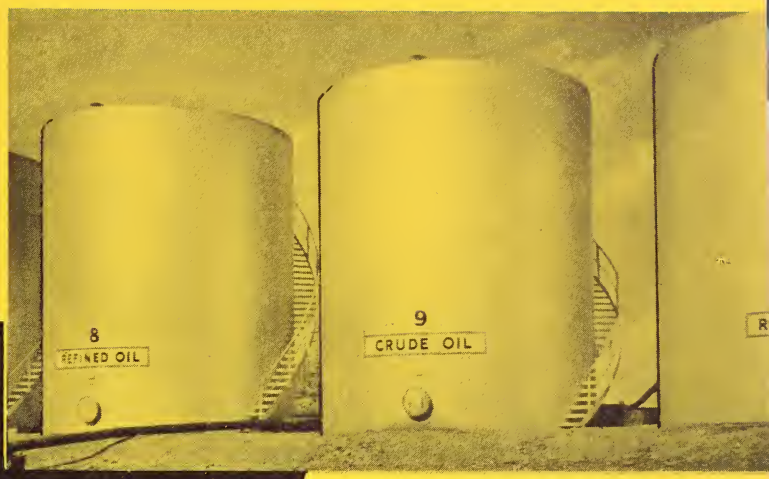
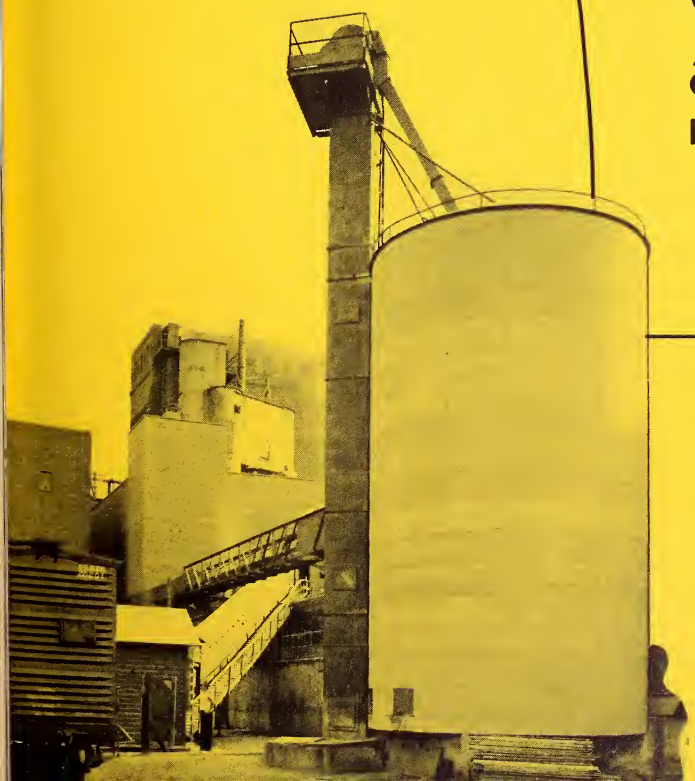
May 1956



Tank Storage of Fats and Oils

and

Mill Storage of Oilseeds and Their Products



Marketing Research Report No.122

U.S. DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Washington, D. C.

PREFACE

This report supplies information on the location, condition, and adequacy of storage facilities for fats and oils and for oilseeds in the United States.

The study on tank storage is based on data from 3,100 replies to questionnaires sent out by the Bureau of the Census in December 1951, at the request of the U. S. Department of Agriculture, to all known producers, industrial users, and warehousemen of fats and oils.

Information on mill storage space was obtained from 85 percent of the mills that produced oil from cottonseed, soybeans, flaxseed, and peanuts, during the 1951-52 marketing year. Such information was needed at the time of the Korean conflict to assist the Government and industry in the planning of farm marketings of oilseeds and in the processing, transportation, and storage of the products.

Acknowledgment is due the National Cottonseed Products Association and the National Soybean Processors Association for making available data pertaining to storage capacity at oil mills, and to the Farmer Cooperative Service and the Link-Belt Company for providing certain illustrations used in this bulletin.

Preliminary results of the surveys were published in the October 1951 and August 1952 issues of "Marketing Activities," a monthly publication of the USDA. Since the 1951-52 surveys, supplementary studies have been made of the storage situation.

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TANK STORAGE OF FATS AND OILS AND MILL STORAGE OF OILSEEDS AND THEIR PRODUCTS

By C. B. Gilliland and Donald Jackson, agricultural economists,
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SUMMARY

Enough storage space was available in the period studied to service the oilseed crops of cottonseed, soybeans, flaxseed, and peanuts and their products even in years of heavy production, with space to spare. This does not mean, of course, that every dealer, processor, or handler had all the storage capacity he wanted for his operations.

Visible monthly stocks of fats and oils averaged about a half the tank storage capacity normally considered available for these commodities. This seemingly low proportion of use is largely explained by two facts: (1) Storage capacity at each location must be sufficient to handle peak stocks while also keeping separate the different kinds and grades of fats and oils, and (2) storage space at producing, processing, or consuming plants (oil mills, refineries, etc.) is alternately filled and emptied, permitting an average stock of not more than 50 percent of total storage capacity.

In case of emergencies considerable flexibility exists between tank usage for fats and oils, molasses, petroleum, and miscellaneous chemicals. Shifting between fats and oils and molasses is not often done; shifting between fats and oils and chemicals or petroleum products is rarely done. In normal practice, however, a large volume of tank storage at times is shifted between edible and inedible fats and oils.

Tank storage capacity for fats and oils in 1951 was concentrated at 20 transportation terminals, with over 50 percent at 6 ports. Use of 60 percent of the capacity was restricted to inedible fats and oils. Seventy-two percent of the total had heating facilities. About 10 percent of the tank storage space reported was at cottonseed and soybean oil mills. A total tank capacity of 6.2 billion pounds was indicated, and our total supply of fats and oils (excluding butter) was about 12 billion pounds.

Mill storage capacities were generally well distributed among the different oilseeds, geographical areas, and individual mills. Cottonseed is mostly stored at the oil mills. The type of storage structure has changed, but in recent years has largely been standardized. Cottonseed mills had seed storage capacity equivalent to 102 days of crushing capacity.

A half of all soybean storage was distributed about equally between farms and mills. The other half was at country elevators, terminal elevators, and

with dealers at transportation centers. Soybean oil mills had an average bean storage capacity equivalent to 143 days of processing capacity, and in addition had the availability of commercial storage.

Flaxseed is stored at mills or in commercial grain-storage facilities, and thus does not normally present a separate problem of storage space.

