1967. World sun oil production reached 4.2 million tons in 1970 or nearly one fifth of total world production of edible vegetable oils (Table I) (1). Soybean oil was "number one" with 6.7 million tons or 31% of world production. Sun oil production during the 1969–70 period increased at an average annual rate of 8.5% compared to 6.5% for soybean oil. However on a tonnage basis soybeans gained more than sunflowers during this period.

In the past several years substantial interest has developed in expanding the production of oilseed sunflowers in the U.S. This interest stems from several factors including: (1) the need for alternative cash crops in various areas; (2) introduction of high oil Russian varieties; (3) growing world demand for edible oils; (4) the rising prominence of sun oil in world markets; (5) excess crushing capacity, particularly among cotton oil mills. Major efforts to expand production have been centered in the Red River Valley of Minnesota and North Dakota and in the Cottonbelt states of the South.

TABLE I

World Production of Edible Vegetable Oils, 1970, and Average Annual Increase, 1960–1970

Oil	World production, 1970: 1000 tons	World production, 1970: %	Average annual increase, 1960–70, %
Soybean	6710	31.0	+6.5
Sunflowerseed	4210	19.4	+8.5
Peanut	3435	15.9	+1.9
Cottonseed	2655	12.2	+1.0
Rapeseed	2090	9.7	+5.9
Olive	1380	6.4	+0.6
Sesame	635	2.9	+0.9
Corn	290	1.3	+3.8
Safflower	245	1.1	+6.8
	21650	100.0	+4.4

In considering whether or not to produce a new product one must be concerned basically with two questions: (1) What is the market for this product or similar products; (2) Can it be produced at a price to compete in this market? All other questions one might raise are subordinate to these two. The product may be modified in some way to give it wider acceptance or means for more efficient production may be developed. But these actions are still directed at our two basic questions.

The purpose of this paper is to examine briefly these questions with respect to oilseed sunflowers as a new commercial crop for the U.S.

During the past decade substantial increases have occurred in both our domestic consumption of fats and oils and in our exports of these products. Domestic consumption reached an all-time high in 1970 of 79.2 pounds per capita (2). This is a 14.5% increase over the 69.2 lb. consumed in 1960. About two thirds or 53.1 lb. of the 1970 total was consumed as food products and a little over one third or 26.1 lb. were used in industrial products. Fats and oils consumption per capita worldwide has shown a substantial upward trend in recent years, although the level of worldwide consumption is still far below that in the U.S.

Figure 1 shows the trend in our domestic use and exports of food fats and oils for the period 1961–70 and forecast for 1971 (3). Domestic use during this period showed a steady increase reaching an all-time high of 11.3 billion pounds in 1970. This was a 25% increase over the 9 billion pounds used in 1961.

Of major interest is the unprecedented expansion in U.S. exports of food fats and oils that occurred in 1970, when total volume exported reached 7.4 billion pounds.

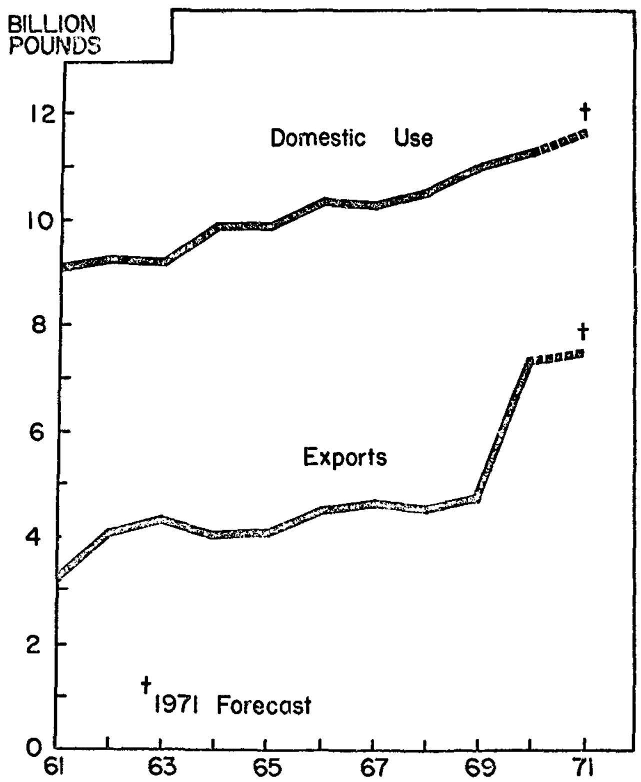

FIG. 1. Food fats and oils, 1961–1971, year ending September 30.

