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# Agricultural Raw Materials for Industrial Use

**1963  
and 1964**

U.S. DEPARTMENT OF AGRICULTURE  
Agricultural Research Service

ARS 20-14  
March 1966



TABLE OF CONTENTS

	<u>Page</u>
Introduction-----	2
Fats and oils-----	2
Starches and flours-----	3
Sugar and molasses-----	3
Agricultural fibers-----	4
Turpentine and rosin (naval stores)-----	5
Miscellaneous raw materials-----	5
Conclusion-----	17

LIST OF TABLES

Table 1.--Fats and oils used by the U. S. chemical and allied industries, 1963 and 1964-----	6
Table 2.--Starches and flours used by the U. S. chemical and allied industries, 1963 and 1964-----	9
Table 3.--Sugar and molasses used by the U. S. chemical and allied industries, 1963 and 1964-----	11
Table 4.--Agricultural fibers used by the U. S. chemical and allied industries, 1963 and 1964-----	12
Table 5.--Turpentine and rosin used by the U. S. chemical and allied industries, 1963 and 1964-----	14
Table 6.--Miscellaneous raw materials used by the U. S. chemical and allied industries, 1963 and 1964-----	15
Table 7.--Agricultural raw materials for industrial uses-----	17

AGRICULTURAL RAW MATERIALS FOR INDUSTRIAL USE,  
1963 and 1964

by

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INTRODUCTION

Agricultural raw materials are used by the chemical and allied industries in the manufacture of products such as adhesives, drilling muds, drying oils, lubricants and greases, fabrics, rayons, paper, plastics, plasticizers, pesticides, surface coatings, soaps, surfactants, and cosmetics. Many commodities from which these raw materials are derived are available in large surplus quantities here or abroad. In order to assist industry in its selection of suitable raw materials, the more important agricultural raw materials are listed. Brief descriptions of their chemical composition, approximate wholesale prices, and industrial end uses are included in this report.

The dollar value of the agricultural raw materials used by the chemical and allied industries has been estimated at over \$1 billion.<sup>2/</sup> This figure did not include tobacco, nor the wood pulp used in the production of paper and paperboard, nor the natural fibers used by the textile industry. However, these are also agricultural raw materials with large industrial outlets. In most cases, these statistics are for the year 1964, or for 1963 if 1964 data are not available. Estimates based on consensus are employed whenever recent data are not available.

FATS AND OILS

The annual U. S. production of fats and oils exceeded 20 billion pounds in 1964, and approximately 4.3 billion pounds of this total were used by the chemical and allied nonfood industries.

Most of the oils and fats separated from animal tissue and from fruits and seeds are subjected to some sort of refining. Fats and oils are usually complex mixtures of triglycerides and may contain up to 5 percent of other substances. The mixtures of triglycerides may be split into their component

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<sup>1/</sup> Staff specialists (chemicals).

<sup>2/</sup> Anonymous. The chemical industry facts book. 5th ed., p. 40. Manufacturing Chemists' Assoc., Washington, D. C. 1962.

monobasic fatty acids and glycerol and may be modified to give them special characteristics for various industrial uses.

Utilization research has brought about a continually changing picture. The natural oils and fats that served as simple lubricants for thousands of years are now modified to serve as additives in more complex lubricating oils and greases. Synthetic resins derived from fats and oils (or their components) are used in paints, varnishes, and other surface coatings. The number and variety of industrial uses of the oils and their component fatty acids are continually expanding. This expansion is due largely to the development of such chemical derivatives as the sulfated oils and acids, epoxidized fats and oils, fatty alcohols, dimer and dibasic fatty acids, fatty acid esters, amides, and amines.

Table 1 gives statistics on both domestic and imported oils and fats and includes brief listings of the best known industrial uses. Tall oil, which is obtained from wood, is the only nonglyceride oil in the table.

### STARCHES AND FLOURS

As indicated in table 2, the U. S. industrial nonfood and nonfeed consumption of starches and flours is about 2.5 billion pounds. This excludes more than 3.5 billion pounds of cornstarch converted into corn sugar and corn sirups (see table 3).

Corn, wheat, grain sorghum (milo), and potatoes provide the major domestic sources for starch, but the relatively inexpensive tapioca and sago starches consumed are imported. The largest industrial consumers are the paper mills, paper box manufacturers, textile mills, and the adhesives manufacturers. Lesser amounts find an almost endless variety of uses. Utilization research has resulted in many new chemical derivatives of starch and has contributed to a tripling of the annual consumption by industry since 1940.

### SUGAR AND MOLASSES

Sugar, obtained principally from sugarcane and sugarbeets, serves primarily as a carbohydrate food. U. S. consumption in 1964 amounted to about 9.7 million tons, raw value. Nonfood and nonfeed uses accounted for less than 1 percent of this total, despite the fact that refined sugar is one of the purest of the major organic raw materials (table 3).

Blackstrap molasses, a byproduct derived from sugarcane, and beet molasses are used principally in livestock feed and in the production of such industrial products as citric acid and yeast. As a chemical or industrial raw material, molasses must compete with sugars, sirups, starches, and even petroleum gases in the production of sorbitol, ethyl alcohol, and other end products.

## AGRICULTURAL FIBERS

All people use fibers. Fibers are the raw materials out of which yarns, cords, ropes, cloth, felt, brushes, paper, and the like are made.<sup>3/</sup> Their use as chemical raw materials is a relatively modern development, as exemplified by the use of cellulose--the woody part of trees and other plants--in the production of rayon, acetate, nitrocellulose, and cellophane.