Oil-stock peanuts originate over the season as they are graded or sorted from edible peanut stocks, mostly at shelling plants. For this reason oil-stock peanuts require relatively little storage.

Oilseed products typically are stored at mills somewhat longer than their marketing and physical movement absolutely require. In addition to size of inventories required for operating efficiency and convenience, further stocks commonly are held awaiting improved market conditions. Storage capacities at mills are, in general, greater than required by the physical operation of the mills. They probably are not greater than dictated by customary marketing practices in the oil-milling industries.

For cottonseed the amount of storage space must be sufficient to hold roughly the quantity to be crushed from December 1 to the end of the season. At mills with the longest season the requirement may sink to 75 percent of the crush from December 1 onward. With soybeans the minimum requirement may be no more than can be crushed in 10 days, because soybeans can be obtained throughout the season from commercial or farm storage, at market price. For oil-mill products, minimum mill-operating storage capacity seems to be between 5 and 10 days' processing volume for most mills.

For cottonseed meal storage, the requirement for mill working stocks seems not to have been higher than 40 percent of the average inventories held during the seasons 1949-50, 1950-51, and 1952-53. Working stock of cottonseed hulls appears to have required not over a half of the actual average stocks held in 1950-51 and 1952-53, or more than a third of those held in 1949-50. Corresponding requirements for soybean-meal working stocks seem to have been less than half of the stocks held in 1951-52 and 1952-53.

BACKGROUND

Fats and oils originate in diverse ways and places, both at home and abroad. Nevertheless, in their two major categories--animal and vegetable--they pass through fairly well standardized processes of recovery and refinement. As they are further processed, their significant division changes from animal and vegetable to edible and inedible, or to food and industrial. Like most economic commodities they require protection from contamination, even from mixing. Yet their similarities permit their extraction, storage, transportation, and marketing by a relatively few standardized methods.

These similarities permit a unified summary and analysis of returns from the survey of tank storage of fats and oils and the survey of mill storage of oilseeds and their products.

The characteristics of cottonseed and the climate of the Cotton Belt prescribe exacting conditions of cottonseed storage and practically preclude storage elsewhere than at the mills; the nature of crude cottonseed oil and the climate of the Belt also practically preclude the storage of crude cottonseed oil as such. Efficient location of tanks for storage of cottonseed oil thus becomes an intricate problem.

A major part of our seasonal and longer term stocks of fats and oils (other than butter) is stored in tanks. The location and character of that storage are of great importance to processors, dealers, and, indirectly, to consumers. In a national emergency it can be of strategic importance to our country.

The first 6 individual sources (by common classification) of our fats and oils supply, in order of size, are: Soybean oil, tallow and grease, lard, cottonseed oil, butter, and linseed oil--although the order does not remain precisely fixed. Three of the 6 are vegetable oils that pass through remarkably similar recovery and handling processes. In some cases the 3 major oilseeds are crushed in the same plant and with the same equipment.

Protein meal from soybeans, cottonseed, and flaxseed finds its principal use in livestock feed, although there is considerable geographical differentiation and definite preferences among the 3 in certain uses.

Principal use of the oil of both soybeans and cottonseed is for food--largely shortening and margarine. Thus equipment, methods, and standards in the production, refining, storage, and handling of the 2 oils are closely similar. Moreover, much of the time they move to the same points for further processing and final distribution to areas of ultimate consumption. Linseed oil is used primarily as a drying oil.

Soybeans and flaxseed both are produced in predominantly grain growing areas, and from the farm to the processing plant both are handled in essentially the same way as grain. This means that commercial storage is possible for these products at the various steps in their marketing channels. Cottonseed, however, becomes a separate commodity not at the farm but at the cotton gin. Farm storage consequently is impracticable. Moreover, because of the climate of the Cotton Belt and the usual condition of seed at harvest time, it is impractical also to hold cottonseed in storage at the gin or at any intermediate point between gin and oil mill. The same conditions also mean unique seed-storage conditions at cottonseed oil mills (a situation approached by the storage conditions for spring harvested flaxseed in the humid Southwest).

All the oilseeds require careful handling at the mill. Customarily, oilseed that is exceptionally moist or otherwise subject to unusual depreciation is processed shortly after receipt. Some seed is put through dryers, or ventilated by forced draft in the storage structures.

Domestic oilseeds worth more than 1.3 billion dollars are crushed for oil and meal each year in nearly 600 mills throughout the country. Domestic

animal fats, including butter, are valued at an equal amount. More than 60 percent of the fats and oils we use are consumed as food. Cottonseed and soybean oils are used mainly in shortening and margarine and as salad and cooking oils. Together the two oils account for more than three-fourths of the vegetable oils used for food.

Cottonseed is produced from coast to coast across the southern part of the United States. Soybeans are produced preponderantly in the Corn Belt. In recent years both soybeans and soybean oil have been exported in substantial quantities through Atlantic and Gulf ports.

Either cottonseed oil or soybean oil may be used alone in shortening or margarine, or the two may be mixed. The proportions in which the two are used have been changing since the war, with the continuing increase in the soybean oil supply. This involves a gradual shifting in the geographical area of vegetable food oil production, storage, and use.

This mobile nature of the supply of fats-and-oils materials makes the calculation of storage space requirements and their location a problem in practical probability. Each warehouseman, miller, or further processor must allow tremendous latitude for chance when he plans his storage needs.

With this uncertainty is coupled the chance, no less important, of unexpected price variations. An efficient milling operation may lose money because of unexpected price movements for raw material or for products. As a result, the miller feels the necessity of flexibility in his merchandizing schedule. He wants freedom to buy or sell at the most favorable time. That in turn demands storage space beyond operating requirements, both for seed and for mill products. (Cottonseed offers little flexibility in mill purchase schedule because the physical movement is mostly fixed by cotton harvesting and ginning schedules.)

Oil refiners and other "further processors," likewise insist on storage space adequate to permit a flexible marketing schedule for their products.

For soybeans commercial storage is practically always available. Furthermore, farm storage of soybeans is common. Soybeans normally can be attracted to market by a sufficiently favorable price. The farmer typically delivers his beans to the country elevator when he sells them.

The processor has three common choices: He may buy and take delivery of beans as he needs them for processing; he may buy ahead but take delivery from commercial storage (country elevator operator or dealer) as needed; or buy ahead and store the beans at the mill. Again flexibility requires ample storage space at each step in the channel. A great economy in soybean marketing results from the interchangeability of commercial storage facilities for soybeans and small grains.