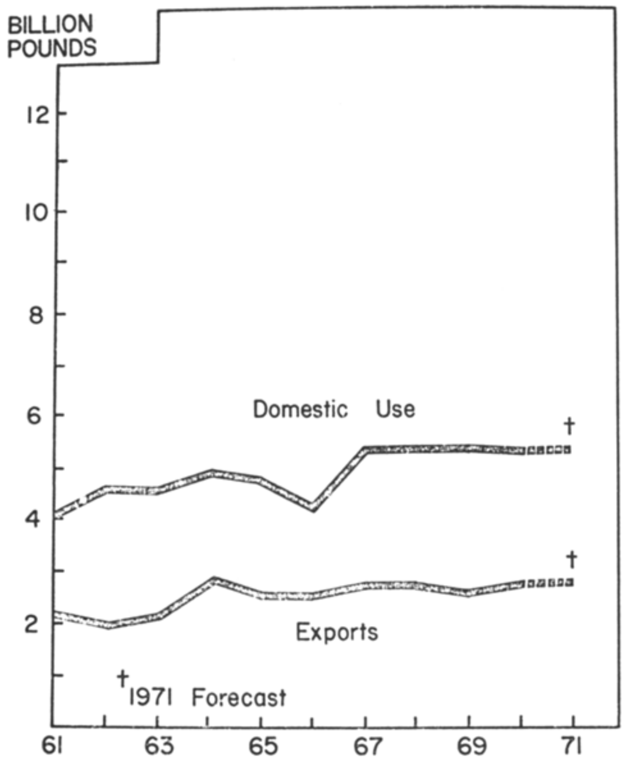

FIG. 2. Nonfood fats and oils, 1961–1971, year ending September 30.

This was a 58% increase over the 4.7 billion pounds exported the previous year and was 2.3 times the volume exported in 1961. This sharp increase in our exports came about because of reduced export availabilities of sunflower seed and cottonseed oil from the Soviet Union, rape seed from Poland, olive oil from Spain, fish oil from Peru and South Africa, peanuts from Nigeria and Senegal, and soybeans from Communist China.

Forecasts for the crop year ending September 30, 1971, project both domestic use and exports of food fats and oils to be somewhat above 1970 levels.

The trend in domestic use and exports of nonfood fats and oils is shown in Figure 2 (4). Domestic use of these products showed a moderate increase through 1967 but has remained rather stable since. Exports also show only a moderate increase during the past decade. Although there is some interest in sunflower oil for drying oil products, its greatest potential appears to be in food products.

Major components of the domestic market for food fats and oils and their average annual growth for the period 1960–1969 are shown in Table II (2). The total market for food fats and oils in 1970 amounted to 11.4 billion pounds and has shown an average annual growth over the past decade of 2.9% annually. Probably the most significant point shown in this table is the rapid expansion of cooking oils demonstrated by a growth rate of 8.4% annually. The market for cooking oils has doubled in the past 10 years and if growth continues at the same rate it will double again in the next 10 years.

TABLE II
Market Size and Annual Growth of Fats and Oils Use in Foods

Use	Market size, 1970, million lb.	Annual growth, 1960–1970, %
Butter	1058	− 2.8
Margarine	2223	+ 3.2
Lard	935	− 3.3
Shortening	3496	+ 4.9
Salad oils	1027	+ 3.9
Cooking oils	2098	+ 8.4
Potato chips	431	+ 6.6
Frozen french fries	133	+16.9
Other edible uses	541	+ 6.2
All food products	11378	+ 2.9