In 1964, the U. S. produced about 30 percent of the world's cotton and used about 19 percent of the world total of 51.3 million bales--the equivalent of 25 trillion pounds. At the same time, the U. S. produced only 4.6 percent (greasy basis) of the world's wool and consumed about 12.3 percent (clean basis) of the world total. The use of chemical processing auxiliaries such as bleaching agents, dyes, and film-forming finishes on natural fibers does not necessarily qualify these fibers as chemical raw materials. But today's competition with synthetic fibers has forced the development of chemically modified natural fibers (or fabrics made therefrom). The resulting fabrics have properties differing noticeably from those made from unmodified natural fibers. Thus, in the chemical treatment used to produce a fabric or garment with wash-wear or durable press properties, a cross-linking reaction between cotton and resin takes place. But, whether these natural fibers are chemically modified or not, they are still industrial (nonfeed, nonfood) raw materials.

Timber removed from the world's forests totaled about 62 billion cubic feet in 1963. From this was produced about 70 million short tons of pulp. Nearly two-thirds of this was in the form of chemical and semichemical wood pulp used chiefly in papers other than newsprint and for paperboard and synthetic materials such as rayon, plastics, and films. Chemical pulp that serves as the base raw material for production of rayon and other cellulose derivatives has been treated to remove the lignin and other noncellulosic substances and has been thoroughly bleached. Semichemical pulp, produced by softening the wood chips with more dilute chemical solutions prior to mechanical defibering, is used primarily in production of boxboards and the coarser types of paper.

Practically all the 659,000-ton total of cellulose consumed by U. S. producers of rayon and acetate fibers in 1963 (698,000 tons in 1964) was derived from wood pulp, less than 500 tons being based on cotton linters. Only this usage of wood pulp is considered in table 4, because the so-called chemical and semichemical pulps are not chemically modified raw materials.

A little over 1 million tons of other fibrous materials such as cotton fibers, hemp, jute, etc., were consumed in U. S. paper and paperboard mills in 1965. This is in addition to the wood pulp consumed by the U. S. paper and paperboard mills (30.2 million tons in 1963 and 32.0 million tons in 1964).<sup>4/</sup>

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<sup>3/</sup> Downs, A. A., and coworkers. [Vegetable fibers.] In Farmer's World, U. S. Dept. Agr. Yearbook 1964:211-250. 1964.

<sup>4/</sup> American Paper Institute. Monthly statistical summary. Vol. 44, No. 1, p. 3. New York, N. Y. January 1966.

## TURPENTINE AND ROSIN (NAVAL STORES)

Once trees were regarded principally as sources of lumber, paper, and naval stores. Table 5 gives the current picture on turpentine and rosin. Many other "silvichemicals" are extracted from sawdust, bark, wood chips, the fluid left after pulping operations, and other sources (see table 6).

An estimated 98 percent of the turpentine consumption is in the chemicals category, which includes retail sales to professional painters and private individuals for use as a solvent and paint thinner. Chemical products and intermediates obtained from turpentine include the pinenes, camphor, alpha terpineol, chlorinated camphene, and synthetic terpene alcohols.

A downtrend of rosin consumption in paint, varnish and lacquer formulations continues, while use in rubber, paper and paper size, and in chemicals and pharmaceuticals continues to climb.

## MISCELLANEOUS RAW MATERIALS

In table 6 we have included a number of agricultural raw materials that could not be classified under the headings listed in tables 1 through 5. We have not included items such as tobacco, wood pulp for the paper industry, lumber, corncobs, straw, and silk.

The value given for "silvichemicals" is based on estimated 1964 sales of \$260 million, a 7-percent gain from 1963.<sup>5/</sup> Among those being produced in quantity are acetic acid, methanol, propionic acid, and methyl acetone, basic chemicals with dozens of end uses. Lignin, a glue-like substance that literally binds a tree together, is used "as is" for a variety of specialty jobs and in the form of surface-active lignin sulfonates. Dimethyl sulfide, a gas odorant extracted from lignin, is oxidized to dimethyl sulfoxide, an important commercial solvent. Lignin compounds such as vanillin (a base chemical used in making synthetic vanilla, etc.) and ethyl vanillate (a food preservative and an ultraviolet screening agent in suntan lotion) are two of the many being marketed. Production and consumption statistics on most of these products are not available, though U. S. Tariff Commission did report the 1964 production of 427 million pounds and consumption of 413 million pounds of lignin sulfonates, valued at \$14.7 million.

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<sup>5/</sup> Hartley, W. D. Paul Bunyan's lab: Chemicals from trees find increasing use. The Wall Street Jour., Nov. 30, 1965, p. 1.

Table 1.--Fats and oils used by the U. S. chemical and allied industries, 1963 and 1964<sup>1/</sup>

Raw material and industrial use	Annual production		Imports		Exports		Industrial nonfood and nonfeed		Major fatty acid constituent of glycerides	
	Million pounds	Value	Million pounds	Value	Million pounds	Value	Consumption	Price <sup>2/</sup>	Fatty acid	Percent
Castor oil-----	40		96		1		153	17.4	Ricinoleic--	87
Hydraulic fluids, lubricants, electrical insulations, plasticizers, plastics, polyurethanes, sebacic acid, medicines									Oleic-----	7
Coconut oil-----	342		410		1		510	12.9	Lauric-----	45
Soaps, candles, cosmetics, emulsions, resins, surfactants, fatty acid derivatives									Myristic----	18
Corn oil-----	367		--		--		3/ 30	10.3	Palmitic----	10
Soaps, lubricants, leather dressing, rubber substitute, hair dressing									Capric-----	8
Cottonseed oil-----	1,939		--		586		12	10.8	Oleic-----	8
Limited use									Linoleic----	56
									Oleic-----	30
									Palmitic----	10
Crambe oil (new)-----	(4/)		--		--		(4/)	--	Erucic-----	50-60
Fibers, lubricants, casting of steel, plastics, plasticizers, waxes									(which can be ozonized into brassy-lic acid)	
Lard-----	2,481		--		682		231	9.1	Oleic-----	41
Soaps, surfactants, lubricants, greases, chemicals									Palmitic----	31
									Stearic-----	18



