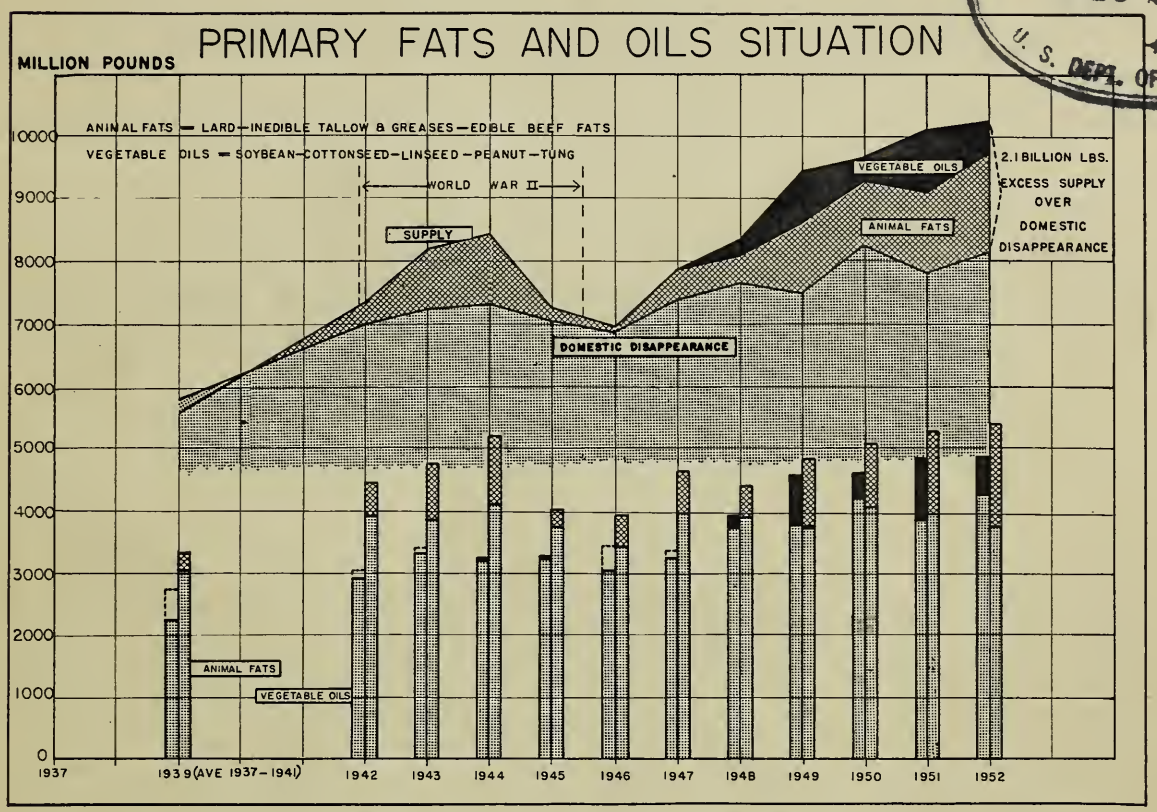
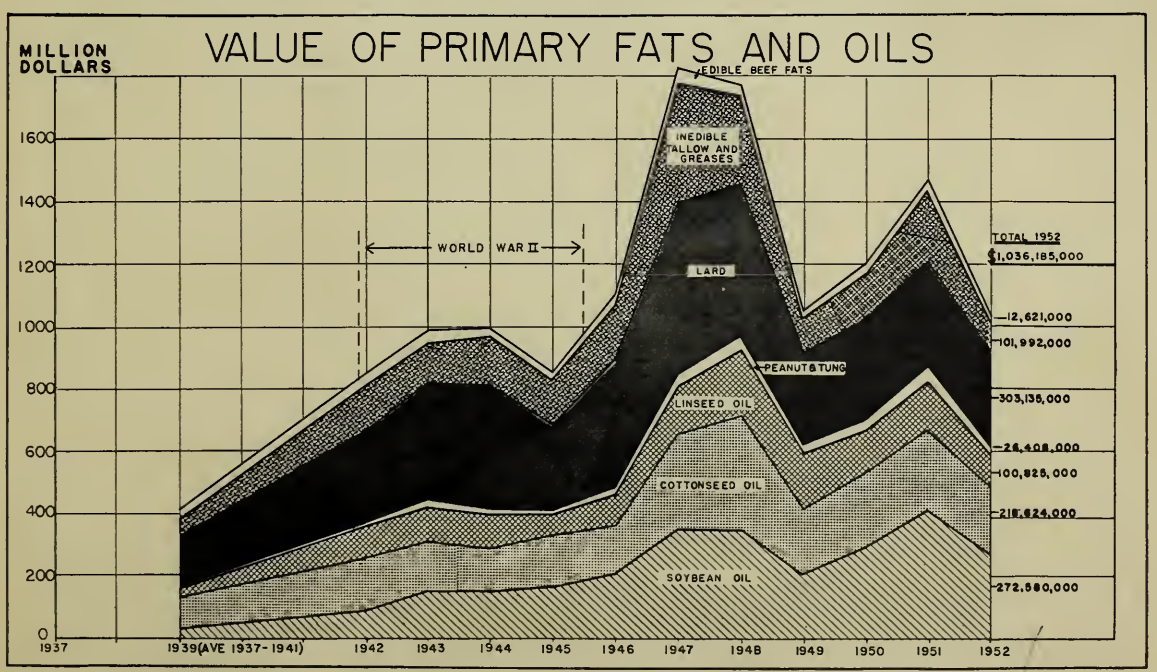
# FATS AND OILS CONFERENCE

## BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY

WASHINGTON, D. C.






JUNE, 1953

# FATS AND OILS CONFERENCE

June 30 - July 1, 1953



## C O N T E N T S

## SUMMARY

The general conference to consider the fats and oils situation, reported in the following pages, developed a number of significant points which can serve to guide the Bureau of Agricultural and Industrial Chemistry in the direction of its utilization research in this field.

In opening the conference, Dr. Hilbert emphasized the need for stimulating fat and oil utilization research in the nonfood field and cited the depressing effect upon such research that has been occasioned by frequent shifts that have been necessary between emergency and nonemergency research in the Bureau's relatively short history as a regionalized organization.

The production and supply situation is such that ample quantities of animal and vegetable fats and oils are available for expanded use in present products or for the development of new products. While the size of the available supply is difficult to measure accurately, it is apparent that the present production of fats and oils exceeds prewar production by 50 percent, while domestic disappearance has, in the same period, increased only 11 percent. Aggravating this situation is the fact that the Government, as a result of its support program, holds or has under loan or purchase agreement, enormous stocks of cottonseed and linseed oil and appreciable stocks of tung oil and soybeans.

A look at the prospects in fats and oils production and use in current markets indicates that little abatement in the present situation can be expected from these sources. For example, butter fat production will continue at high levels and full use is not anticipated until satisfactory means can be developed for the production of a completely satisfactory dried whole milk, and of acceptable cheese products that will contain higher quantities of butter fat. Current intensive efforts to develop castor bean as a domestic crop appear assured of success, as does also the development

of safflower and possibly sesame crops, all of which will add to our available vegetable oil supplies. Cottonseed and soybean production is destined to increase as it is almost certain that there will be increased demand for high-protein seed meals for animal feeding. If the growth trend of the past continues, production of tallow and grease should increase by 500 million pounds in the next five years.

While the export situation with respect to fats and oils is currently good, a large part of these exports consists of low-priced animal fats and vegetable oil foots, there being much less demand abroad for our high-priced food oils. Moreover, as the foreign situation with respect to fats and oils improves, and if the rate of dollar exchange continues to be disadvantageous, we may expect a further decline in volume and value of our fat and oil exports.

Substantial increase in the use of fats and oils as food cannot be expected except as some additional fat consumption will necessarily result from the population increase that has been forecast. Consumption of fats and oils in the nonfood field is currently trending downward and will continue in this direction unless effective steps, through research, can be taken to reestablish fats and oils in fields where competition with synthetic materials is causing their displacement and to develop new uses for these raw materials. This fact is illustrated by the current situation with respect to vegetable drying oils. The protective coating industry, which once depended almost exclusively on the vegetable drying oils, now utilizes synthetic materials to such an extent that the consumption of drying oils per unit of sales in the industry has dropped from a high of 1.0 pound in 1940 to 0.6 pound in 1952 and is still declining.