Fats and oils, as well as oilseeds, require ample storage if each operator is to attain flexibility in his marketing; furthermore, seasonal production coupled with preponderantly nonseasonal consumption demands tremendous seasonal storage facilities to spread the supplies over the crop year.

The survey data considered in the present report have been analyzed to provide answers to two questions on the marketing of oilseed crops and fats and oils; namely: How much storage space do handlers and processors provide? How much storage do they need for efficient operation? Determining the amount provided is relatively simple. The question of the amount needed is more complicated. A processor of oilseeds or other fats and oils commodities needs, as a minimum, enough storage capacity for both raw material and products so that a delay in transportation is not likely to shut down his plant. The space required varies with the plant situation, and few members of the industry agree precisely on the amount in any given situation.

The relatively stable prices of cottonseed oil and soybean oil, due to competition with other fats and oils, greatly reduce the opportunity to gain significant market advantage by holding these two oils, and consequently reduce the usefulness of storage capacity for "trading stocks."

Throughout this report the term "storage capacity" is used to mean space available to store a given commodity at one time. It is discussed in terms of the quantity of the given commodity that can be accommodated.

Tank storage has considerable flexibility; in case of emergencies it can be used for fats and oils, molasses, petroleum, and miscellaneous chemicals. Shifting between fats and oils and molasses is not often done; shifting between fats and oils and chemicals or petroleum products is rare. In normal practice, however, a large volume of tank storage at times is shifted between edible and inedible vegetable fats and oils. Thus it is not possible to state precisely how much storage capacity for fats and oils does exist. It is clear that capacity at each location must be sufficient to handle peak stocks while also keeping separate the different kinds and grades of fats and oils, and because storage space for working stocks at oil mills, refineries, etc., is alternately filled and emptied, permitting an average stock of not more than 50 percent of total storage capacity.

TANK STORAGE OF FATS AND OILS

The survey of tank storage capacity for fats and oils covered all geographic locations and all major storage steps in the marketing channel. Tanks at the vegetable oil mills were included in the nationwide survey of tank storage.

Storage capacities were classified (table 1) by transportation, or marketing, terminals inasmuch as about 78 percent of the total fats and oils tank capacity was congregated in 20 terminal areas, with slightly over 50 percent in the environs of 5 ocean ports and 1 lake port (table 2).

The preponderance of the 6 ports in the total storage capacity for fats and oils indicates that these commodities are not stored long in the production areas but move rather quickly to distribution or export points. Only about 10 percent of the tank capacity was reported from oilseed-processing plants, principally cottonseed oil and soybean oil mills. Its distribution at

Table 1.—Fats and oils: Firms reporting and tank storage capacity, by States, December 1951