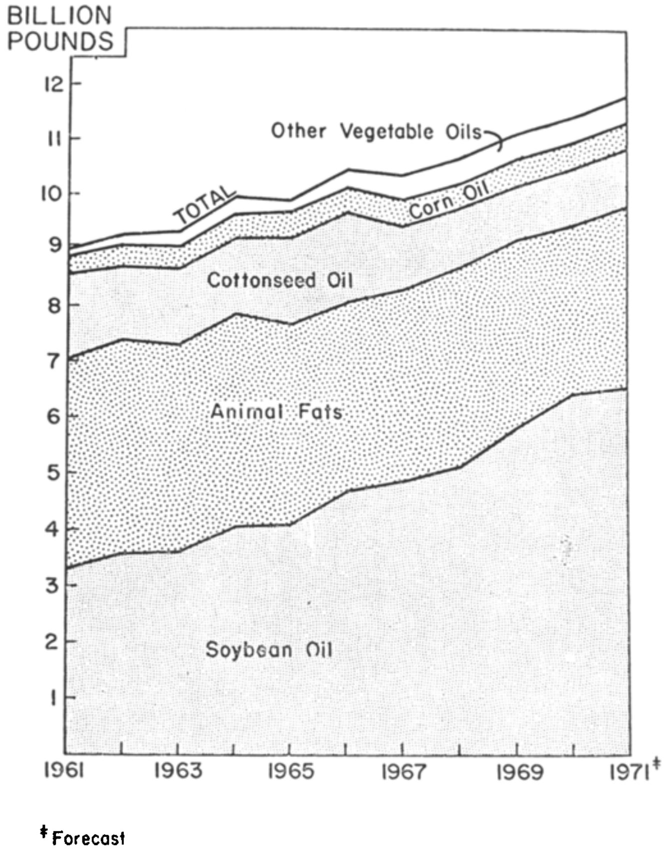

FIG. 3. U.S. consumption of food fats and oils, 1961–1971, year ending September 30.

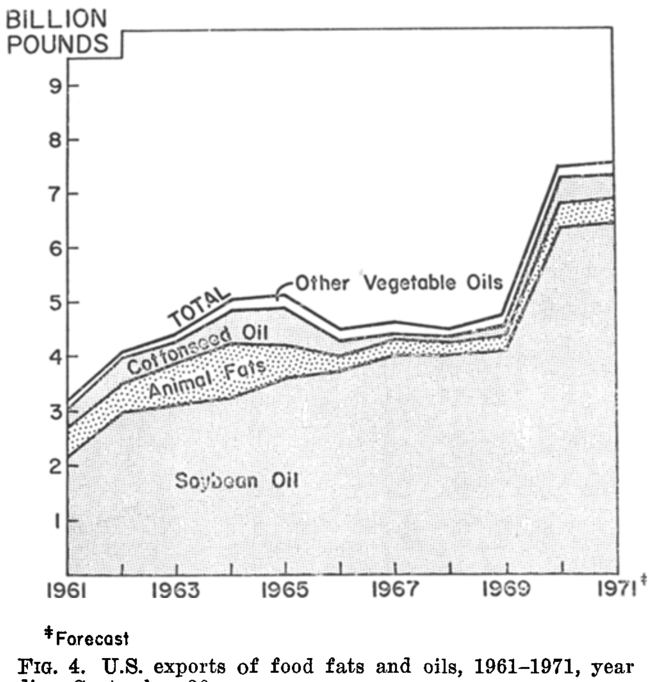

FIG. 4. U.S. exports of food fats and oils, 1961–1971, year ending September 30.

TABLE III
Wholesale Prices of Major Vegetable Oils[a]

Oil	Average, cents/lb. 1965–1969	1970
Corn	14.3	16.5
Cottonseed	12.3	13.4
Peanut	13.2	15.9
Soybean	9.9	12.0
Safflower	15.3	16.3

[a] Price basis: Crude, tank cars, f.o.b. mills.

TABLE IV

Estimated Value of Sunflower Seed[a]

Oil yield and price	Value of seed with meal price per ton $60	$70	$80
	Dollars per cwt		
30% Oil yield			
@10 cents/lb	3.50	3.73	3.96
@12 cents/lb	4.10	4.33	4.56
@14 cents/lb	4.70	4.93	5.16
@16 cents/lb	5.30	5.53	5.76
35% Oil yield			
@10 cents/lb	3.85	4.05	4.26
@12 cents/lb	4.55	4.75	4.96
@14 cents/lb	5.25	5.45	5.66
@16 cents/lb	5.95	6.15	6.36
40% Oil yield			
@10 cents/lb	4.20	4.38	4.56
@12 cents/lb	5.00	5.18	5.36
@14 cents/lb	5.80	5.98	6.16
@16 cents/lb	6.60	6.78	6.96

[a] Assumes hull yield of 16% @$15/ton; oil + meal yield to total 76%; processing loss of 8%; processing margin, $20/ton.