One possible ray of hope, which in itself can only be partially effective in relieving overproduction of animal fats, is the current efforts of

the Bureau of Animal Industry to stimulate conversion by the farmer and the meat industry to a lean-type hog.

Presentations made by regional laboratory personnel reveal that our current research programs, while properly directed in some respects to the urgent present problems in the fats and oils field, can and should be re-oriented as promptly as possible so that even greater emphasis will be placed upon the development of expanded and new nonfood uses for the plethora of raw materials now available.

George W. Irving, Jr.
Chairman of the Conference

U.S. Department of Agriculture
Bureau of Agricultural and Industrial Chemistry
Washington, D. C.

Room 4045 - S

# FATS AND OILS CONFERENCE

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Bureau of Agricultural and Industrial Chemistry
Chairman of the Conference

## A G E N D A

June 30

9:45 a.m. G. E. Hilbert, Chief
Bureau of Agricultural and Industrial Chemistry
"Brief Review of the Bureau's Work and Purpose of the Fats and Oils Conference."

10:15 a.m. Sherman Johnson, Assistant Chief
Bureau of Agricultural Economics
"Economic Problems in Fats and Oils Production"

11:00 a.m. Sidney Gershben, Statistician, Fats and Oils Section,
Bureau of Agricultural Economics
"Supply-Demand Situation of Fats and Oils and the Outlook."

1:30 p.m. G. E. Holm, Head, Dairy Products Research Division,
Bureau of Dairy Industry
"Prospects in Butter-fat Production and Utilization."

2:15 p.m. Paul E. Quintus, Head, Fats and Oils Division,
Foreign Agricultural Service
"The Foreign Situation with Respect to Fats and Oils."

3:00 p.m. L. M. Pultz, Principal Horticulturist, Tobacco, Medicinal and Special Crops Division,
Bureau of Plant Industry, Soils and Agricultural Engineering,
Beltsville, Maryland
"The Outlook for Castorbean and Other New Domestic Oil Crops"

4:00 p.m. Leonard Smith, Director of Utilization Research,
National Cotton Council, Washington, D. C.
"Future Prospects for the Cotton Crop."

4:45 p.m. T. C. Byerly, Head, Animal Husbandry Division, Bureau of Animal Industry, Beltsville, Maryland
"Effect of the 'Meat-type Hog' and Other Production and Utilization Developments in BAI on Fat Surpluses."

July 1

9:30 a.m. Francis Scofield, Chemist, National Paint, Varnish and Lacquer Association, Washington, D.C.
"The Outlook for Drying Oils."

10:15 a.m. George L. Pritchard, Director, Fats and Oils Branch, Production and Marketing Administration
"Government Stocks of Fats and Oils and the Outlook."

11:00 a.m. Callie Mae Coons, Assistant Chief, Bureau of Human Nutrition and Home Economics
"Have We Reached Maximum Fat Consumption Per Capita?

1:15 p.m. R. M. Walsh, Deputy Assistant Administrator for Marketing, Agricultural Research Administration
"What Marketing Research Can Do to Encourage Greater Use of Fats and Oils.

2:00 p.m. L. A. Goldblatt, Oil Chemistry Section, Oilseed Division, Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry, New Orleans, Louisiana
"Potential Industrial Outlets for Fats and Oils."

3:00 p.m. "What Utilization Research Has Accomplished and Can Do to Increase Use of Fats and Oils:

3:05 p.m. W. C. Ault, Head Animal Fat Division, Eastern Regional Research Division, Bureau of Agricultural and Industrial Chemistry, Wyndmoor, Pennsylvania
"Animal Fats."

3:35 p.m. J. C. Cowan, Head Oil and Protein Division, Northern Regional Research Division, Bureau of Agricultural and Industrial Chemistry, Peoria, Illinois
"Soybeans and other Northern Oilseed Crops."

4:05 p.m. A. M. Altschul, Head, Oilseed Division, Southern Regional Research Division, Bureau of Agricultural and Industrial Chemistry, New Orleans, Louisiana
"Cottonseed and other Southern Oilseed Crops."

# BRIEF REVIEW OF THE BUREAU'S WORK AND PURPOSE OF THE FATS AND OILS CONFERENCE.

G. E. Hilbert, Chief,
Bureau of Agricultural and Industrial Chemistry
Washington, D. C.

The Bureau of Agricultural and Industrial Chemistry is engaged in research on the utilization of agricultural commodities. Until 1938, most of the Bureau's attention was given to the utilization of agricultural products for food uses and the broad field of utilization of farm products for nonfood uses was largely neglected.

When the four Regional Research Laboratories were started, we had an opportunity to undertake a program in this latter field. Such an endeavor was started in 1940-1941, when attention was focused on the "surplus problem" that then exised. At that time as now, Bureau emphasis was divided between research devoted to food as well as nonfood uses.

With the outbreak of World War II our program was redirected in 1942 to defense problems. These problems were primarily in the food or feed fields and our few ventures into the nonfood field were not too successful. For example, in view of the shortage of rubber, we developed a synthetic rubber (Norepol) from soybean oil, but the War Foods Administration ruled that soybean oil was too valuable as a food product to warrant its use for such a purpose. That decision prevented the use of soybean oil for industrial purposes during the war period.

At the end of World War II we again redirected our program to peacetime problems, and became concerned briefly with the development of new and extended outlets for surplus commodities before the Korean War required us to shift our program once more to defense problems. In this shift major emphasis was again placed on food problems. The proportion of the Bureau's program presently devoted to defense problems is about 40 percent.

Now that we are faced with acute surpluses, it is desirable to consider another reorientation of our broad program. It seemed necessary and desirable, therefore, to hold a series of commodity conferences to evaluate the Bureau's program for attacking the acute surplus problems. For these conferences we are bringing in the men from the Regional Research Laboratories who are responsible for carrying out particular commodity programs. We are also inviting other experts from within the Department (and in some instances from outside organizations) who are concerned with these commodities with the idea of obtaining their advice on the problems we will be faced with, perhaps for the next five or ten years. At this conference we will consider the agricultural fats and oils.

Much of the recent emphasis on fats and oils in the newspapers has been centered on animal fats, but we appreciate that the problem concerns fats regardless of origin. Practically all fats and oils - both vegetable and animal - are declining in price in spite of the large holdings on the part of the Government.

We intend to continue to devote our research efforts in the fats utilization field to a properly balanced program embracing improved processing and the development of new and expanded industrial and food uses. While there is possibility of increasing the food uses of many commodities, we believe greatest chance for success lies in developing new and extended industrial outlets.

We appreciate having the experts from other agencies and organizations with us and their willingness to give us their advice on the fats and oils outlook and on the most pressing problems needing attention. We will need the best advice and counsel we can obtain from all of you to help us in reorienting our fats and oils research program toward the most important objectives.

# ECONOMIC PROBLEMS IN FATS AND OILS PRODUCTION

Sherman E. Johnson
Assistant Chief
Bureau of Agricultural Economics

Total production of fats and oils in 1952 was up about 50 percent from the average of the prewar years 1937-41. Edible fats were up 40 percent and inedible fats 80 percent. Domestic disappearance increased 11 percent for the same period. But production in 1952 was 15 percent over domestic consumption whereas prewar production was 15 percent below domestic use. As a result we have shifted from a net import basis in prewar years to a net export position.

Most of the expansion in production of edible oils has been in the vegetable group. In fact, soybeans account for 85 percent of the increase. The wartime push for increases in oilcrops to offset the decline in imports largely accounts for expansion above prewar levels. Support prices were developed to achieve a cost-price relationship favorable to expansion. Higher yielding varieties and improvement in production and harvesting also made it profitable to increase production.

Is production of fats and oils unbalanced at the present time in relation to prospective markets? There are certainly no indications that we will encounter any difficulty in meeting market demands in the immediate future, unless new international crises develop. Even at present levels, oilcrops constitute only about 5 to 7 percent of our total cropland. Expansion, therefore, could take place without great inroads on other major crops. Animal fats are largely joint products and there production is dependent on markets for other products as well as fats.

The unbalance in fats and oils production in relation to present markets is not unique. In fact, at the present time we seem to need larger markets for most farm products. Our total output of farm products in 1952 was

44 percent above prewar years. Consumption has increased both because of larger population and higher per capita consumption, but we are also depending upon exports for a part of our market, and last year we experienced a considerable drop in exports. Domestic consumption will expand with the increase in population, but that is not an immediate remedy for the pressure of supplies on the market.