State and division	Reporting						Storage capacity								Capacity that can be heated			
	Total		No storage		Storage		Total		Inedible		Edible		Total		Inedible		Edible	
	Firms	Percentage	Firms	Percentage	Firms	Percentage	Quantity	Percentage	Quantity	Percentage	Quantity	Percentage	Quantity	Percentage	Quantity	Percentage	Quantity	Percentage
	Number	Percent	Number	Percent	Number	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent
Maine	11	0.36	6	0.53	5	0.25	2,422	0.04	2,052	0.06	370	0.02	1,828	0.05	1,458	0.06	370	0.02
New Hampshire	6	.19	3	.27	3	.15	6,837	.13	6,837	.21	0	0	262	.01	262	.01	0	0
Massachusetts	127	4.09	70	6.19	57	2.88	81,749	1.51	78,518	2.43	3,231	.15	71,656	1.84	71,286	3.11	370	.02
Rhode Island	23	.74	10	.88	13	.66	2,257	.04	2,141	.07	116	.01	1,053	.03	953	.04	100	.01
Connecticut	24	.77	13	1.15	11	.56	2,924	.05	2,331	.07	593	.03	2,610	.07	2,210	.10	400	.03
New York	263	8.46	140	12.38	123	6.23	333,086	6.15	217,301	6.72	115,785	5.31	267,138	6.86	173,636	7.57	93,502	5.85
New Jersey	174	5.60	48	4.24	126	6.38	718,017	13.27	458,084	14.16	259,933	11.93	578,976	14.88	333,932	14.56	245,044	15.33
Pennsylvania	233	7.50	99	8.75	134	6.78	193,197	3.57	163,493	5.05	29,704	1.36	148,106	3.80	128,957	5.63	19,149	1.20
North Atlantic	861	27.71	389	34.39	472	23.89	1,340,489	24.76	930,757	28.77	407,732	18.81	1,071,629	27.54	712,694	31.08	358,935	22.46
Ohio	225	7.24	96	8.49	129	6.53	265,291	4.90	158,721	4.91	106,570	4.89	233,802	6.01	137,084	5.98	96,718	6.05
Indiana	100	3.22	37	3.27	63	3.19	144,277	2.67	87,769	2.71	56,508	2.59	128,552	3.30	78,435	3.42	50,117	3.14
Illinois	249	8.01	95	8.40	154	7.79	413,564	7.64	221,738	6.85	191,826	8.81	321,311	8.26	170,156	7.42	151,155	9.46
Michigan	91	2.93	39	3.45	52	2.63	35,195	.65	33,536	1.04	1,659	.08	25,797	.66	24,931	1.09	866	.05
Wisconsin	57	1.84	22	1.94	35	1.77	34,792	.64	24,042	.74	10,750	.49	26,403	.68	17,866	.78	8,537	.54
East North Central	722	23.24	289	25.55	433	21.91	893,119	16.50	525,806	16.25	367,313	16.86	735,865	18.91	428,472	18.69	307,393	19.24
Minnesota	80	2.58	28	2.48	52	2.63	160,353	2.96	150,908	4.66	9,445	.43	70,872	1.82	64,628	2.82	6,244	.39
Iowa	101	3.25	17	1.50	84	4.26	64,501	1.19	38,062	1.18	26,439	1.21	47,827	1.23	32,210	1.41	15,617	.98
Missouri	84	2.70	32	2.83	52	2.63	46,441	.86	43,054	1.33	3,387	.16	35,940	.92	33,843	1.48	2,097	.13
North Dakota	6	.19	0	0	6	.30	4,970	.09	485	.02	4,485	.21	550	.01	470	.02	80	.01
South Dakota	6	.19	0	0	6	.30	8,600	.16	1,234	.04	7,366	.34	7,706	.20	460	.02	7,246	.45
Nebraska	36	1.16	10	.88	26	1.32	19,055	.35	9,083	.28	9,972	.46	17,468	.45	8,773	.38	8,695	.54
Kansas	44	1.42	16	1.42	28	1.42	87,513	1.62	69,888	2.16	17,625	.81	77,179	1.99	69,395	3.02	7,784	.49
West North Central	357	11.49	103	9.11	254	12.86	391,433	7.23	312,714	9.67	78,719	3.62	257,542	6.62	209,779	9.15	47,763	2.99
Delaware	17	.55	8	.71	9	.46	2,711	.05	1,740	.05	971	.05	1,233	.03	262	.01	971	.06
Maryland	43	1.38	22	1.94	21	1.06	67,900	1.25	65,964	2.04	1,936	.09	66,300	1.71	65,207	2.84	1,093	.07
Virginia	40	1.29	13	1.15	27	1.37	64,325	1.19	5,554	.17	58,771	2.70	60,820	1.56	3,585	.16	57,235	3.58
District of Columbia	2	.07	2	.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Virginia	17	.55	10	.88	7	.35	17,463	.32	17,463	.54	0	0	6,905	.18	6,905	.30	0	0
North Carolina	56	1.80	14	1.24	42	2.13	43,185	.80	5,618	.18	37,567	1.72	24,539	.63	2,606	.11	21,933	1.37
South Carolina	35	1.12	9	.80	26	1.31	27,704	.51	4,905	.15	22,799	1.05	20,146	.52	2,406	.11	17,740	1.11
Georgia	87	2.80	25	2.21	62	3.14	175,913	3.25	28,420	.88	147,493	6.77	149,966	3.85	20,343	.89	129,623	8.11
Florida	24	.77	12	1.06	12	.61	28,475	.53	7,509	.23	20,966	.96	12,350	.32	1,429	.06	10,921	.69
South Atlantic	321	10.33	115	10.17	206	10.43	427,676	7.90	137,173	4.24	290,503	13.34	342,259	8.80	102,743	4.48	239,516	14.99
Kentucky	27	.87	9	.80	18	.91	43,167	.80	6,723	.21	36,444	1.67	38,797	1.00	4,046	.18	34,751	2.17
Tennessee	58	1.87	19	1.68	39	1.97	207,618	3.84	8,026	.25	199,592	9.17	106,830	2.75	4,733	.21	102,097	6.39
Alabama	39	1.26	11	.97	28	1.42	28,471	.53	15,763	.49	12,708	.58	1,975	.05	1,555	.07	420	.03
Mississippi	41	1.32	2	.18	39	1.97	57,033	1.05	15,192	.47	41,841	1.92	7,680	.20	3,403	.15	4,277	.27
Arkansas	24	.77	4	.35	20	1.01	18,440	.34	14	1/	18,426	.85	2,924	.08	14	1/	2,910	.18
Louisiana	42	1.35	8	.71	34	1.72	326,605	6.03	245,146	7.58	81,459	3.74	278,508	7.16	207,765	9.06	70,743	4.43
Oklahoma	41	1.32	13	1.15	28	1.42	32,372	.60	6,606	.20	25,766	1.18	17,360	.44	3,558	.16	13,802	.86
Texas	185	5.95	41	3.62	144	7.29	886,295	16.37	607,748	18.78	278,547	12.79	405,521	10.42	246,188	10.73	159,333	9.97
South Central	457	14.71	107	9.46	350	17.71	1,600,001	29.56	905,218	27.98	694,783	31.90	859,595	22.10	471,262	20.56	388,333	24.30
Montana	9	.29	3	.27	6	.30	2,101	.04	2,101	.07	0	0	800	.02	800	.03	0	0
Idaho	5	.16	1	.09	4	.20	850	.02	670	.02	180	.01	850	.02	670	.03	180	.01
Colorado	30	.97	10	.88	20	1.01	14,340	.27	12,200	.38	2,140	.10	12,999	.34	10,859	.47	2,140	.13
New Mexico	5	.16	1	.09	4	.20	1,270	.02	214	.01	1,056	.05	550	.01	214	.01	336	.02
Arizona	12	.39	3	.27	9	.46	6,115	.11	1,268	.04	4,847	.22	1,349	.03	818	.04	531	.03
Utah	10	.32	5	.44	5	.25	1,938	.04	1,933	.06	5	1/	1,710	.04	1,705	.07	5	1/
Washington	49	1.57	17	1.50	32	1.62	84,691	1.56	83,920	2.59	771	.04	82,717	2.13	82,480	3.60	237	.02
Oregon	29	.93	10	.88	19	.96	7,790	.14	6,786	.21	1,004	.05	5,982	.16	5,852	.26	130	.01
California	223	7.17	70	6.19	153	7.75	636,606	11.76	311,021	9.61	325,585	14.94	512,976	13.19	260,922	11.38	252,054	15.78
Western	372	11.96	120	10.61	252	12.75	755,701	13.96	420,113	12.99	335,588	15.41	619,933	15.94	364,320	15.89	255,613	16.00
All other States	6	.21	2	.18	4	.20	1,104	.03	1,074	.03	30	1/	1,100	.03	1,070	.05	30	1/
Unknown	11	.35	6	.53	5	.25	3,482	.06	2,180	.07	1,302	.06	2,430	.06	2,180	.10	250	.02
United States	3,107	100.00	1,131	100.00	1,976	100.00	5,413,005	100.00	3,235,035	100.00	2,177,970	100.00	3,890,353	100.00	2,292,520	100.00	1,597,833	100.00

1/ Less than 0.005 percent.

Table 2.--Fats and oils: Percentage distribution of firms reporting and tank storage capacity, by major terminal points in the United States, December 1951

Terminal 1/	Firms reporting storage	Storage capacity			Capacity that can be heated		
		Total	Inedible	Edible	Total	Inedible	Edible
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
New York	9.3	17.7	18.6	16.4	20.3	20.4	20.1
Houston	1.2	11.0	16.4	3.1	6.1	8.6	2.5
Chicago	4.9	7.9	7.1	9.0	9.3	7.9	11.3
New Orleans	.5	5.6	7.2	3.2	7.0	8.9	4.4
Los Angeles	3.2	5.4	4.5	6.7	6.5	5.1	8.4
Oakland-San Francisco	2.6	5.2	4.9	5.7	6.5	6.0	7.2
Cincinnati	1.0	3.1	2.6	3.9	4.3	3.6	5.3
Memphis	.9	3.0	.2	7.3	1.8	.2	4.1
Minneapolis-St. Paul	1.5	2.8	4.4	.3	1.6	2.5	.4
Philadelphia	4.0	2.7	3.7	1.2	3.1	4.6	1.0
Dallas-Fort Worth	1.2	2.7	1.1	5.1	3.1	1.5	5.4
Seattle-Tacoma	.9	1.5	2.5	0	2.1	3.5	--
Kansas City	1.1	1.5	2.2	.4	1.9	3.0	.4
Boston	1.9	1.4	2.3	.1	1.8	3.0	0
Louisville	.9	1.4	1.2	1.7	1.9	1.7	2.2
Baltimore	1.0	1.2	2.0	.1	1.7	2.8	.1
Macon	.3	1.1	0	2.8	1.5	0	3.7
Portsmouth-Norfolk	.5	1.1	0	2.7	1.5	0	3.6
Sherman	.4	1.0	0	2.4	.6	0	1.4
Decatur	.7	.9	.4	1.5	.7	.6	.8
Total for 20 terminal points	38.0	78.2	81.3	73.6	83.3	83.9	82.3
United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Savannah, Ga., properly lies within the lower half of the terminals but data for Savannah cannot be shown without disclosing operations of individual firms.