Linseed oil-----	444	--	19	377	13.0	49	Linolenic---	50
Paint and varnish, linoleum:							Linoleic-----	20
and oilcloth, resins, lub-							Oleic-----	20
ricants and greases, fatty							Saturated---	10
acids, concrete highways								
Oiticica oil-----	--	8.3	--	10	28.4	3	Licanic-----	78
Paint and varnish							Eleostearic-	5
							Oleic-----	6
							Saturated---	11
Palm oil-----	--	5/ 29	--	24	14.9	6	Oleic-----	47
Soaps, tin plating, sur-							Palmitic-----	41
factants, lubricants,							Linoleic-----	6
candles							Stearic-----	4
Palm kernel oil-----	--	5/ 85	--	5/ 5	12.9	1	Lauric-----	50
Soaps, lubricants,							Oleic-----	16
cosmetics							Myristic-----	16
							Palmitic-----	8
Peanut oil-----	97	--	39	--	12-16	--	Oleic-----	55
Soaps, medicine							Linoleic-----	27
							Palmitic-----	7
							Stearic-----	6
Rapeseed oil-----	--	5/ 4.8	--	3/ 5	14.0	1	Erucic-----	50-60
Soaps, lubricants, rubber							(which can	
substitutes, heat treat-							be ozonized:	
ment of steel							into brassy-	
							lic acid)	
Safflower oil-----	6/ 75	--	17	6/ 30	12.8	4	Linoleic-----	75
Plasticizers, drying oils,							Oleic-----	17
paint, varnish								
Soybean oil-----	4,822	--	1,105	383	9.0	34	Linoleic-----	51
Paint, varnish, resins and							Oleic-----	30
plastics, linoleum and							Saturated---	13
oilcloth, soaps and fatty							Linolenic---	5
acid derivatives, lubri-								
cants, and greases								

Continued

Table 1.--Fats and oils used by the U. S. chemical and allied industries, 1963 and 1964<sup>1/</sup> --Continued

Raw material and industrial use	Annual production	Imports	Exports	Industrial nonfood and nonfeed		Major fatty acid constituent of glycerides	
	Million pounds	Million pounds	Million pounds	Consumption	Price <sup>2/</sup> Cents per lb.	Value	Fatty acid
				Million pounds	3.6/7.5	Million dollars	Percent
Tall oil-----	1,104	--	34	1,066	38		Oleic and linoleic----
Fatty acid derivatives, paint, varnish, linoleum, oilcloth, resins and plastics, lubricants, surfactants					7/		Rosin-----
Tallow and grease, inedible- Soaps, surfactants, paints, varnishes, lubricants, greases, chemicals	4,538	2	2,416	1,444	6.4	92	Other-----
Tung oil-----	25	29	2	33	27.0	9	Oleic-----
Varnishes, linoleum, waterproofing							Palmitic-----
Totals-----	16,274	664	4,902	4,313	--	355	Stearic-----
							Eleostearic--
							Oleic-----
							Saturated----

<sup>1/</sup> U. S. Department of Agriculture. Fats and oils situation. U. S. Agr. Marketing Serv. FOS 223:18. 1965.  
 U. S. Department of Agriculture. Agricultural statistics 1964. 623 pp. Washington, D. C. 1964.  
 Commodity Research Bureau, Commodity year book 1965. 386 pp. New York, N. Y. 1965.

<sup>2/</sup> Approximate.

<sup>3/</sup> Maclay, W. D., Matchett, J. R., and Pollack, Morris. Industrial utilization of seed oils. Econ. Bot. 17(1):23-30. 1963 [Data are for 1959.]

<sup>4/</sup> Small.

<sup>5/</sup> Data for 1962.

<sup>6/</sup> Data for 1961.

<sup>7/</sup> Prices for crude and refined oil.

Table 2.--Starches and flours used by the U. S. chemical and allied industries, 1963 and 1964<sup>1</sup>/

Raw material and industrial use	Annual production	Imports	Exports	Industrial nonfood and nonfeed		Major constituents
				Consumption	Price/Value	
	Million pounds	Million pounds	Million pounds	Million pounds	Cents per lb.	Value
Corn starches (wet process)-	2,495	--	--	3/ 1,875	6-12	112
Auxiliaries in manufacture of paper and paperboard and in processing of textile goods. Also used in preparing adhesives, batteries, boiler compounds, briquettes, ceramics, chemicals, cosmetics, crayons, dyes, explosives, foundry sand, insecticides, insulation, laundry aids, linoleum, oil well muds, paints, pharmaceuticals, plastics, plywood, rubber, soap, etc.						High polymeric carbohydrates, approximately (C <sub>6</sub> H <sub>10</sub> O <sub>5</sub> ) <sub>n</sub>
Tapioca starch-----	0	4/ 263	--	5/ 130	5-10	8
Same uses as those above						-----Do.-----
Wheat starch-----	6/ 80	--	--	4/ 60	7-10	4
Same uses as those above						-----Do.-----
Potato starch-----	7/ 11	--	--	37	6-10	2
Same uses as those above						-----Do.-----
Wheat flour-----	24,096	--	4,235	4/ 145	5-7	8
Used in mining, road paving, tanning, etc.						Starch, protein.