Larger markets for fats and oils would have to come from the following three sources: (1) Increasing domestic consumption per person, (2) expanding exports, and (3) increasing industrial uses. I assume that the chief efforts of the Bureau of Agricultural and Industrial Chemistry will be concentrated on the possibility of increasing industrial uses. This would result in larger markets providing the new uses do not displace other farm products. It is necessary, of course, to produce the new materials at prices that are competitive with other sources of raw material.

If we cannot find a larger market for fats and oils, is it possible for the farmers to shift into other lines of production? In this connection we need to understand one very simple fact. Farmers are going to produce something. They are not likely to leave land, machinery, and other resources idle. In most sections of the country it is physically possible for farmers to produce several different crops, but they will try to produce those which will give them the largest net income--those that pay best.

The lard problem is especially acute at the present time. One of the shifts that has been suggested is production of meat-type hogs, but here we run into a possible conflict between individual interest and the interests of the group. If all farmers produced meat-type hogs the market would reflect a higher price per pound. But as long as there is no way of reflecting that difference in price back to the individual producer, he will continue

to produce the type of hog that brings him the most money. Farmers will produce meat-type hogs if they can be sure of either one of the following: (1) Higher price per pound for the meat-type hog, or (2) if meat-type hogs can be produced at lower cost for the same volume of output.

The butter problem is a really tough one because many farmers in butterfat areas have large fixed investments in dairy production. Often their farms are small, and it is difficult to find other enterprises that will provide as large an income as dairying even at reduced prices for butterfat. However, we can expect a gradual shift over a period of time. The percentage of the milk supply going into butter manufacture has declined from nearly 50 percent of the total in 1925 to about 25 percent in 1952.

Soybeans is the giant among our oilseed crops. Production in 1952 was nearly four times the level of prewar years. We are likely to have a gradual expanding market for soybean meal as a high protein feed for livestock, but we also need a larger market for the oil in order to reflect profitable prices of beans to farmers. If we find ourselves faced with acreage reduction programs in cotton, wheat, and perhaps also in corn, farmers are likely to increase soybean acreage. Consequently, if cotton acreage is reduced and soybeans are planted on a part of the former cotton acreage, there might be very little decrease in total oil production.

The problems facing farmers in production of fats and oils emphasize the following points:.

(1) That farmers are not likely to leave their resources idle.

(2) Most farmers cannot increase their net incomes by reducing total output on their farms.

(3) If they remain in farming, they are going to continue to produce something.

(4) They will be looking for the most profitable alternatives.

(5) If new uses can be found for fats and oils and if the market can be increased in that way, farmers can continue to produce these products at relatively high levels..

(6) It is necessary for the new market to be a profitable one to farmers if it is to constitute a real market opportunity.

# SUPPLY-DEMAND SITUATION OF FATS AND OILS AND THE OUTLOOK

Sidney Gershben, Statistician
Fats and Oils Section
Bureau of Agricultural Economics
Washington, D. C.

There has been a substantial increase in production of fats and oils over prewar levels. Lard production has increased 900 million pounds and tallow by 1.1 billion pounds. Linseed oil production has doubled and there has been a very substantial increase in soybean production. These increases have been due in part to increased production of the raw materials but also in part to improved technology in the form of better varieties and greater yields of oil through solvent-extraction.

Uses for some fats and oils have declined. Thus, there has been a reduction in the total use of butter and margarine. The per capita use of fatty acids in soap has declined to one-half the prewar level. Even use of drying oils has not kept pace with growth of the protective coating industry.

Prices of fats and oils have been generally down. Lard is down to prewar level. Cottonseed oil is off the market, otherwise prices of other vegetable oils would be lower. The production of fats and oils is not responsive to needs, therefore, there is not a healthy supply-demand situation. Most of these are byproducts of other commodities--animal fats of animal meat; cottonseed oil of cotton. The value of meal in soybeans is almost equal to that of the oil, thus the oil production is influenced by the meal market. Only in flaxseed and castorbean do most of the value come from the oils.

The consumption of fats and oils tends to be constant regardless of price. Price declines are therefore much sharper than corresponding increases in production. For 1953-54, we will have more fats and oils than we can use. Stocks will probably be at a record level. Most of this will be in food fats (butter and vegetable oils). We have had, for years, a large supply of flaxseed.

Tallow and greases will also be in big stock and there will be more than we know what to do with. There probably will be less lard in the coming year. The rate of disappearance of fats and oils will not change too much in the coming year. There will not be much change in the per capita consumption of food fats. Nonfood items are a matter for research. We might expand our uses of fats and oils or we might cut down production. Although difficulties may be encountered--as pointed out by Johnson--efforts might be made to shift over to non-oil crops.

# PROSPECTS IN BUTTER-FAT PRODUCTION AND UTILIZATION

G. E. Holm, Head
Dairy Products Research Division
Bureau of Dairy Industry
Washington, D. C.

Approximately 15 billion pounds of milk solids are produced annually, of which over 4.5 billion pounds are milk fat. Approximately 50% of the fat is sold in market milk and cream, 30% in the form of butter, 8.4% in cheese, 7.3% in ice cream, and the balance in concentrated milks and other products. On the basis of total solids, the butter produced is but 9% of the total solids production.

For many years prior to 1942 the annual production of butter exceeded 2 billion lbs. The present production is slightly under 1.5 billion and seems to be in surplus. The crux of this situation seems to be price. While butter is selling for 65 to 67 cents per lb., other fats and butter substitutes are selling for approximately 1/3 of this price. In view of this, the question of the possibility of industrial outlets for butter can be dismissed.

Although this should not be the case, the price of butter has tended to regulate the whole milk price structure. Milk and cream are usually based on butterfat prices. The fat has carried practically the entire price load and little consideration has been given to the other solids in milk. The time has come when other solids must bear a price commensurate with their food value. When this can be done, the price of the butterfat can be reduced to a basis competitive with other fats.

The status of price of milk may be seen from the following considerations. Even when the fat is priced at 70 cents per lb. and milk is selling at 24 cents per quart, the proteins must be valued at over $2.50 per lb. This is comparable to the price of protein in most meats selling at 60 cents

per lb. Similarly, the price of protein in cottage cheese will be somewhat less than that in meats. The bargain on the market today is dried skim milk, where the protein costs approximately $1.00 per lb. From these considerations it appears that the price of milk fat is too high and that of the solids-not-fat in most milk products do not yield a return commensurate with that of similar constituents in other food products.

The long-range solution of the present difficulties in the dairy products industry is therefore to find uses for all of the milk constituents as foods or in foods which the consumer will demand, especially for the surplus non-fat constituents which are now used insufficiently as feed for animals or wasted.

The solution of the problem is two-fold: (1) increase the quality of all dairy products, thereby increasing their consumption, especially in the case of products which contain all or nearly all of the normal milk constituents--i. e., market milk, cheese, and evaporated milk. (2) increase the utilization of byproducts as and in foods.

Butter was once the balance wheel of the dairy industry. This is no longer the case. As the industry is developing and as facts in nutrition are discovered, indications are that the ideal balance wheel of the industry would be a generally acceptable sterile concentrated milk. Such a product would conserve all of the milk solids for food uses. It would also tend to level and stabilize milk prices throughout the country.

To what extent can we utilize our surplus butter supply by increases in our market milk, cheese, and evaporated milk consumption. Each 100,000,000 lbs. of surplus butter represents 2 billion pounds of milk or 13⅓ lbs. of milk per capita. An increase of 13 lbs.annual per capita consumption should not be difficult of attainment through price adjustment, since our

consumption is at an all-time low and is sensitive to price changes at the present income levels. The surplus indicated, translated into evaporated milk, would be approximately 6/ lbs. per capita, or for cheese, 2.6 lbs. per capita. These goals are all well within the possibility of attainment.

# THE FOREIGN SITUATION WITH RESPECT TO FATS AND OILS

Paul E. Quintus, Head
Fats and Oils Division
Washington, D. C.

The world's annual production of fats and oils is around 25 million tons. These are grouped as edible vegetable oils, palm oils, industrial oils, animal fats, and marine oils. Butter leads in world production followed closely by lard. Together, animal fats account for one-third of the total production; the edible vegetable oils for another third.