those mills is shown on tables 3 and 16. The plants processing these 2 seeds account for the great bulk of all tank storage at oilseed-processing plants. Although tank storage facilities and requirements for other fats and oils cannot be stated with so great a degree of certainty, they are believed to be similar to those for cottonseed and soybeans (tables 3 and 15).

Total tank storage space (usually used for fats and oils) shown by this survey represented a capacity of 5.4 billion pounds. About 60 percent of this capacity was normally used for storage of inedible fats and oils only, and 72 percent was fitted with heating equipment. Neither of these classifications appeared to fluctuate widely about its average over large geographical areas or between the 2 first-ranking oilseeds, cottonseed and soybeans.

Technical requirements and managerial choices govern the extent to which tank storage capacities are divided between production points and industrial consumption centers. There is a widely held opinion in the trade and industry that vegetable oils should be moved from oilseed-processing plants to the refinery or place of consumption as quickly as possible. Insofar as this view is accepted, any tank capacity at the oil mill beyond the minimum amount of storage needed to receive and hold oil until it is shipped in tank-car lots may be considered in the nature of a reserve, or an emergency capacity. One exception is the occasional need for additional tank storage at mills to hold crude oil tendered to CCC, pending receipt of orders for shipment to a refinery. This is related specifically to cottonseed and soybean oil mills in later sections of this report.

Adjustment of the total of 5.4 billion pounds of fats and oils tank storage capacity reported by members of the industry to account for the nonrespondents gives an estimate of 6.2 billion pounds as a United States total. Appreciable additional capacity has been added since the 1951-52 season, but even the total estimated at that time appears adequate to handle current volumes of fats and oils, with reserve capacity for irregularities of movement, year-to-year fluctuation in supplies, and foreseeable shifts in geographical area of production or use. The supply of fats and oils (excluding butter) in the year beginning October 1, 1949, was 11,800 million pounds; in the year beginning October 1, 1953, it was 13,000 million pounds.

STORAGE OF COTTONSEED AND COTTONSEED PRODUCTS AT OIL MILLS

Cottonseed

The questionnaires used for the study of storage at mills asked for information on type, age, capacity, condition, and ventilation of seed-storage structures and the type and capacity of seed-unloading equipment. The returns show that over a period of years there has been a change in type of storage structure for cottonseed, and also a differentiation by structure for kind of seed stored. Cottonseed mills have always stored most of their cottonseed in "houses," but during the last 30 years or so these houses have become more and more standardized as to type and material.

Table 3.--Cottonseed oil: Production and mill stocks, United States, by months, August 1949-July 1953

Year and month	Production	Stocks at end of month						
		Total	Refined	Crude		As percentage of--		
				Total	At mills	Production	Total stocks	Total crude stocks
	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	Percent	Percent	Percent
1949-50								
Aug.	64,805	113,498	72,590	40,908	13,150	20	12	32
Sept.	184,228	158,474	69,708	88,766	41,649	23	26	47
Oct.	241,956	248,944	125,482	123,462	62,754	26	25	51
Nov.	251,307	341,405	177,944	163,461	71,472	28	21	44
Dec.	216,043	408,419	226,063	182,356	68,026	31	17	37
Jan.	210,139	427,960	255,630	172,330	73,484	35	17	43
Feb.	172,433	443,272	286,394	156,878	56,256	33	13	36
Mar.	163,636	385,291	285,418	99,873	42,469	26	11	43
Apr.	122,137	368,511	285,761	82,750	37,277	31	10	45
May	92,034	317,187	251,672	65,515	28,712	31	9	44
June	69,364	292,255	241,422	50,833	27,536	40	9	54
July	59,122	215,374	167,526	47,848	22,222	38	10	46
Year	1,847,204							
1950-51								
Aug.	74,003	141,015	97,930	43,085	16,571	22	12	38
Sept.	122,996	137,314	73,827	63,487	33,206	27	24	52
Oct.	196,545	197,219	107,446	89,773	49,469	25	25	55
Nov.	183,747	253,738	155,220	98,518	44,604	24	18	45
Dec.	139,834	271,928	171,639	100,289	41,152	29	15	41
Jan.	145,601	286,087	180,967	105,120	45,810	31	16	44
Feb.	105,117	292,880	204,800	88,080	33,884	32	12	38
Mar.	77,628	287,135	226,525	60,610	20,896	27	7	34
Apr.	57,719	280,180	231,652	48,528	12,295	21	4	25
May	38,305	257,015	226,997	30,018	6,375	17	2	21
June	34,127	216,449	194,120	22,329	6,541	19	3	29
July	24,271	167,145	147,024	20,121	7,980	33	5	40
Year	1,199,893							
1951-52								
Aug.	60,200	127,236	98,103	29,133	17,118	28	13	59
Sept.	167,168	192,901	102,715	90,186	54,303	32	28	60
Oct.	259,819	307,540	154,868	152,672	74,864	29	24	49
Nov.	244,053	409,980	225,137	184,843	90,749	37	22	49
Dec.	206,005	479,173	292,881	186,292	97,586	47	20	52
Jan.	221,090	536,133	345,219	190,914	112,017	51	21	59
Feb.	176,041	566,765	391,952	174,813	98,948	56	17	57
Mar.	143,727	586,737	424,408	162,329	85,916	60	15	53
Apr.	106,633	573,643	444,370	129,273	65,173	61	11	50
May	72,082	529,539	432,622	96,917	48,177	67	9	50
June	52,967	460,003	401,401	58,602	24,549	46	5	42
July	41,358	402,399	361,322	41,077	18,435	45	5	45
Year	1,751,143							