Continued

Table 2.--Starches and flours used by the U. S. chemical and allied industries, 1963 and 1964<sup>1/</sup>--Continued

Raw material and industrial use	Annual production	Imports	Exports	Industrial nonfood and nonfeed		Major constituents
				Consumption	Price <sup>2/</sup> Value	
	Million pounds	Million pounds	Million pounds	Million pounds	Cents per lb.	Million dollars
Corn and milo flour-----	--	--	--	4/ 270	5-8	13
Adhesives, papermaking, briquettes, foundry cores, ore refining, oil well drilling, wallboard						Starch, protein.
Totals-----	>26,700	>300	>5,000	>2,500	--	>150

<sup>1/</sup> U. S. Department of Agriculture. Agricultural statistics 1964. 623 pp. Washington, D. C. 1964. Commodity Research Bureau. Commodity year book 1965. 386 pp. New York, N. Y. 1965.

<sup>2/</sup> Approximate.

<sup>3/</sup> Senti, F. R. Fifty years of progress in industrial utilization of cereal grains. Cereal Sci. Today 10:320. 1965. [Data are for 1963.]

<sup>4/</sup> Trotter, W. K. Economic outlook for increased industrial utilization of cereals. Paper presented at meeting of American Association of Cereal Chemists, Kansas City, Mo., April 1965. [Data for 1963-64.]

<sup>5/</sup> U. S. Department of Commerce. U. S. census foreign trade report. U. S. Bur. Census Rpt. FT 110, pp. 34-35. Washington, D. C. June 1965. [Estimated food usage based on 50 percent of imports.]

<sup>6/</sup> Data for 1963.

<sup>7/</sup> Data for 1962.

Table 3.--Sugar and molasses used by the U. S. chemical and allied industries, 1963 and 1964<sup>1/</sup>

Raw material and industrial use	Annual production		Imports	Exports	Industrial nonfood and nonfeed		Major constituents
	Million pounds	Million pounds			Consumption	Price/Value	
Sugar (cane and beet)-----	12,850	8,984	42	122	6.9	8	Sucrose (C <sub>12</sub> H <sub>22</sub> O <sub>11</sub> ).
Detergents, emulsifiers, plasticizers, resins, explosives, insecticides, humectants, adhesives, chemicals, tanners							
Corn sugar-----	1,049	--	(3/)	4/ 200	7.3	15	Glucose (C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> ).
Chemicals: sorbitol, mannitol, citric and gluconic acids, methyl glucoside, etc.							
Molasses (industrial)-----	4,367	3,178	51	1,685	1.3	22	Carbohydrates (such as sucrose, dextrose, or levulose).
Raw material for fermentation industry: yeast, ethanol, butanol, acetone, citric acid, propionic acid, itaconic acid, glycerol; tobacco flavoring, etc.							
Corn syrup-----	2,800	--	23	(3/)	6.5	--	Reducing sugars, 40 percent (dextrose, maltose, etc.)
Medicinal syrups, tobacco, adhesives, shoe polish, textile finishing, soap-making, wrapping twine							
Totals-----	21,066	12,162	116	2,007	--	45	

<sup>1/</sup> U. S. Department of Agriculture. Agricultural statistics 1964. 623 pp. Washington, D. C. 1964. Commodity Research Bureau. Commodity year book 1965. 386 pp. New York, N. Y. 1965.

<sup>2/</sup> Approximate.

<sup>3/</sup> Small.

<sup>4/</sup> Senti, F. R. Fifty years of progress in industrial utilization of cereal grains. Cereal Sci. Today 10:320. June 1965.

Table 4.--Agricultural fibers used by the U. S. chemical and allied industries, 1963 and 1964<sup>1/2</sup>

Raw material and industrial use	Annual production		Imports		Exports		Industrial nonfood and nonfeed		Major constituents
	Million pounds	Value	Million pounds	Value	Million pounds	Value	Consumption	Price	
Chemical cellulose <sup>3/</sup>	---	---	---	---	---	---	1,396	6.8	α-cellulose.
Manufacture of rayon, rayon acetate, nitrocellulose, and cellophane	---	---	---	---	---	---	---	---	---
Cotton	7,602	---	57	---	2,100	---	4,600	30.2	1,389 Cellulose (C <sub>6</sub> H <sub>10</sub> O <sub>5</sub> ) <sub>n</sub> .
Apparel, household fabrics, industrial fabrics, upholstery	---	---	---	---	---	---	---	---	---
Cotton linters	989	---	75	---	150	---	693	3-5	21 Cellulose.
Rayon and rayon acetate manufacture, pyroxylin, plastics, batting, stuffing for felt, mixing with wood, alpha cellulose, explosives, insulation	---	---	---	---	---	---	---	---	---
Vegetable fibers <sup>4/</sup>	---	---	568	---	---	---	568	16-24	91 -----Do.-----
Linen fabrics from flax; burlap, ropes, twine, bags, webbing, mats, etc. from jute, manila, hemp, sisal; life jackets, insulation, pillows, upholstery from kapok	---	---	---	---	---	---	---	---	---
Wool	119	---	212	---	---	---	355	130.0	461 Protein chains (keratin).
Apparel, blankets, carpets, felt, upholstery	---	---	---	---	---	---	---	---	---

Mohair (goat hair)	29	--	29	88.0	26
Upholstery fabrics, men's	:	:	:	:	:
summer suiting, draperies,	:	:	:	:	:
wigs, rugs, etc.	:	:	:	:	:

Totals-----	>9,000	912	2,250	7,641	--	2,083
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1/ U. S. Department of Agriculture. Agricultural statistics 1964. 623 pp. Washington, D. C. 1964.  
Commodity Research Bureau. Commodity year book 1965. 386 pp. New York, N. Y. 1965.