TABLE V

Estimated Returns to Land From Specified Crops, 1970

State and area	Dollars per acre Cotton[a]	Corn[a]	Soy-beans	Grain sorghum[a]
Alabama				
Black Prairie	73	21	37	....
Limestone Valley	123	35	41	....
Wiregrass	87	42	32	....
Georgia and S.C.				
Piedmont	71	28	35	....
Coastal Plain	90	48	32	....
Mississippi				
Delta Loam	152	....	23	....
Brown Loam	172	65	45	....
Texas				
Central Blackland Prairie	39	12	....	24
Rolling Plains Loam	74	....	....	26

[a] Returns for cotton, corn and grain sorghum include government support payments.

TABLE VI

Yield Required for Sunflowers to Equal Returns to Land From Soybeans

State and area	Sunflowerseed price per pound $0.04	$0.05	$0.06
	Pounds per acre		
Alabama			
Black Prairie	1913	1530	1275
Limestone Valley	2020	1616	1347
Wiregrass	1810	1448	1207
Georgia and South Carolina			
Piedmont	1874	1499	1249
Coastal Plain	1798	1438	1198
Mississippi			
Delta Loam	1480	1184	987
Brown Loam	2131	1705	1421

TABLE VII

Sunflower Yields Required to Equal Returns to Land From Corn With and Without Set-aside Payments

State and area	With set-aside payments $0.04	$0.05	$0.06	Without set-aside payments $0.04	$0.05	$0.06
	Pounds per acre					
Alabama						
Black Prairie	1520	1216	1013	1200	960	800
Limestone Valley	1886	1509	1257	1510	1208	1007
Wiregrass	2048	1640	1366	1634	1307	1089
Georgia and South Carolina						
Piedmont	1711	1369	1141	1375	1100	917
Coastal Plain	2210	1768	1473	1738	1390	1159
Mississippi						
Brown Loam	2615	2092	1743	2071	1656	1380
Texas						
Central Prairie						
Blackland	1299	1039	866	1059	847	706
Greyland	1000[a]	800[a]	666[a]	1000[a]	800[a]	666[a]

[a] Breakeven yields for sunflowers. Returns to land from corn were negative.

TABLE VIII

Sunflower Yield Required to Equal Returns to Land From Sorghum, Texas

Area	Sunflowerseed price per pound $0.04	$0.05	$0.06
	Pounds per acre		
With set-aside payments			
Central prairie, blackland	1604	1283	1069
Central prairie, greyland	1178	942	785
Rolling plains, loam	1645	1316	1097
Without set-aside payments			
Central prairie, blackland	1285	1028	856
Central prairie, greyland	1000[a]	800[a]	666[a]
Rolling plains, loam	1399	1119	933

[a] Breakeven yield for sunflowers. Returns to land from sorghum were negative.

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Economics of Producing Sunflowers for Oil

This section considers the economics of producing sunflowers for oil in several areas of the cottonbelt states and the Red River Valley of Minnesota and North Dakota. In this analysis sunflowers are viewed as an alternative to crops now grown. As such they should yield a return at least equivalent to, and preferably in excess of, established crops in the various producing areas.

In this analysis the following questions are examined: (1) What is sunflower seed worth to the processor; (2) What does it cost to produce them; (3) What yield per acre is required to provide returns to the farmer comparable to returns from established crops?

Value of seed: Oil is the most valuable part of the sunflower seed. The price the processor can afford to pay for seed, therefore, depends largely on the price he can obtain for the oil.

Average prices of our major edible vegetable oils, on a crude oil basis, for the 1965–69 period and for 1970 are shown in Table III (6). Average prices for the five year period 1965–1969 ranged from 9.9 cents/lb. for soybean oil to 15.3 cents for safflower oil. Prices in 1970 were substantially higher because of the reduced export availabilities in some major exporting countries. Prices for edible oils in recent months have been substantially above these 1970 averages.

On the basis of its composition and properties it would appear that sunflower oil should be at least equivalent in price to cottonseed oil. Cottonseed oil averaged 12.3 cents/lb. during the 1965–1969 period, 13.4 cents in 1970, and reached 15 cents early in 1971.

Table IV relates prices and yields of products to the value of sunflower seed. For example, with a 35% oil yield at 12 cents/lb. and $70/ton for meal, sunflower seed should be worth around $4.75/cwt to the processor. Values in this table assume a hull yield of 16%, oil and meal yield to total 76%, and a processing loss of 8%. These yield data are based on the limited experience of screw-press mills with the 1968 and 1969 trial plantings of sunflowers in the cottonbelt states. Yields from prepress solvent mills would differ from these.