Continued -

Table 3.--Cottonseed oil: Production and mill stocks, United States, by months, August 1949-July 1953 - continued

Year and month	Production	Stocks at end of month					
		Total	Refined	Crude		As percentage of--	
				Total	At mills	Production	Total stocks	Total crude stocks
	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	Percent	Percent	Percent
1952-53								
Aug.	44,775	356,389	318,007	38,382	22,634	51	6	59
Sept.	157,222	392,594	288,214	104,380	72,550	46	18	70
Oct.	251,863	506,512	343,167	163,345	106,278	42	21	65
Nov.	233,965	634,394	445,409	188,985	98,470	42	16	52
Dec.	215,713	745,474	560,826	184,648	79,956	37	11	43
Jan.	211,728	825,103	643,173	181,930	82,737	39	10	45
Feb.	182,276	894,869	723,763	171,106	90,906	50	10	53
Mar.	167,121	962,088	811,815	150,273	63,803	38	7	42
Apr.	133,124	996,880	881,275	115,605	44,188	33	4	38
May	95,387	1,001,124	916,453	84,671	34,382	36	3	41
June	74,529	991,691	935,273	56,418	32,011	43	3	57
July	55,418	971,012	928,561	42,451	23,166	42	2	55
Year	1,823,121							

Replies from the survey indicate that in 1951 few cottonseed houses were being built of other than the "Muskogee" type (fig. 1). Important characteristics of the Muskogee house are a hip-roof sloped at the assumed angle-of-rest for cottonseed, a loading conveyor in the peak, and a tunnel and unloading conveyor along the center of the floor. Today most Muskogee houses are being built of metal, although a few are of wood or of wood and metal.

In the dry Southwest, some "ricks" (outdoor piles) are used--with or without good platforms, and sometimes even with forced ventilation. Use of the rick in the Southwest, and its restriction to that area, is readily understood in terms of climate. Only where rainfall is normally light during the early part of the crushing season, and interspersed with bright weather, can such storage in the open be relied upon. If the ricked seed is crushed before drawing on that stored in houses, however, ricks can serve as satisfactory auxiliary storage capacity.

Cottonseed houses reported as over 40 years old were of miscellaneous types and sizes, built of brick, wood, or wood and metal. A few houses of brick, tile, or concrete have been built in recent years, but their number is very small. During a period of about 25 years before World War II some silos, or tanks, were built for cottonseed storage, but none were reported less than 10 years old and relatively few less than 20 years old. Most of those for which dimensions were stated were of very moderate height for storage silos.

Figure 1.--Muskogee-type cottonseed storage house.

Because the structures are described partially by type and partially by materials of construction, it is impossible to give precise percentages by types. Nevertheless, it is clear that a fourth to a third as many silos as Muskogee-type houses were reported. The chief types of cottonseed storage structures reported were of approximate average ages as follows:

Type	Average age (years)
Frame house	35
Brick house	29
Tank	27
Steel, iron, and "tin" house	20
Concrete house	19
Muskogee house	10
Average for all structures	24

Contrary to a common assumption, the more recently built cottonseed houses did not seem to average appreciably larger than older houses. To a considerable extent, as larger tonnages of seed per mill are processed,

multiple houses, rather than larger houses, furnish the necessary storage. This statistical result is somewhat misleading, however, as to an important tendency apparent in the reports. When all types of structures reported were analyzed by capacity, the largest number were found in the 4,000- to 5,000-ton group, the average for all structures being 5,500 tons. For the Muskogee houses, however, the largest number were in the group of 10,000 tons and over, and the average for all was 10,300 tons. Compared with this, a majority of the tanks were in the 4,000- to 5,000-ton group, and all tanks averaged 4,200 tons. Thus, over the several decades covered by the information, the average size of storage structures has increased as their type changed. Development of mechanical equipment such as conveyors has assisted this size increase. Within any one type, however, there appears to have been an optimum size about which most structures clustered fairly closely.

The questionnaires regarding mill storage asked whether specific seed storage structures were (1) in good condition, (2) in need of structural repair, or (3) used in emergency only. Except for those in one small area the facilities as a whole were reported to be in good condition. More than 94 percent of all cottonseed storage structures were reported to be in good condition (96 percent for those that are used to store cottonseed only), and only a negligible number were reported as used in emergencies only.

Cottonseed puts less strain on a storage structure than soybeans or flaxseed. This is due to the fact that cottonseed represents about twice as great a volume per ton as do soybeans, and nearly twice as great as flaxseed. Thus, a given storage space will hold only about a half as many tons of cottonseed as of either soybeans or flaxseed. The requirement of greater structural strength for soybean storage has been a matter of concern to some individual oilseed processors in the Cotton Belt who have supplemented their cottonseed supply with soybeans. It may well become of wider concern as the current trend of increasing soybean production in the South continues. A somewhat smaller percentage of the storage structures at oil mills in the Cotton Belt may be found satisfactory for unrestricted storage of all oilseeds crushed.

The newer houses and the best average condition were disclosed by the survey to be in the newer cotton growing areas. Nevertheless, the condition of the structures in all areas indicated good upkeep. Nearly any storage structure subject to extensive stresses in addition to the weather will require structural repairs periodically to prevent excessive deterioration. Average age of these houses was 24 years at the time of the survey, and more than a third of the units were constructed of wood. No more than 4 to 6 percent were in need of repair.

One major reason for the continued preference for houses in which to store cottonseed is the climate of the Cotton Belt. Cottonseed frequently arrives at the mill containing from 11 to 15 percent, or even more, of moisture. If it is to be kept in good condition, even for the average crushing season of between 6 to 7 months, it must be ventilated. This is not possible in concrete silos, such as those typically used in grain

storage (frequently more than 100 feet tall) as almost no moisture is dissipated through incidental air movement. Furthermore, it is practically impossible to ventilate such a silo by drawing air through the cottonseed. Most cottonseed storage structures have an average depth of seed pile of less than 30 feet and two-thirds of those reporting had forced-air ventilating systems. In practically all cases these systems were comprised of fans that drew air through the piled cottonseed. Even the outside ricks had ventilating systems in about two-fifths of the cases reported.