2/ Approximate.

3/ U. S. Department of Commerce. Current industrial reports. U. S. Bur. Census Ser. M26A(63)-12:  
Pulp, paper, and board: 1963, 15 pp. Washington, D. C. 1964.

Textile Economics Bureau, Inc. Textile organon, 51 pp. New York, N. Y. March 1965.

U. S. Tariff Commission. Synthetic organic chemicals. United States production and sales, 1963.  
U. S. Tariff Comm. Pub. 143, 244 pp. Washington, D. C. 1964.

4/ Exclusive of cotton.

Table 5.--Turpentine and rosin used by U. S. chemical and allied industries, 1963 and 1964<sup>1/</sup>

Raw materials and industrial uses	Annual production		Imports		Exports		Industrial nonfood and nonfeed		Major constituents <sup>3/</sup>
	Million pounds	51	Million pounds	--	Million pounds	33	Consumption	Price <sup>2/</sup> Value	
	Million pounds	51	Million pounds	--	Million pounds	33	Million pounds	Cents per lb. dollars	
Turpentine (gum)-----							30	7.2	2
Solvent or thinner for paints and varnishes, synthetic pine oil, chemicals, insecticides, lubricating oil additives, polishes, cleaners, disinfectants, rubber solvent, and reclaiming agent									Mixtures of rosin and cyclic monoterpene hydrocarbons C <sub>10</sub> H <sub>16</sub> : alpha pinene, beta pinene, and di-pentene.
Turpentine (wood)-----	193		--		26		175	7.2	13
Same uses as listed above									-----Do.-----
Rosin (gum)-----	239		--		34		82	12.0	10
Adhesives, paper sizing, synthetic resins and ester gums, surface coatings, printing inks, lubricating oil additives, chewing gum, linoleum, soaps, emulsifiers, core oils, rubber processing, miscellaneous chemicals									Unsaturated resin acids of the abietic and pimaric type: C <sub>19</sub> H <sub>29</sub> COOH.
Rosin (wood)-----	846		--		218		689	12.0	84
Same uses as listed above									-----Do.-----
Totals-----	1,329		--		311		976	--	109

<sup>1/</sup> U. S. Department of Agriculture. Agricultural statistics 1964. 623 pp. Washington, D. C. 1964.  
<sup>2/</sup> Commodity Research Bureau. Commodity year book 1965. 386 pp. New York, N. Y. 1965.  
<sup>3/</sup> Approximate.

Inc., New York, N. Y. 1955. The Interscience Encyclopedia, Ed. 1, v. 14, p. 381.



Table 6.--Miscellaneous agricultural raw materials used by U. S. chemical and allied industries, 1963 and 1964<sup>1/</sup>

Raw material and industrial use	Annual production	Imports	Exports	Industrial nonfood and nonfeed		Major constituents
				Consumption	Value	
	Million pounds	Million pounds	Million pounds	Million pounds	Cents per lb.	Million dollars
Animal hides and skins-----	--	--	--	1,360	10-150	425
Shoes, belting, harness-saddle, riding tack, upholstery, luggage, clothing, gloves, chamois, mechanical and athletic goods						
Casein-----	--	109	0.3	109	25.0	27
Plastics, paper coatings, glues, paints, adhesives, textile sizing						
Glue and gelatin-----	3/ 250	21	5	3/ 200	16-71	3/ 76
Photographic films, adhesives, plastics, laminates, coatings, pharmaceuticals						
Gums (natural)-----	--	--	--	3/ 110	25-550	3/ 72
Adhesives, pharmaceuticals, paint and varnish, textile sizing and printing, paper-making, cosmetics						
Glycerol-----	3/ 157	--	--	3/ 200	22.0	44
Alkyd resins, cellophane, explosives, plasticizers, printing inks, humectants, lubricants, drugs, cosmetics						

Continued

Table 6.--Miscellaneous agricultural raw materials used by U. S. chemical and allied industries, 1963 and 1964<sup>1/</sup>--Continued

Raw material and industrial use	Annual production	Imports	Exports	Industrial nonfood and nonfeed		Major constituents
				Consumption	Value	
	Million pounds	Million pounds	Million pounds	Million pounds	Cents per lb.	Million dollars
Rubber (natural)-----	--	--	--	1,082	25.0	270
Silvichemicals-----	--	--	--	--	--	3/ 260
Stabilizers, binders, solvents, gums, synthetic chemicals						(C <sub>5</sub> H <sub>8</sub> ) <sub>x</sub> (C <sub>10</sub> H <sub>13</sub> O <sub>3</sub> ) <sub>x</sub> (Contains benzene nuclei, methoxy groups, and 3-carbon side chains).
Other raw materials----- excluding tobacco and wood pulp	--	--	--	--	--	250
Totals <sup>3/</sup> -----	> 500	> 130	> 5	> 3,500	--	1,424

<sup>1/</sup> U. S. Department of Agriculture. Agricultural statistics 1964. 623 pp. Washington, D. C. 1964.  
Commodity Research Bureau. Commodity year book 1965. 386 pp. New York, N. Y. 1965.

<sup>2/</sup> Approximate.

<sup>3/</sup> Estimated.