The United States now accounts for about 25 percent of the world production; before the war (1935-39) we produced 15 percent of the total. Production in the United States is up 50 percent and in the world, 10 percent, from the prewar period. With the exception of Canada and Cuba, all fat-deficit countries have a soft currency and do not have enough dollar exchange to procure fats and oils freely from dollar sources. Tallow and lard, however, are so cheap in comparison to other fats that even countries with soft currency manage in some way to find enough dollars for large scale purchase. Most of the soap is now being made from cheap animal fats coming from the United States. The percentage of palm oil in European margarine has gone up; it no longer is used in soap to the same extent that it was in soap in the past. Thus, our inedible tallow and grease exports indirectly just about offset the population increase in other countries.

Efforts so far to improve the world's fats and oils situation have only restored prewar production in the rest of the world. There is an incentive to increase production in soft currency areas because of the dollar shortage. The greatest potential for such increase is in the African palm. However, on an over-all basis, gains in some directions are offset by losses in others.

One of the difficult aspects of the world picture, is the part China is likely to play in international trade in fats and oils. For most countries, we can establish what their production and requirements are and what they are likely to import or export. This is not the case with Russia or China. Even if you know something about production in China, what China exports is based simply on political design. For the last six months, there has been a heavy trade to Europe involving large volumes of sesame, soybeans, peanuts, rapeseed and flaxseed. This, of course, will have some impact on future exports from the United States.

We must improve quality of our exports to maintain our markets in Europe. There is a declining preference for American lard, partly because of poor quality. We could sell tallow and greases in the foreign market for a higher price than we are now receiving. The reason tallow price is so low is that we have a buyers' market at the present time. When the price goes higher than that for palm oil, which is above tallow but below present prices for United States edible oils, buying tallow goes down. Synthetic detergents have been introduced in Europe but it does not seem that these will ever take over to the same extent as in the United States. However, competition of synthetic detergents may develop in which case exports of tallow and greases will be adversely affected. Most countries will not take our soybean oil at our prices, since they can get this oil as well as rapeseed and other vegetable oils in local currencies.

# THE OUTLOOK FOR CASTORBEAN AND OTHER NEW DOMESTIC OIL CROPS

L. H. Pultz, Principal Horticulturist
Division of Tobacco, Medicinal, and Special Crops
Bureau of Plant Industry, Soils, and Agricultural Engineering
Beltsville, Maryland

Castorbeans and safflower are now established crops with 150,000 acres in castorbeans, and 50,000 acres in safflower. Sesame is not yet established. Present production areas for castorbeans are in the Southwest including the following acreages:

| | Dryland | Irrigated |
|---|---|---|
| Texas | 76,000 | 22,000 |
| Oklahoma | 38,000 | --- |
| California | --- | 5,000 |
| Arizona | --- | 3,700 |
| New Mexico | --- | 2,500 |
| Arkansas | 4,500 | --- |
| | 118,500 | 33,200 |

The crop may go into the Southeast, but diseases must be conquered to make it profitable to the farmer.

Lack of suitable varieties has been a major probem with castorbeans, but this is being solved. Present varieties include: Conner, a dry-land variety, which is satisfactory for hand harvesting, but gives low yields and will be replaced as soon as seed of improved varieties is available, Cimarron and USDA 74, which are good dry-land varieties which can be harvested by hand or with the newly-developed stripper. Dwarf types are finding use on irrigated lands because they have a fine stem, small spikes, and can be harvested with a modified peanut combine. The big advance in varietal research has come with two developments: (1) The discovery of a male sterile variety at Nebraska Experiment Station in 1948, which permitted the development of hybrids, and (2), the discovery of two lines of castorbeans which give only female

plants when crossed, thus permitting easy production of triple-cross hybrids. Hybrids produce about 15-20% more than inbred lines and hybrids from triple crosses should give additional vigor and possibly even higher yields. The new development will also lower the cost of hybrid seed. Several plant diseases cause damage to castorbeans in the more humid sections of the south and resistant varieties must be developed if castorbean production is to be developed there. Few resistant strains are available and problem appears to be tough, but not unsolvable.

Cultural practices are being mechanized. New dehullers suitable for use on the farm are or will be available shortly. The present support price of $0.09 per pound has brought considerable acreage into production and with improved production practices castorbeans should be a profitable crop at even lower prices. Yields on dry-land vary widely but run between 300-1200 lbs. and on irrigated lands are 1500-3500 pounds per acre. New varieties may yield 4000 pounds per acre.

The future of castorbeans seems to depend on whether yields go up and production costs go down in which case they can compete with other oilseed crops. Industry people seem to think acreage will be increased to from 1/2 to 1 million acres in the near future even if the price paid to farmers goes lower than the present support price of 9¢ per pound.

No sesame is being grown--except for an experimental 1000 acres in Texas. The hope of production hinges on the development of non-shattering types. Several goodnon-shattering types have been developed but the agronomic characteristics of these varieties in commercial production need to be determined. Prospects for sesame production look good. Yields of shattering varieties vary from 1000 to 2500 pounds per acre and the new non-shattering types yield more than 1000 pounds per acre. Present high yielding varieties.

are not disease-resistant, but give good yields when disease-free seed is used. Sesame could be a partial replacement for cotton in the South.

Safflower production needs a processing industry to continue and expand. The commodity is being grown in California, Idaho, and Washington with yields running from 1500 to 3500 pounds per acre. Safflower has no planting or harvesting problems. However, disease-resistant varieties are needed because present varieties are not resistant to root rot and rust. Improved varieties are in process of development and will soon be ready for release.

# FUTURE PROSPECTS FOR THE COTTON CROP

Leonard Smith, Director of Utilization Research
National Cotton Council
Washington, D. C.

The present and potential domestic use and demand for cotton was reviewed in considerable detail and the export demand briefly. The domestic consumption in the 1920's and 30's was placed at about 6 million bales annually. Consumption increased greatly in the 1940's and averaged 9.4 million bales in 1947-51. In 1952 the consumption was 9.3 million bales. Exports have decreased. Domestic consumption in 1952 was broken down (in millions of bales) as follows: Apparel 3.1; household use 2.5; industrial 2.4; cloth for export 0.6; military 0.7.

Three forces will influence future demand. In order of definiteness these are: increase of population, change in per capita consumption, and competition with other fibers. If population increases at present rate and living standards improve as between 1939 and 1951, total fiber requirements for apparel and household use will probably rise by a million bales annually each 4.5 years. In these fields there are no serious threats from other fibers. Except for jute, all other fibers are in a higher price range. Jute has improved its competitive position, but much depends on how long low prices for jute continue. Paper competes with cotton on the basis of price and convenience, but seldom on quality. Paper has already gotten most of the markets it is going to get. Of the synthetics, only rayon currently poses any serious threat to cotton. Here the competition is both in price and quality. Rayon has taken over the tire cord market. Forty percent of rayon goes into tire cord and if this market is lost to nylon, competition with cotton in other industrial uses will be extremely severe. For household uses rayon is still a poor competitor with respect to durability and launderability, but is a tough competitor where appearance is concerned. It is noted that in the last two textile depressions, the effect was felt first in rayon and the

recovery was felt first in cotton. The possibilities for cotton to expand its uses in the industrial field through chemical modification and improved methods of production to yield longer, stronger fibers at lower cost are good. Fiber length has increased 7% in the last 10 years. The strength has increased from 65,000 pounds to 85,000 and some hybrids in experimental breeding blocks have run as high as 130,000.

It was felt that in the future the foreign trade in cotton should be more nearly normal and that cotton consumption is going to increase and most of this cotton is going to come from the U. S. Requirements for 15 million bales of cotton in 1961 and thereafter were believed to be conservative.

# EFFECT OF THE "MEAT-TYPE HOG" AND OTHER PRODUCTION AND UTILIZATION DEVELOPMENTS IN BAI ON FAT SURPLUSES

T. C. Byerly, Head
Animal Husbandry Division
Bureau of Animal Industry
Beltsville, Maryland

The following table shows that the per capita consumption of pork and lard have remained fairly constant over the years and that we have always been a large exporter of lard. It is nothing new, therefore, to have an excess of

| Year | Per Capita Consumption: Lard (pounds) | Per Capita Consumption: Pork (pounds) | Lard Exports (million pounds) |
|---|---|---|---|
| 1908 - 1913 | 12 | 65 | 530 |
| 1913 - 1918 | 12 | 63 | 480 |
| 1918 - 1923 | 13 | 66 | 830 |
| 1923 - 1928 | 13 | 68 | 800 |
| 1928 - 1933 | 13 | 69 | 680 |
| 1933 - 1938 | 11 | 56 | 216 |
| 1938 - 1943 | 14 | 65 | 570 |
| 1943 - 1948 | 13 | 71 | 600 |
| 1948 - 1953 | 13 | 69 | 650 |

lard production over domestic consumption. This surplus problem has always been with us--certainly for the last 40 years. We like the pig and if we want to produce the pork we need we must consider the lard that comes along with it. It is interesting to point out that the ratio of the price of lard per pound to the live weight price per pound of hog has declined each successive five years as follows: 190, 142, 118, 109, 80 and is now about 40.