It appears that processors have recognized that silos especially would require artificial ventilation because, of all types of cottonseed storage reported, the silos show the highest percentage with forced-air ventilation. The principal types with percentages ventilated are, roughly, as follows:

Type of structure	Percentage ventilated
Tank (silo)	90
"Tin"	80
Muskogee	80
Steel	70
Concrete	70
Frame	60
Corrugated iron	50
Quonset	50
Rick	40
Brick	40
Average for all structures	66

Reports from many areas in the eastern part of the Belt indicated that a relatively small percentage of the seed houses were equipped with fans. This may be due to several causes, important among which are: (1) The greater average age of mills and storage houses, and difficulties in installing ventilating systems, and (2) decrease in cotton production, 1/ with consequent excess capacity of cottonseed oil mills, short crushing seasons, and short storage periods. In Georgia, about half of the storage structures had ventilating fans, whereas in the Mississippi River Delta the percentage was close to 100.

Apparently the operators assume that most ventilated houses can safely handle cottonseed with no more than 15 percent of moisture content, although some maximum figures were reported at 18 percent or higher. Presumably any seed received with greater moisture can be crushed either immediately or after a very short storage period.

Information on the method and maximum normal speed of moving cottonseed from trucks into storage was reported for 630 storage structures. Methods

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1/ Brewster, John M. Cottonseed-Supply Areas. U. S. Dept. Agr. Statis. Bul. 90. 96 pp., illus. 1950.

were reported by four classes: Power shovel, pneumatic unloader, truck dump, and manual labor. Capacity, or maximum speed as given, will not always apply to all structures simultaneously because one unloader--a truck dump, for example--may serve several storage structures. It is doubtful that even with manual labor the indicated unloading speed could be maintained at all storage houses at once.

The data indicated that the larger unloading equipment had been installed at the newer mills. Maximum rates of cottonseed truck unload per hour were reported as follows:

Method of unloading	Maximum tons
Truck dump	100
Manual labor	80
Pneumatic	75
Power shovel	70

There is persistent difference of opinion in the industry as to the relative advantages of these 4 usual methods of seed unload. It appears probable that there is no one best method under all conditions. Also, the relationship of usual performance to maximum performance varies widely among the 4 methods. Average performance per hour reported was as follows:

Method of unloading	Average tons
Truck dump	19
Manual labor	14
Pneumatic	22
Power shovel	32

From these figures it appears that, in practice, the capacities for each method vary widely. No indications were given as to historical trends, preferences by geographical areas, or other classifications of the seed unloading facilities.

At some mills the same equipment is used to unload both trucks and railroad cars; at others separate equipment and methods are employed. Not much more than 5 percent of all cottonseed is moved by railroad, however, and so most mills have no freight car unload equipment.

Owing to the usual moisture content of cottonseed when ginned, the covering of lint that greatly reduces natural ventilation, and the climate of most of the Cotton Belt, it is essential to move the seed quickly from the gin to the mill, where processing can be done immediately if serious deterioration threatens. These conditions bring about a greater concentration of cottonseed storage at the oil mills than is customary with other oilseeds. With railroad transportation of the cottonseed being impractical, the prevailing situation has had an extensive influence on freight cost differentials within the industry, and hence on cottonseed oil mill location. The conditions that have prescribed the storage requirements for cottonseed are

somewhat unique among the oilseeds of the United States. They also have exerted a far-reaching influence on both the location and operations of the cottonseed-processing industry.

Analysis of replies received through the cottonseed oil mills survey shows an average seed-storage capacity equivalent to a 102-day crushing capacity. State averages varied from 48 to 214 days, and individual mills varied from practically no seed-storage space to an amount sufficient for a 250-day or greater crushing capacity. About half of the mills had less than 90 days of seed-storage space (table 4).

Table 4.--Cottonseed oil mills: Distribution by storage capacity for cottonseed, United States, 1951

Storage capacity in terms of daily crushing capacity	Mills		Storage capacity in terms of daily crushing capacity	Mills	
	Number	Percent		Number	Percent
Under 21 days	4	1.6	131 - 140 days	9	3.6
21 - 30	11	4.4	141 - 150	7	2.8
31 - 40	13	5.2	151 - 160	4	1.6
41 - 50	22	8.9	161 - 170	8	3.2
51 - 60	20	8.0	171 - 180	2	.8
61 - 70	17	6.9	181 - 190	4	1.6
71 - 80	18	7.2	191 - 200	12	4.8
81 - 90	12	4.8	201 - 210	3	1.2
91 - 100	18	7.2	211 - 220	4	1.6
101 - 110	17	6.9	221 - 230	3	1.2
111 - 120	20	8.0	Over 230	4	1.6
121 - 130	17	6.9	Total	249	100.0

Storage space (in days' capacity) tends to increase slightly with size of mill, but this may be accounted for mostly, if not entirely, by an appreciable and associated increase in size of mill and number of days' seed storage capacity (from east to west). This geographical variation results from a combination of circumstances--humidity, age of mills, method of oil extraction, and length of processing season.

The data on capacity indicate the way in which the mills were planned. They do not mean, however, that the operator with an average seed-storage space would expect to operate from storage for only 102 days after the completion of the heavy harvesttime seed receipts. Normally, if he can obtain the seed at the "going" price he will fill his seed houses and also crush direct from receipts as long as the heavy flow continues. After his rate of receipts falls below his rate of crushing, there is less reason to hurry; then more thought can be given to the most efficient rate of operation.

In a large majority of cottonseed oil mills, the amount of seed crushed per month falls off after the point of peak storage, and stored seed plus current receipts supply the mill over a considerably longer period than one would suspect when first comparing storage capacity and operating capacity.

Monthly reports made by cottonseed oil mills to the Bureau of the Census furnish data that indicate how seed receipts, seed storage, and crushings synchronize month-by-month in the average situation. No attempt is made here to show these relationships for individual mills. The seasonal patterns of receipts of cottonseed at cottonseed oil mills and soybeans at soybean oil mills are compared in figure 2.

For the industry as a whole, table 5 shows month-end cottonseed stocks and monthly crushings for the 4 seasons 1949-50 through 1952-53. Both the largest monthly crushings and the largest storage stocks are attained during the heavy autumn movement of cottonseed from gin to mill. The series cannot be broken down to show precisely the day when the peak rate of crushing and the peak storage of seed occurred. The 2 high points probably were reached at about the same time. This is shown in an approximate way by charting smooth line graphs of the monthly series. 2/ In 3 of the 4 seasons the maximum crush occurred in October, whereas maximum storage is recorded every season at the end of November. During December, receipts continued at a substantial level, the rate of crushing was reduced somewhat, and the amount of decrease in storage was relatively small.