## CONCLUSION

Figures 1 and 2 show the more important raw materials (excluding wood pulp for the paper industry, as well as tobacco) in order of decreasing industrial nonfood and nonfeed consumption in the U. S. More than 25 different items are consumed in excess of 100 million pounds each per year.

The total industrial consumption of all agricultural raw materials (including imports but also excluding tobacco and wood pulp) as shown in table 7, is estimated at more than 21 billion pounds for 1964. The estimated dollar value of the agricultural raw materials used by the chemical and allied industries exceeds \$4 billion per year. This figure probably is on the low side; whenever a price range is indicated (for instance, 6 to 12 cents per pound for starch in table 2), the lower figure was used in calculations.

Table 7.--Agricultural raw materials for industrial uses<sup>1/</sup>

Raw material	U. S. consumption for industrial nonfood and nonfeed uses	
	<u>Million pounds</u>	<u>Million dollars</u>
Fats and oils-----	4,313	355
Starches and flours-----	> 2,500	> 150
Sugar and molasses-----	2,007	45
Agricultural fibers-----	7,641	2,083
Turpentine and rosin-----	976	109
Miscellaneous raw materials (excluding tobacco and wood pulp)-----	>3,500	1,424
Totals-----	~21,000	>4,166

<sup>1/</sup> Estimates are based on statistics for 1964, or for 1963 if 1964 data were not available.

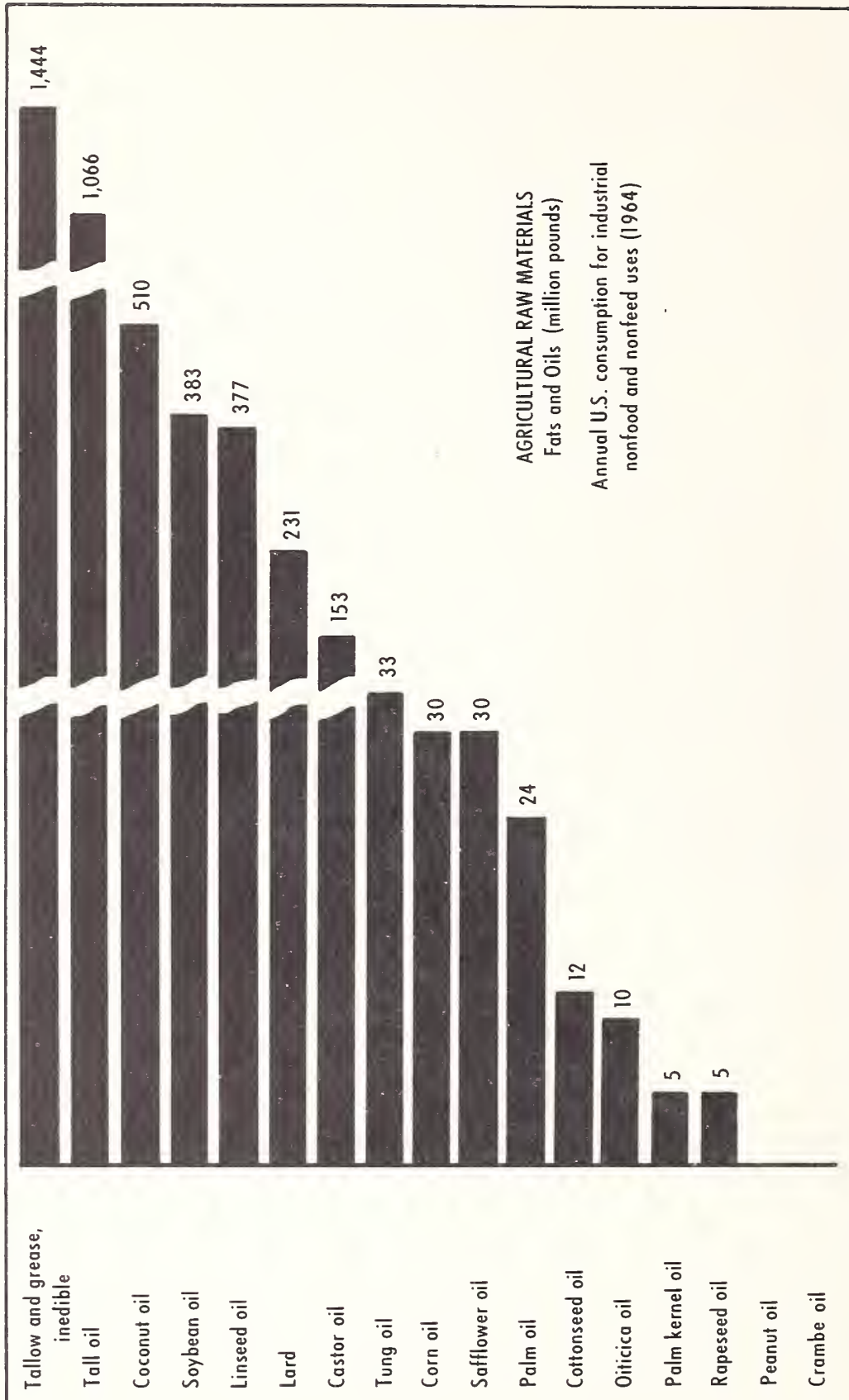


Figure 1.