At present, in order to produce enough pork for two people, we produce enough lard for three people. How can we produce a pig that will produce enough meat for two people and at the same time enough lard for only two

people? To produce an economic pig you must have certain requirements. Compared to the present pig these are:

| | What we now have | What we want |
|---|---|---|
| Choice cuts | 45% | 50% |
| Slaughter weight | 235 lbs. | 220 lbs |
| Litter size | 6.5 | 8.0 |
| Age at market | 200 days | 165 days |
| Feed efficiency | 450 | 350 feed per 100 pounds live wht. |
| Carcass yield | 75% | 75% of slaughter wht. |

We require a pig that is fleshy with good marbling of fat in lean cuts. To get the desirable internal fat we must have some of the outside fat. With an inch and a half of back fat, we should have the desirable amount of internal fat. How can these objectives be achieved? We can raise a pig that will produce proportionately less lard by limited feeding to cut down on growth and by increasing the percentage of protein in the feed.

EFFECT OF DIFFERENT LEVELS OF PROTEIN IN DIET (OHIO EXP. STA. DATA)

| Protein level % | 9.7 | 12.0 | 14.9 | 19.7 |
|---|---|---|---|---|
| Primal cuts % of carcass weight | 60.3 | 61.2 | 64.2 | 66.2 |

Present hogs coming to the market run about 30 percent of the meat-type. Lean types are found in all breeds of hogs. Introducing the meat-type pig presents a number of problems which were mentioned also by Dr. Johnson. One of these is that the meat-type pig must be capable of being competitively fed by the farmer, otherwise he would have no incentive in raising the meat-type.

# THE OUTLOOK FOR DRYING OILS

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The amount of drying oils consumed by the paint, varnish and lacquer industry has increased very markedly during the past twenty-five years, but so has the volume of products of the industry. The increase in drying oil consumption has not been as great as the increase in volume. Perhaps, in the absence of figures for the actual volume of production of the industry in gallons, the best way to show this trend is the ratio of the pounds of oil to the dollars of total sales, corrected for the changes in the prices. The general wholesale price index has been used to make this correction, although it is not necessarily an accurate measure of the price of paint at any given moment. Still, it shows the general trend.

For many years, the industry used just about one pound of drying oil for every dollar of sales. This ratio increased slightly from 1930 until the War, but whether this is a real increase, or whether it represents a failure of one of our assumptions to accord with the facts is hard to say.

During the War, there was a very sharp drop in consumption of drying oils, brought about in part by the various oil conservation orders which were in force and in part by changes in the type of material made by the industry for defense and military use. Immediately after the close of the War, there was a minor reaction but then the consumption levelled off at about 0.6 pounds of oil per dollar of sales.

While there has been some reduction in the amount of oil used in certain products, and some substitution of non-oil-containing products for those containing oil, the primary cause of this change has been the relative increase in industrial sales over trade sales.

In general, the industry divides their products into two classes--Trade Sales are those products which usually move through wholesale and retail outlets to the consumer who applies them himself or contracts to have it done. Industrial Sales are those sales made to manufacturers who apply the products to products that are sold in the finished state. Automobiles, refrigerators, furniture, and toys fall in this class.

The amount of oil per gallon of products is much higher for trade sales than for industrial, since, in general, the emphasis in trade sales products is on ease of application and, often, exterior durability. In many products these properties are best achieved with substantial amounts of drying oils. Industrial Sales, on the other hand, put their primary emphasis on fast drying and color retention, and are usually applied over a prepared and standardized surface of known properties. This makes the use of materials based on resins or cellulose derivatives, carrying little or no oil common in industrial finishes. Obviously, any trend toward increasing production of industrial finishes will result in reduced consumption of drying oils. Prior to the War, the industrial market represented less than 40% of the total sales of the industry. Now it is approaching 50% and is getting higher all the time.

We have had many products offered to the paint industry which were supposed to replace one of the standard raw materials, and, in general, the history has been about the same. The new material takes over those fields in which it has done a particular outstanding job--which is usually a field where the standard materials have not been particularly effective, but the consumption of the old material continues to increase.

A good example of this is the development of lacquers for automobiles. Before lacquer was developed the painting of cars took several weeks and the

amount of space required to store cars in the process of finishing was a serious bottle-neck in the industry. The introduction of lacquer reduced this to a matter of hours. It also set a new standard of performance which was soon matched by the oil-containing materials (alkyds) and today it is probable that ten times as much drying oil is used in the finishing of automobiles as was used in 1920. Of course, this is largely because the production of automobiles has increased tremendously in that time, but the development of lacquer is one of the steps that produced that increase.

Similarly, latex paints set a standard which was rapidly matched by alkyd flats and although the production of latex paints has increased from almost nothing in 1949 to more than 40 million gallons in 1952, it will be noticed that it had little effect on the consumption of drying oils. By making the application of interior paints simpler, and producing cleaner and more attractive colors, latex paints have resulted in more painting being done, with a consequent increase in the consumption of oil-containing paints as well.

There are two factors which may operate to reduce further the consumption of drying oils, other than the continued trend toward higher quantities of industrial finishes. One of these is further development of the latex-type paints. These products are relatively new to the industry, and we have no idea, as yet, what modifications may be made as a result of further research. It seems probable that the products at present available have nearly reached the limit of their usefulness, but it is difficult to predict the results of future research in the development of new materials with substantially different properties.

The other factor is the possible development of an oil-free exterior house paint of reasonable durability. As far as I know, this has not yet

been done, nor is it very close to accomplishment, but it could happen in the more distant future. Water-thinned paints are superficially attractive for this use since they do not require an absolutely dry surface, their odor is better, and the fire hazard associated with their storage and use is substantially reduced. They also tend to have a shorter drying time, but are more susceptible to rain damage during the drying period. There are certain other drawbacks that have not yet been overcome and which will limit their use for some time.

Factors now in the picture which might increase the use of drying oils in the future are: (1) modification of the oils to increase their desirable properties and make them useful in fields now more successfully covered by other products, such as improved methods of styrenation and the further development of the epoxide resins which can be esterified with fatty acids; and (2) the shorter work week and higher national income, leading to increased home-ownership, more time for painting, and the consequent improvement in trade sales.

One of the most important needs of the paint industry is more basic research in the drying oil field. The Regional Laboratories are ideally equipped to do a substantial amount of this, but are less well equipped to handle development of application research. If the Regional Laboratories could develop the fundamental information and make it available to industry, the development of new uses for drying oils could proceed more rapidly.

For example, although we have a good deal of empirical knowledge about adhesion, we actually know very little about the theoretical aspects of the subject. If we knew why paint sticks to surfaces we might develop vehicles with improved adhesion by the proper chemical modification, instead of relying on cut-and-dry methods. The same is true of several other basic

problems. ith this basic information available, the application research of industrial organizations could be conducted on a much more efficient basis.

It would be very useful if the Regional Laboratories could study, as far as possible, the various reactions which drying oils undergo, and make as complete a list as possible of the products to be expected, without too much concern as to the immediate usefulness of any of them. Then industry could choose the particular reactions which yielded products needed for the particular problem with which they were confronted at a given time.