A processing margin of $20/ton was used to arrive at these values. This is based on estimated costs of processing sunflower seed plus an allowance for mill profits.

Oil yields obtained by screw-press mills during the 1968 and 1969 trial plantings generally ranged between 30–35%. These yields should improve as processing techniques are improved and new hybrid sunflowers having a higher oil content are commerciallized.

Sunflower production cost: The estimated cost of producing an acre of sunflowers is approximately $40/acre in the cottonbelt states and $26/acre in the Red River Valley area of North Dakota and Minnesota. The cost for the cottonbelt states was based on records obtained from producers and oil mills in the region. We believe this cost to be representative of most areas of the Southeastern and South Central States athough the composition of the cost may vary somewhat from area to area. The cost figure for the Red River Valley area was developed by the Agricultural Extension Service at North Dakota State University (7). These estimates represent the cost of inputs, other than land, required to obtain present average yields of around 1250 lb./acre in the cottonbelt states and 1000 lb./acre in the Red River Valley area.

Producers in the Red River Valley appear to have a cost advantage due to less need for extensive weed and insect control and lower fertilizer use because of less rainfall. However the low rainfall may impose a limit on increasing yields through higher rates of fertilization.

Should sunflowers be more widely produced, intensification of insect control would likely be necessary resulting in slightly higher production costs. Also, hybrid seed, which should be available in the future, will be more expensive than seed of the present open-pollinated varieties. It is estimated that these items would increase production costs above present costs by \$5–7/acre. However the certainty of these additional costs are not known. As it is possible that further trial plantings may reveal ways to lower other costs, the costs of production presently being encountered are used in this analysis.

Yields required: Returns to land from established crops in various areas of the South are shown in Table V. These returns are based on average yields of each crop in a particular area and costs estimated to be associated with these yields. Product prices used were the average prices received by farmers for the three year period 1968–1970.

While it is realized most farmers would achieve returns either above or below these averages, this type of analysis can indicate the general level of sunflower yields that would be required to compete for farm production resources in various areas.

In recent years soybean acreage in the southeastern states has expanded to the point that it is now considered a major cash crop in the region. Soybean yields of 25–35 bu/acre have made the crop profitable in many localities. If we assume a price of 4 cents/lb. for the seed, sunflower yields of 1600–2000 lb./acre would be needed to compete with soybeans (Table VI). A price of 5 cents would bring required yields down to 1300–1600 lb.

Yields of about the same magnitude would be required to compete with corn produced under the feed grain program in the southeastern states (Table VII). Lower yields would compete with corn in Texas.

A substantial quantity of corn is produced in the South which is not under the feed grain program and consequently does not benefit from the support program. At 4 cents/lb. sunflower yields of 1200–1600 lb. would compete with such corn in most areas of the Southeast (Table VII). At 5 cents yields of 1000–1400 lb. would be competitive. In Texas it appears that yields of around 1000 lb. should compete with corn not under the feed grain program.

Grain sorghum is a major crop in Texas. At 4 cents/lb. sunflower yields of 1200–1600 would be required to compete with sorghum produced under the feed grain program (Table VIII). At 5 cents/lb., 1000–1400 lb. would be competitive. Sunflower yields 200 lb. lower would compete

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More Surveillance Urged on Adverse Reactions to Drugs

A National Center for Drug Surveillance should be established to detect and determine "at the earliest possible moment" adverse drug reactions not discovered by studies in laboratory animals or by early clinical investigations. Such a Center would increase the safety of drugs and facilitate the early availability of new important drugs, states the *Report of the International Conference on Adverse Reactions Reporting Systems,* issued by the Drug Research Board of the National Research Council.

While beneficial effects of drugs have been increasingly documented, present mechanisms for detecting and identifying adverse reactions are "haphazard and inadequate," the report states. More investigations are needed on topics such as specific reaction to drugs and chemicals; interactions between different drugs, between drugs and foods, and drugs and alcohol; and long term effects of drugs such as oral contraceptives, antidiabetics, anticoagulants and cholesterol lowering agents.