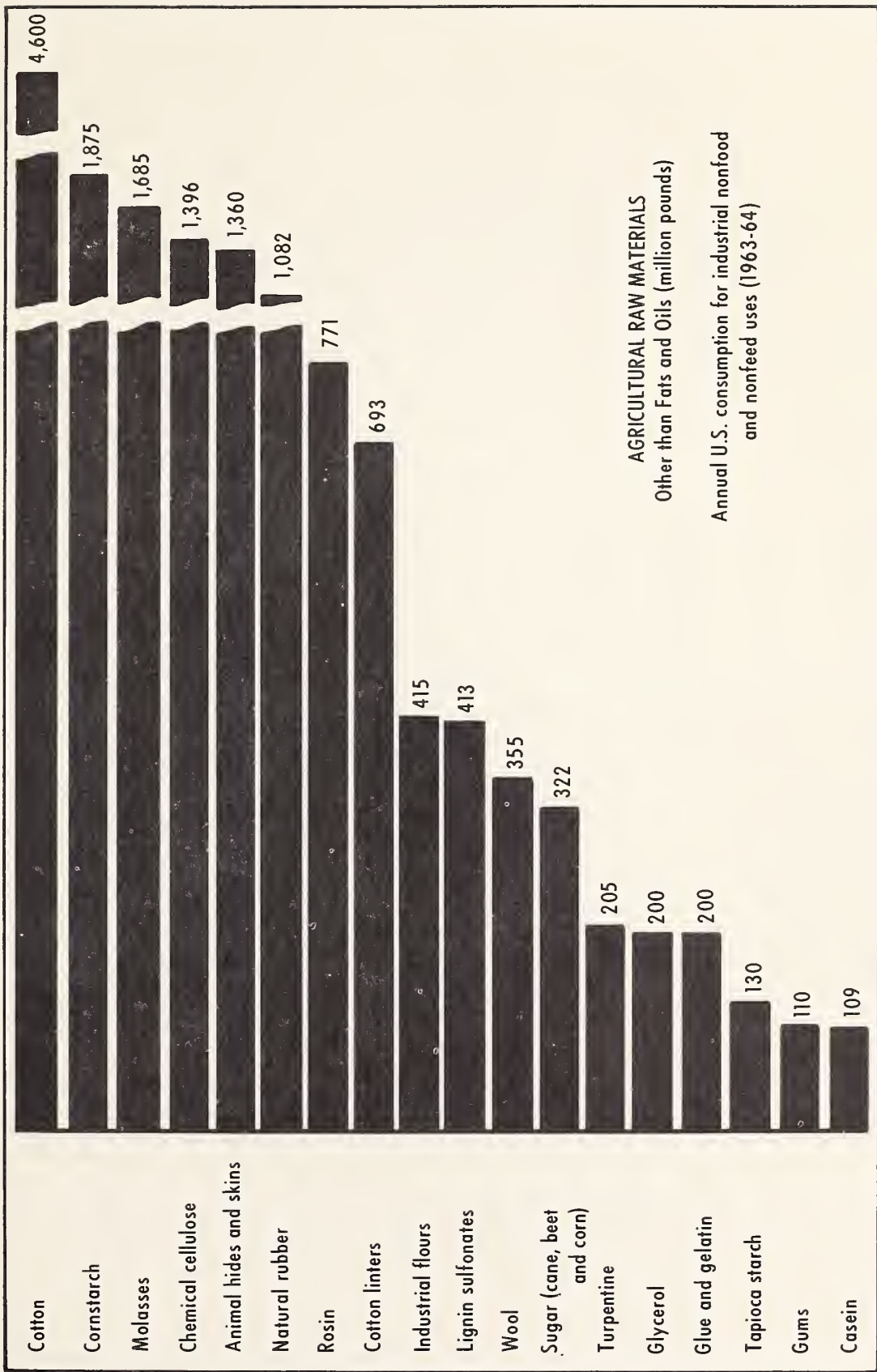
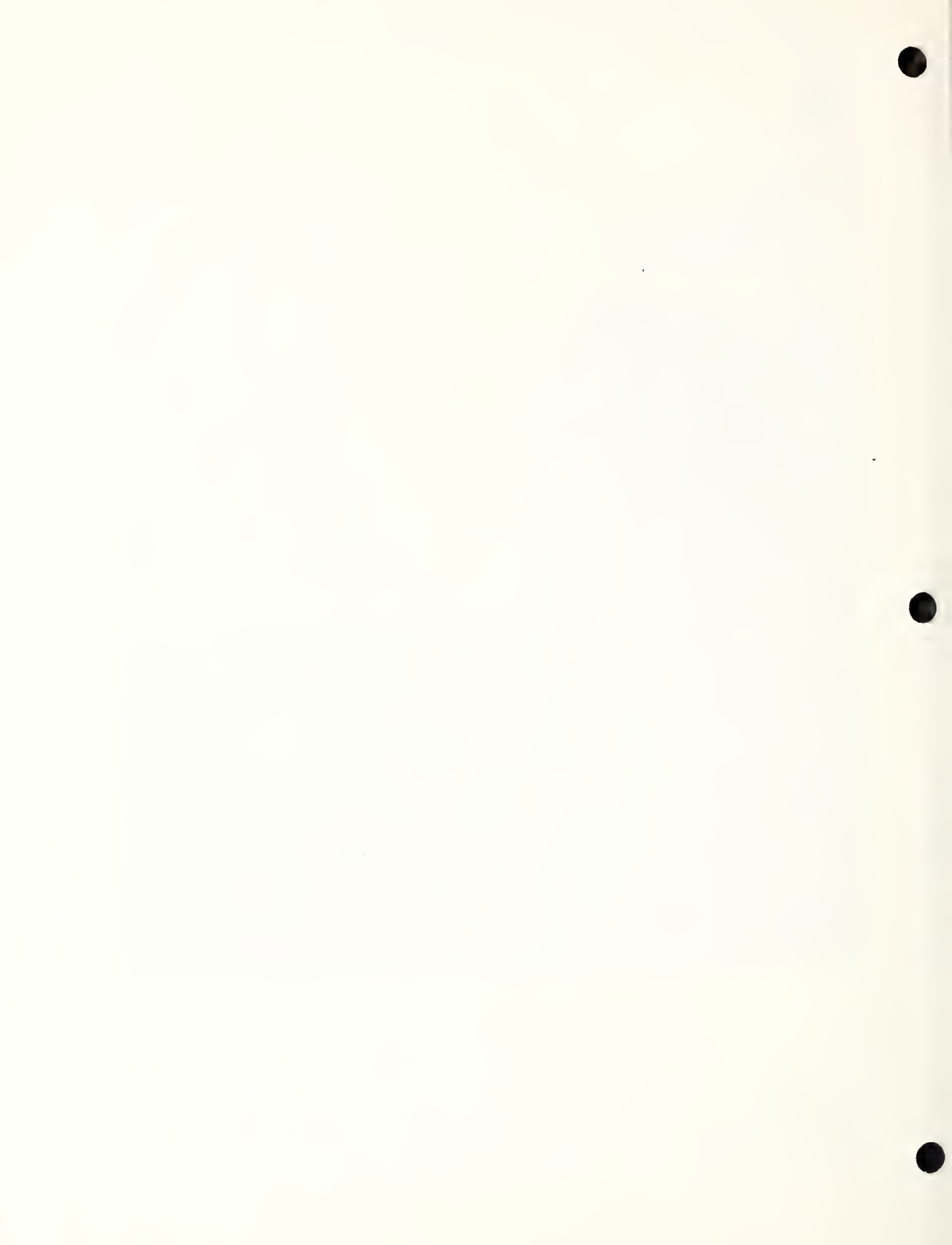