# GOVERNMENT STOCKS OF FATS AND OILS AND THE OUTLOOK

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Data on government holdings or quantities under loan or purchase agreement of a number of oils and oilseeds were presented as shown in the following table:

## Oils and Oilseeds 1/

U. S. Government Holdings, Amounts under Loan or Purchase Agreement, Costs and Market Price

| Oil or Oilseed | Unit | Gov't. Holdings (millions) | Under Loan or Purchase Agreement (millions) | Approx. Cost Per Unit (dollars) | U. S. Market Price (dollars) |
|---|---|---|---|---|---|
| Cottonseed oil (refined basis) | lb. | 915 2/ | - | 0.181 | 0.1575 N. Y. |
| Linseed Oil | | | | | |
| Total | lb. | 490 | - | | |
| CCC | lb. | 190 | - | 0.289 | 0.140 Minneapolis |
| Secretary | lb. | 300 | - | | |
| Tung oil | lb. | 0 | 9.25 | 0.2650 | 0.275 Southern mills |
| Olive oil | lb. | 1.5 | 4.9 | 0.332 | 0.348 New York |
| Flaxseed | bush. | 4.6 | - | 4.42 | 3.65 Minneapolis |
| Soybeans | bush. | 0.5 (4.9 million lbs.) | 5 - 10 (48-98 million lbs.) | 2.71 | 2.72 Decatur |

1/ Excluding peanuts and castorbeans

2/ Includes inventory plus contracts to purchase

The cottonseed oil which is shown on a refined basis was acquired under the 1951 and 1952 Cottonseed Price Support Programs. Cottonseed oil was supported at 90 percent of parity in both of these years, and it has been announced that the support price for the 1953 crop will be 75 percent of parity. The cost shown does not reflect profit realized from sales of cottonseed meal acquired in connection with the cottonseed oil and linters.

The linseed oil was acquired under surplus production in 1948-1949. This oil has been in store since about 1949 but is keeping in excellent quality, and arrangements have been made to draw the good oil off the top of the tanks and we will then either centrifuge or resettle the tank bottoms, thereby reclaiming all of the oil and leaving only the foots for disposition. This oil should then be storable for an indefinite period.

The tung oil is under Loan or Purchase Agreement and may or may not be tendered to CCC at the maturity date, October 31, 1953, depending upon the ability of the market to absorb the oil at or above the support price of 26-1/2 cents.

It was explained that the olive oil price support was inaugurated for the 1951 crop when there was a bumper domestic production and a record world production. It was continued in 1952 because approximately 750,000 cases of canned olives were packed from the 1951 crop in excess of the edible market demand, and it is not contemplated there will be any future price support operations for olive oil. These two price support programs were inaugurated to give the industry an opportunity to adopt marketing practices and take other steps necessary to obtain their income from the primary market--edible use. Recently a marketing agreement has been proposed to meet these objectives.

The inventory of soybeans is approximate because it is not known what quantities would be delivered to CCC under the Loan and Purchase Agreement following the loan maturity date, May 31, 1953.

It was pointed out that 150,000 gallons of olive oil and nearly 4,000,000 pounds of cottonseed oil is being used for the School Lunch Programs.

No good indication could be given to ultimate disposition of these inventories of oils and oilseeds at this time (since the meeting, CCC has announced it would sell flaxseed at market price and under an amended announcement offered to sell soybeans at the market but not less than support price).

It was also pointed out that CCC was holding approximately 100,000 tons of 1951 and 1952 crop peanuts and something over 200,000,000 pounds of butter. The 1951 crop of peanuts are being offered for domestic crushing and for export for crushing, but generally the 1952 crops of peanuts are being held until more is known about the size of the 1953 crop.

The oil inventories are sampled periodically and the assistance given by BAIC and the Regional Laboratories in connection with these inventories is much appreciated.

# HAVE WE REACHED MAXIMUM FAT CONSUMPTION PER CAPITA?

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Three problems must be faced in attempting to answer the question: Have we reached maximum fat consumption per capita? One relates to present consumption in this country and whether it can be changed; another is the present or propsective attitude of the public towards fats; the third problem is concerned with the way nutrition research is pointing with respect to human requirements for fats.

The per capita consumption of the principal "fats" in our present annual foodsupply (butter, margarine, lard, shortening) on a water-free basis is about 45 pounds, not counting meat fats. The amount varies only slightly from year to year. If meat fats are added, the per capita consumption is 65 to 70 pounds. A lot of fat, however, other than the visible ones mentioned, are getting into the average diet from milk, fruits and vegetables, nuts and similar sources. More and more fats are creeping into diets by way of processed foods, including frozen desserts and such items as frozen french fries, potato chips, and other snacks processed in fats, which appear to be increasing in supply. When all of these sources of fat are considered, the per capita consumption of fats runs as high as an equivalent of 115 pounds per year. While we are consuming less calories per day than we did 25 years ago, a higher percentage is derived from fat. The National Research Council stated some years ago that about 25 percent of the calories in a normal diet should be from fats. Our present level is more nearly 40 percent. Fat in the food supply is not going down and there is good evidence that it may be going up, but is reaching us in different forms.

The public attitude toward fat is changing and is decreasingly

favorable to high fat products, especially where the fat is visible as in meats, and the waste is obvious. Forty percent of the fat sold in some meats may never be eaten because it is either thrown away before it reaches the plate or is left uneaten on the plate. On the health side is the attitude toward obesity. The possible relation of fats in the diet to cardiovascular diseases, associated with high blood cholesterol and hardening of the arteries, is also an important facet of the question of fat requirements. Blood cholesterol appears to be related to the percent of calories from fat in the diet. A number of long-term studies with human subjects are in progress in the search for an explanation of the role of fat in diets and in the health of older persons.

In summary it is concluded that greater per capita consumption of fats does not seem probable owing to factors which indicate less need for increased fats in diets in this country. These factors relate to (1) average age of our population is increasing and the average diet in terms of calories required is less as age advances; (2) occupations are becoming more sedentary owing to development of machines to do more of our work, and we therefore do not require high calorie diets for so-called "heavy labor" occupations.

# WHAT MARKETING RESEARCH CAN DO TO ENCOURAGE GREATER USE OF FATS AND OILS

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The demand for edible fats and oils is inelastic in comparison to the demand for fats for industrial uses. This is due to the fact that under normal conditions price fluctuations for edible fats are wide over a period of years and changes in consumption minor. Some of the changes in consumer preference are: the long-term downward trend in butter-margarine consumption, reflecting the war influence on cooking and restaurant use and downward trend in bread consumption; the upward trend in the use of cooking-salad oils, reflecting more restaurant needs, more use of fruits and vegetables, and possibly more use of prepared foods such as canned fish and soups, potato chips, and related products.

The possibilities of expansion in the use of visible fats in food appear limited. Increasing tendency for use of vegetable fat as a substitute for butterfat in "filled milk" products conceivably could result in net increase in the per capita consumption through lower price and demand. Improvement in the quality of lard would improve its competitive position, but would not necessarily increase the total demand for shortenings.

The industrial demand for fats and oils responds not only to price change but also to technological developments of new products and improvement in quality of products. An outstanding example is the sharp reduction in demand for soap fats resulting from superior accomplishments for many purposes of detergents made from coal-tar and petroleum derivatives. Factors tending to reduce the per capita consumption of fats are: improved quality of synthetic detergents for certain uses; improved quality of paints, varnishes and enamels through incorporation of synthetic resins and latex; stability of supply and prices of petroleum-derived raw materials versus instability of

supply and prices of fats and fatty acids. The factors tending to increase the per capita consumption of fats are: present abundance and low prices of lard, tallow and grease from slaughter and rendering operations, and vegetable oil foots; technological developments that hold promise for new or expanded uses.

Additional laboratory and market research are needed to develop alternative and improved products from fats, and lower costs in processing and distribution to offset the effect of synthetics on the decreasing consumption of fats and thereby expand the total market. The development of new or improved products involves the conception of modifications that can be made, based on fundamental knowledge of structure and properties of fats and their derivatives and pilot-plant development of promising leads. Preliminary market surveys and economic evluation should be undertaken based on more precise data on costs and properties. Surveys are also needed on industrial uses and consumer discrimination and preferences.

For example, we now know that chemically-modified derivatives of low-priced animal fats can produce "synthetic" detergents, emulsifiers, plasticizers, "pure" fatty acids, and other products of potential industrial use. But we know little of the market scope, the competitive factors and future outlook for such products. Here, market research and evaluation can furnish the answers and possibly the clues for needed research to develop additional products. There should be constant interchange of ideas between the technical men and marketing specialists and completely integrated effort. Laboratory researchers cannot afford to work in an economic vacuum with respect to applied research; the end products must have a commercial potential, otherwise much effort may be wasted.

Research in the field of marketing and processing costs and efficiencies opens another field whereby costs and prices of fat products may be made

competitive with those for non-fat products. The first aim would be to pinpoint areas of inefficiency and high costs, which should then be thoroughly analyzed to determine if organization or industry follows a good economic pattern especially with respect to plant facilities, layout, handling of materials and processing techniques. Some of these matters may be illustrated by the tallow rendering industry. Are individual rendering plants of optimum size? Is the industry too atomistic for its own good--too many sellers in relation to number of buyers? Is it possible to make improvements in marketing methods and inventory policies together with increased efficiency in plant operation and materials handling? Here is a field where marketing research might pay off in making tallow a truly competitive raw material for the processing industries.