The recommendations and proposal for the National Center for Drug Surveillance were made at an International Conference on Adverse Reactions Reporting Systems, held October 22 and 23 last year. Participants included more than 300 scientists and administrators from universities, government agencies, the pharmaceutical industry and health care systems. Their major recommendations and conclusions are summarized in the report. A limited number of copies is available from the Drug Research Board, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

• *Abstracts . . .*

(Continued from page 461A)

GELATION PHENOMENA OF SOYBEAN GLOBULINS. III. PROTEIN-LIPID INTERACTIONS. N. Catsimpoolas and E.W. Meyer (Lab. of Protein Chem., Central Soya Res. Ctr., Chicago, Ill. 60639). *Cereal Chem.* 48, 159–67 (1971). The major factors, other than temperature, pH and concentration, affecting the gelation of soybean globulins in the presence of lipids were determined to be (a) the length of the aliphatic chain of the glyceride, (b) the degree of unsaturation of the glyceride, and (c) the number of unesterified hydroxyl groups in the glycerol component. The apparent viscosities of the progel and gel were increased either by decreasing the fatty acid chain length of the glyceride or decreasing the esterification of the hydroxyl groups of glycerol. Saturated fats produced higher gel viscosity than unsaturated ones. Phospholipids and cholesterol also enhance gelation of soybean globulins.

• Drying Oils and Paints

CHROMATOGRAPHIC DETERMINATION OF THE MOLECULAR WEIGHT DISTRIBUTION CURVE OF ALKYD RESINS. G. Bellens. *Double Liaison* 17, No. 183, 617–29 (1970). A fractionating method using column chromatography on glass beads was applied to 7 linseed/glycerol alkyds of 68% oil length differing in polyacid component (phthalic isomers, etc.), the eluent being a mixture of xylene and isopropyl alcohol. The viscosity average mol. wt. of each fraction was determined and results were plotted. Inferences are drawn according to the nature of each resin. (World Surface Coatings Abs. No. 346)

MECHANICAL PROPERTIES OF MODIFIED ALKYD RESINS. P.H. Gedam, R. Vittal Rao, M.A. Sivasamban and J.S. Aggarwal. *Paint Manuf.* 41, No. 1, 36–8 (1971). Properties such as tensile strength, toughness, bursting strength and modulus of rigidity of alkyd resins modified with refined sardine oil and upgraded sardine oil have been studied. They have been compared with those of linseed, soyabean, safflower and dehydrated castor oil alkyd films. Among medium oil length alkyds, upgraded sardine oil alkyd was the toughest. All medium oil length alkyds had far better mechanical properties than long oil alkyds. (World Surface Coatings Abs. No. 348)

• Detergents

HOW TO SELECT EMULSIFIERS. J.B. Mickle (Dept. of Animal Sci. and Ind., Oklahoma State Univ., Stillwater, Ok.). *Food Eng.* 43, 7, 68–71 (1971). The key to emulsifier performance is its water-fat solubility ratio. The latest research correlates this factor with emulsion stability in dairy products and shortenings.

THE DETERMINATION OF PHOSPHATE IN DETERGENTS BY COOL-FLAME EMISSION SPECTROSCOPY. W.N. Elliott and R.A. Mostyn (Quality Assurance Directorate (Materials), Royal Arsenal, London, S.E. 18). *Analyst* 96, 452–56 (1971). The total phosphate content of detergent materials is determined by measurement of the emission of the HPO molecular species at wavelength 528 nm in a cool hydrogen-nitrogen diffusion flame. Preliminary treatment with cation-exchange resin is necessary to remove interference by metals. Analytical results on detergent samples containing up to 20% phosphates (expressed as P_2O_5) indicates a precision of the order of 2 to 4% for the method.

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with grain sorghum not produced under the feed grain program.

Although this area is shown in Table VIII, at the present time sunflowers cannot be produced in the Rolling Plains of Texas due to the carrot beetle. Failure to control this insect will prohibit introduction of sunflowers to this area.

In the Red River Valley sunflower yields required to compete with flax, barley and soybeans are lower than those required to compete with established crops in the Cotton Belt. At 4 cents/lb. sunflower yields of 900 lb. would compete with flax and a yield of around 1100 lb. would compete with soybeans and barley. Substantially higher yields would be required to compete with wheat grown under the domestic allotment program.

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5. Evans, C.D., and R. Shaw, "Proceedings of the Third International Sunflower Conference," Crookston, Minnesota, August 1968.
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