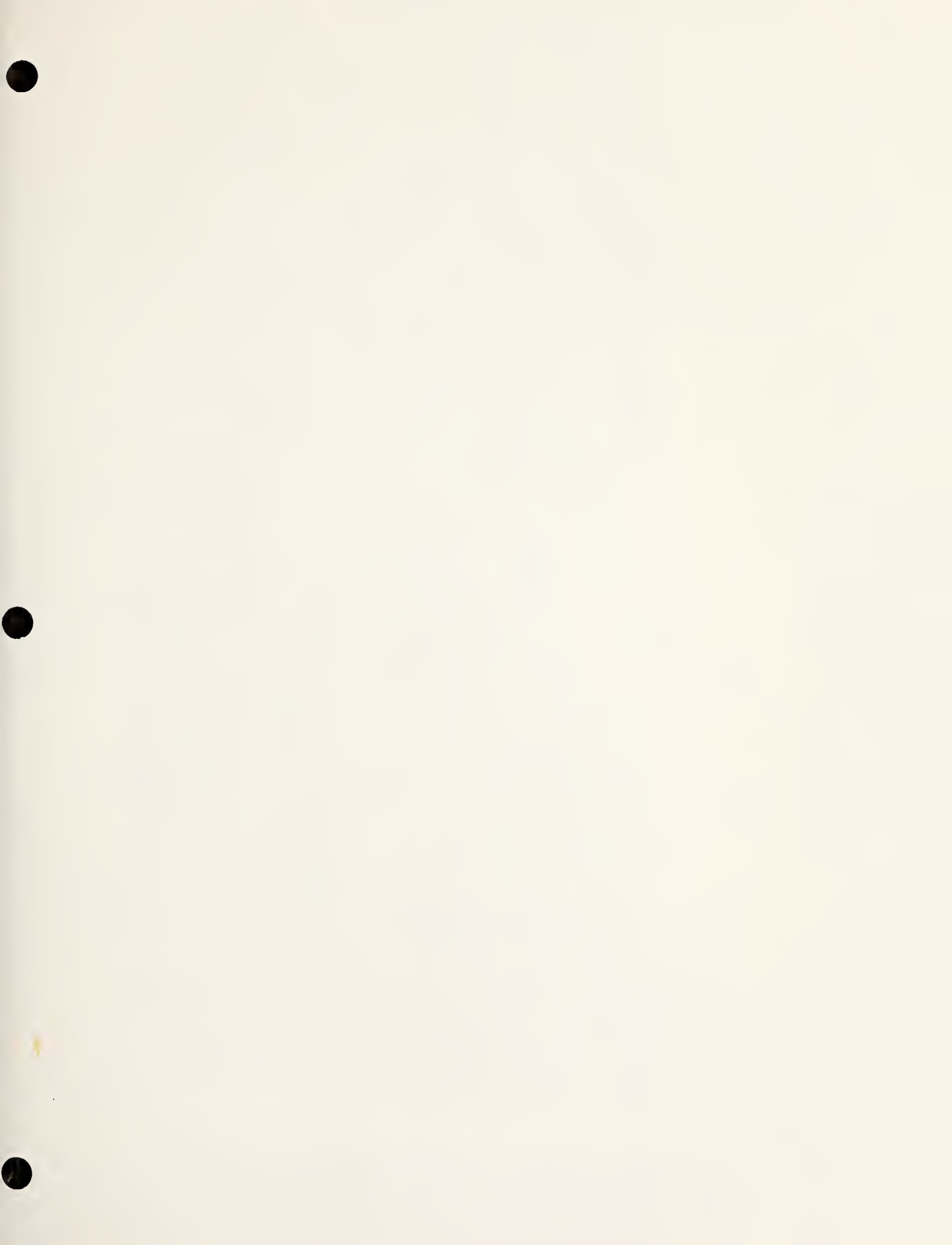


Figure 2





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