Both the chemist and marketing specialist are concerned with preservation of product quality. Quality is an important factor in competition for markets with regard both to the raw material and the finished product. The chemistry of rancidity and other deteriorating factors is of course in the laboratory field, but market specialists can do much in investigating processing, storing and other market practices that lead to deterioration. The market specialist also is concerned with the problem of identifying product quality, through development of methods for establishing standards for grades. Without such standards marketing would be chaotic and more costly and hence products could not compete with standardized products from non-agricultural sources. The marketing specialist can also contribute to orderly marketing through the collection, analysis, and dissemination of market data such as production, imports, exports, inventories, sales, market movements, and prices.

# POTENTIAL INDUSTRIAL OUTLETS FOR FATS AND OILS

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The major potential industrial outlets for fats and oils were reviewed. Consideration of utilization for the production of materials used primarily for their nutritive value was deliberately excluded. It was noted that the consumption of fats and oils in the category of "Other Industrial Products" had increased by about 650 million pounds from 1939 to 1952 and by another 100 million pounds in 1952. Most of this increase was attributed to technological developments and this was interpreted to indicate that new technological developments resulting from research could reasonably be expected to utilize major quantities of fats and oils. Five consuming industries were listed as potential consumers of really significant quantities of fats and oils. They are: soaps (including detergents), drying oils, fibers (natural and synthetic), resins and plastics, and biologically active compounds. It was indicated that a great deal of research would be required to arrest or reverse the present declining trend of use of fatty acids in soaps. Increases in use of drying oils might be expected to result especially from research looking to the chemical utilization of the unsaturated centers present in drying oils. Successful research on the preparation of monomers for the production of synthetic fibers or use of fat derivatives to modify natural and synthetic polymers can be expected to result in the use of really large tonnages of fat-derived products. Preparation of plastics and plasticizers represents another large potential outlet. The production of biologically active compounds presents the possibility of utilizing moderate quantities of fat-derived products. A few specific

examples of possible research for each consuming industry were cited. It was noted that the fats and oils are versatile source materials for application of modern organic chemical reactions and techniques and that, in the long run, possibly the greatest return would be obtained from research not immediately directed to any specific end use but directed toward an increase in the knowledge of the basic chemistry of the acids which comprise the fats and oils and many of which are common to all fats and oils.

# ANIMAL FATS

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Economic effects of overproduction and surpluses in the whole fat industry tend to focus and be concentrated in the animal fat segment of the industry. There are several reasons why this is true, one of them being the byproduct nature of animal fat production. It also seems apparent that research and development in the animal fats industry has not kept pace with research in the vegetable oil industry.

I think in many ways, it is simple to understand why the vegetable oil industry is better equipped to do research than the animal fat industry. Cottonseed oil was not successfully marketed in this country until the process of hydrogenation was discovered. In order to hydrogenate this product, it was necessary to install equipment and to hire technical personnel. Two important effects resulted; first, management in the industry became aware of the value of contributions which could be made by technical people, and second, the financial requirements imposed by the equipment required, tended to concentrate the industry into the hands of a relatively few processors.

The animal fat industry has not been concentrated in any such manner. Lard without further processing possesses properties so close to the desires of the consumer that the hope of selling it continues to remain alive. Hence the animal fat industry remains widely spread--small packing houses, country butchers, even individual farmers are all producing and selling lard. In products of such a widely disseminated industry, the problem of quality and quality variation is usually very i portant. Lard is no exception. The average city housewife no longer buys lard.

The lard problem has reached the stage where I don't believe you can make lard acceptable to consumers by relatively minor improvements of quality

or odor, except possibly for export outlets. I think it must be converted to shortening and even called by a different name. People put out lards that have less odor, but to the housewife they still "stink." I think the quality problem has reached the stage where you have to go the whole way. Lard must be marketed as and used as raw material for shortening to put it back into competition. This is the most the lard people can hope for. Today lard is only in competition with vegetable shortenings because of price, and this is no competition at all from the viewpoint of the housewife.

The packaging is usually cheap and we are living in an era when the housewife is not willing to put up with the resulting inconvenience.

We know that lard can be put into shortening, but we must not forget that we have seen in this conference that you don't increase the consumption of fats and oils by improved edible products.

The tremendous significance of new industrial uses for fats lies in the fact that it is chiefly through developments in this direction that the total outlet for fats can be increased. At the Eastern Laboratory we have been taking that point of view and our program has been divided into two groups involving (1) edible uses and (2) industrial uses. We have put 25-30% of our effort into edible uses--the lard problem; and 70-75% into industrial uses.

Some think one of the reasons research is done on edible fats and not on inedible fats is because the edible market will bring a bigger price. But that is not necessarily so! The highest priced group of oils is the drying oils. Another point--with some of the newer derivatives--I don't think shortening will be able to outbid the chemical companies for the oils used for plastics. When the prices of chemicals, based on fats are compared with prices of materials received by the shortening trade, it is evident

that higher prices for fats in shortenings are an old misconception. There are many cases where it is true, but from a research view, it is bad to put on those blinders.

In research, one must bear in mind that the original raw material cost must not be given over-powering consideration. If one has an idea for a new reaction, the cost per pound should receive minor consideration in the early stages. Chemists must not be confined in their thinking by being forced to give over-powering consideration to cost in the early planning stages. One can only know what a thing is worth after it has been evaluated, and certainly not before it has been prepared.

There are many chemicals selling for higher prices which are replacing less expensive ones. In fact, most detergents are selling at prices higher than the cost of tallow soaps today. There are two reasons for this, first, detergents will in some cases do a job which soap will not do, i.e., work effectively in an acid bath and second, "builders" are used to extend the detergents.

From Dr. Goldblatt's remarks I gained the impression he feels that there is a considerable possibility that fat-based derivatives may push back detergent production from petroleum-based products substantially. We do not wholly share this view for two principal reasons. First, there are a fair number of fat-based derivatives offered on the market which have a definite place for specialty uses, but none of these have led to such an extensive use as household detergents that an outlet for substantial quantities of domestic fats resulted. Second, we do not know how low the price of alkyl benzene might be pushed if faced with real competition.

On the other hand we do agree with Dr. Goldblatt that there are possibilities in this direction and are at present exploring two aspects of this

field. These are: (1) The sulfonated fatty acids--sulfonated in the alpha position. These are cheap, but they have some deficiencies; however, these may be capable of improvement, and (2) The sulfated oleyl alcohol. This is an excellent detergent. The thing lacking is a good process for sulfating the alcohol without attacking the double bond. This is such a good detergent that it could probably successfully be extended. It might cost 50 cents a pound to make, but could still be competitive if built with sufficient inorganic builders; even though it is expensive you would not have to use so much of it.

In thinking about fields of work there is an excellent statement in the Stanford Research Institute Report by Raymond H. Ewell entitled, "The Outlook for Fatty Acid Raw Materials." He states that research on the utilization of fatty acids should aim at developing products in the "big time" synthetic fields for organic chemicals such as plastics, fibers, rubber, plasticizers, pesticides, lubricating oil additives, lubricants, waxes, solvents, adhesives and the like. Essentially these same fields have been mentioned by Dr. Goldblatt. If you look over our field of activity, you will find a great majority of our work has been directed into these things. From our point of view, it would be poor judgment to spend time on anything that would not have a substantial outlet.

Mr. Ewell in the same report has also presented some interesting figures concerning the future financial support required for research in the tallow, grease and fatty acid industries if they are to develop. He estimates this need at 5 to 9 million dollars per year. We must be concerned that after insufficient support for too few years, research be blamed for not accomplishing the desired goal which is admittedly difficult.

This is particularly true because one of the greatest needs in the

industry is for basic research. There is a selling job to be done here. It is not entirely clear why more chemistry professors are not training people in fat chemistry, but the truth is very few of them are. This fact may be associated with the past history of few research grants or fellowships to encourage such work as well as the past history of extremely limited opportunities for employment by the individuals so trained. In fact, the limited number of research people trained in fat and oil chemistry is now a serious problem to those organizations trying to develop research programs in fat utilization. In discussing this problem with several industry leaders several months ago the question was directed to them, "where are you hiring chemists with experience?" Their unanimous answer was, "we hire them from each other."

Time is running out so we must turn to our existing research program. At present, we are doing work on the following: (1) Improved shortenings from edible animal fats, (2) Lard oil improvement, (3) We have recently finished work on hot dip tinning, partly by contract, (4) Contract on animal fats in dog and broiler rations (We need more work on that), (5) Synthetic detergents from domestic fats, (6) Work on vinyl chloride derivatives of animal fats (This is basic work on internally plasticized plastics), (7) We have developed a process for manufacturing improved oleic acid, now in use in industry, (8) Work on hydroxy acids (addition of formic acid), (9) Work on oxidation products of fats (Epoxidized fats used as plasticizers), (10) Work with Pennsylvania State College on distillation and (11) Work with the Hormel Institute on solubility.

One of the basic reasons that chemicals from fats are not used is that the intermediates are of such low purity. By support of the latter two projects above, we hope to be able to supply better information on fundamental processing steps which can be improved.

In summary: As near as can be estimated, work at the Eastern Laboratory over the past 10 years has resulted in development of new uses for fats in the not too long-term future for something of the order of 50 to 75 million pounds of fats per year.

# SOYBEANS AND OTHER NORTHERN OILSEED CROPS

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The scope of the investigations of the Northern Regional Research Laboratory on oils and fats may be summarized briefly under the headings: Dimer acid, flavor stability of soybean oil, investigations on lubricant characteristics of hydroxystearic acid derivatives, on compositions of monoglycerides with liquid oil as edible spread of wide plastic range, isomerization of vegetable oils, composition of soybean phosphatides, and liquid-liquid fractionation of soybean oil.

Investigations on polymeric fat acids (i. e. dimer acid of commerce) extended over several years and were started to find uses for them at a time when few realized their potentialities. It was found that they could be used to produce Norepol rubber. This use was short-lived, but the other reactions of the dimer acids--especially with diamines--indicated that a variety of useful products might be obtained for commercial exploitation. One of these materials (Norelac) is now used extensively in the heat-sealing of glassine paper used in food packages. New combinations with Epon resins also promise to give Norelac a big boost in production.

Flavor stability of soybean oil is the number one problem in importance to the soybean industry. It is unusual among edible vegetable oils and little progress had been made on this subject until work of the Northern Laboratory developed procedures suitable for studying the problem. It was established that linolenic acid was the major precursor of undesirable flavors in soybean oil and many questions in this direction have been answered. Concurrently it was learned that soybean oil was particularly sensitive to flavor changes in the presence of trace metals and that 0.1 part per million of iron and 0.01 part per million of copper was sufficient to substantially reduce the

flavor stability of the oil. The role of citric acid in improving the stability of soybean oil was established as that of a metal-inactivating agent. Since then, it was found that numberous other compounds--such as sorbitol--are effective as metal-inactivating agents. In addition, the importance of good initial deodorization was established. Unquestionably, soybean oil has improved in flavor stability through the efforts of research at the Northern Regional Research Laboratory. There may not be a definite, clear-cut correlation between increased use of soybean oil and the work of the Northern Laboratory, but certain work establishing the importance of trace metals, metal inactivators, and good deodorization have had a pronounced effect on its greater use in edible products. Thus in 1952, the us e of soybean oil increased to over 645 million pounds per year in margarine, 850 million pounds for shortening, and 438 million pounds for other food products to give a total of 1,933 million pounds. The work of the Northern Laboratory, coming at the time it did, placed the edible oil refiner in a position to use more soybean oil and salad dressings. The work is not complete because the oil still reverts and the reversion problem cannot be considered completely solved until measures are found for removing linolenic acid and its derivatives from soybean oil.

During the past two years, the lubricant characteristics of hydroxystearic acid deriva tives have been studies. This work was co ducted with the specific object of finding substitutes for di-2-ethylhexyl-sebacate, which is derived from sebacic acid in castor oil. Although many of the derivatives prepared approach the properties of the castor-oil-sebacate, none of them have as good low-temperature properties as the latter.

One of the problems being studied deals with formulating a spread for use by our Armed Forces which can be used readily at low temperatures and still retain its sha pe, fla vor, form and flavor stability at the high

temperatures which are encountered in modern war. When properly prepared, a combination containing approximately 15-18 percent monostearin from hydrogenated lard, 82-85 parts of liquid oil such as soybean or cottonseed, a crystal stabilizer, color, flavor, vitamins, and salt can be mixed and chilled to give a product which comes close to meeting the desired specifications.

The need was stressed for a long-range viewpoint concerning basic research on fats and oils, especially with respect to the many potential chemical reactions of glycerides, fatty acids and their derivatives. Such work should include catalytic cleavage of fatty acids and their derivatives; preparation of new derivatives of monoglycerides derived from fatty acids; investigations of the reactions of ketenes prepared from fatty acids with acetic anhydride; studies on the utilization of adducts of oleic acid with maleic anhydride; and studies on the preparation of oxidized derivatives of fatty acids.

# COTTONSEED AND OTHER SOUTHERN OILSEED CROPS

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There are two general approaches to improving the competitive position of agricultural oils. The first involves improving their position for present uses; the second involves developing entirely new uses. Both types of research have their place in a balanced approach to improving fats and oils utilization. The first type includes increased efficiency of processing, improvement of quality, and maintenance of uniform quality through improved processing. The present program at the Southern Laboratory to improve the quality of cottonseed oil through processing and the development of better methods of reducing color in the oil is of this type. Another consideration is to improve the value of the byproducts or coproducts. Improving the value of cottonseed meal, for example, strengthens the entire cottonseed industry and the competitive position of cottonseed oil. Similarly, research to find new markets for tung meal, if successful, could improve the competitive position of tung oil in the drying oil field by making it possible to sell the oil at a lower price.

Solution of problems resulting from surpluses require additional lines of research such as finding uses for these materials in entirely new fields. There is room for substantial increase in the use of fats and oils in new uses which take advantage of their edibility. An example is the acetoglyceride development. By far the greatest possible new use for surplus fats and oils is in industrial inedible uses which would have to be created by chemical modification of present materials to yield products that have industrial value.

Research on the processing and utilization of cottonseed is not a new interest of the Bureau of Agricultural and Industrial Chemistry. Through

cooperation with the National Cottonseed Products Association it has been in this field for over 25 years. With the origin of the Regional Research Laboratories, the effort was enlarged to constitute a comprehensive program of research that is now conducted in three divisions of the Southern Laboratory.

In planning the present program attention has been and is being given to problems of basic importance. The composition and variability in composition of cottonseed has been investigated to provide basic information. Efforts have been expended to improve the storageability of the seed. The problems of processing the seed for oil and meal have been surveyed and critically examined. Attention has been directed to the preparation of the seed for processing by hydraulic, screw-pressing, and solvent-extraction. A filtration-extraction process for oil recovery, recently developed, has received a large amount of interest and attention.

Much background research has been completed in regard to the processing conditions required for the production of meals of greater nutritive value and of oils of higher quality. The factors influencing oil color are being studied. The refining, hydrogenation, and winterization of oils as well as the physical properties which effect utilization have been the subject of a number of past and current researches. New methods of refining have been examined.

Within the past few years efforts have been increased on reacting and modifying cottonseed fatty acids in search for new fat products. A recent development is the production of acetoglycerides which give promise of use as flexible coatings, in global spreads, and as plasticizers. In addition to research dealing with cottonseed similar efforts have been under way on peanuts, tung, and rice.

Future research on modifying vegetable fats and oils at the Southern Laboratory will subscribe to the following basic principles: Research should be undertaken to take full advantage of the peculiar qualities of any individual oil and to utilize those peculiarities to the maximum extent. For example, those uses which are peculiar to glycerides containing eleostearic (tung oil) or linoleic acid (cottonseed oil) should be exploited as much as possible. Secondly, wherever such peculiar uses are not practical or of any significant advantage, research should try to provide the greatest interchangeability between all of the oils so that new uses for one oil can just as well be applied to the other oils as well. It should be borne in mind, therefore, that research at the Southern Laboratory on cottonseed and other oilseeds is and will continue to be predicated on the relationship of what is going on in the industry and also on what is being done at the Northern and Eastern Laboratories, whether on vegetable oils or on animal fats. The direction of the program in the future, as in the past, will be guided by the best advice and information and will be aimed at solving the problems of greatest urgency and economic importance, both to the farmer and the fats and oils industry.