For the 4 seasons 1949-50 through 1952-53 average storage was reported to be at its peak at the end of November; then it decreased during the succeeding months. Average storage in terms of percentage of peak storage was as follows:

Month	Percent
December	6
January	20
February	18
March	17
April	12
May	9
June	7
July	2

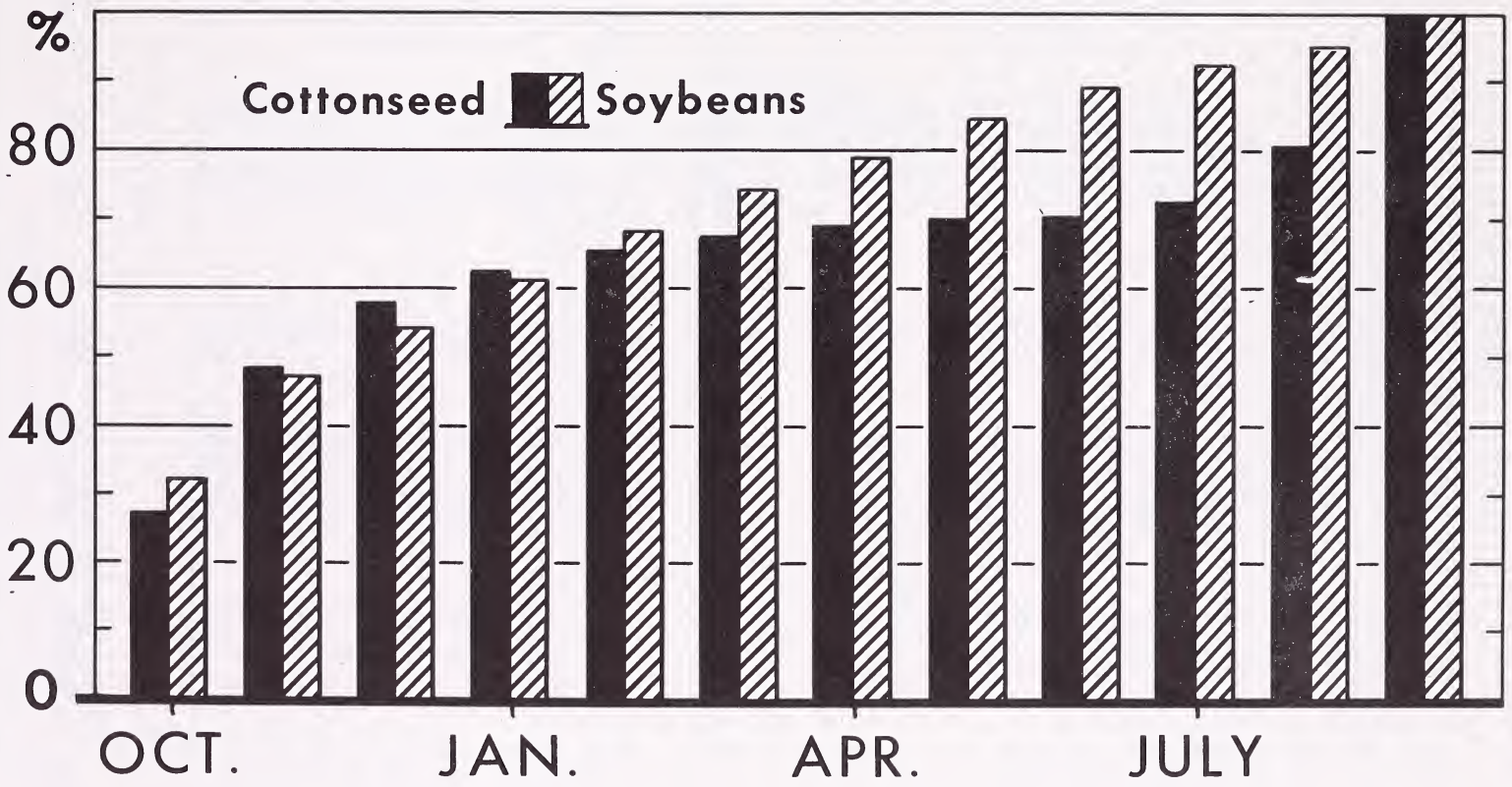
At the end of August the seed-storage level was equal to 12 percent of the level reported at the end of the preceding November. These figures purport to give a correct concept of the industrywide storage. But they conceal 3 component movements; namely (1) the further receipts of seed, (2) decreased number of mills operating, and (3) a decreased rate of operation for many mills. 3/

2/ Kromer, Geo. W. Cottonseed Oil Mill Characteristics and Marketing Practices. U. S. Dept. Agr. Inf. Bul. 79. 35 pp., illus. 1951. p. 4.

3/ Ibid., p. 7.

MILL RECEIPTS OF COTTONSEED AND SOYBEANS

Cumulated by Months, 1949-53 Average



U. S. DEPARTMENT OF AGRICULTURE NEG. 3122-56 (4) AGRICULTURAL MARKETING SERVICE

Figure 2

Table 5.--Cottonseed: Quantity crushed and mill stocks, United States, by months, August 1949-July 1953

Month	1949-50			1950-51		
	Quantity crushed	Stocks at end of month	Stocks as percentage of crushed	Quantity crushed	Stocks at end of month	Stocks as percentage of crushed
	1,000 tons	1,000 tons	Percent	1,000 tons	1,000 tons	Percent
Aug.	207,023	278,434	134	231,735	275,937	119
Sept.	585,200	940,795	161	408,108	473,270	116
Oct.	746,375	1,574,820	211	625,316	981,215	157
Nov.	782,001	2,111,751	270	568,242	1,216,805	214
Dec.	671,812	1,884,014	280	436,555	1,154,011	264
Jan.	651,246	1,427,927	219	452,572	850,575	188
Feb.	528,051	1,152,595	218	322,750	584,841	181
Mar.	496,517	869,260	175	229,448	392,505	171
Apr.	369,289	683,320	185	163,732	244,048	149
May	280,242	498,515	178	117,426	141,761	121
June	212,366	335,398	158	95,626	69,890	73
July	181,961	287,951	158	71,661	66,281	92
Total	5,712,083			3,723,171		
Average	476,007	1,003,732	211	310,264	537,595	173

	1951-52			1952-53		
Aug.	199,371	422,460	212	148,206	386,584	261
Sept.	543,428	956,042	176	523,455	1,039,084	199
Oct.	837,547	1,709,768	204	787,867	2,026,809	257
Nov.	776,093	1,966,397	253	725,205	2,409,103	332
Dec.	652,542	1,930,851	296	670,308	2,286,033	341
Jan.	694,589	1,561,459	225	663,101	1,854,856	280
Feb.	545,314	1,179,504	216	554,354	1,404,625	253
Mar.	432,902	801,752	185	484,318	962,666	199
Apr.	305,597	518,480	170	376,581	613,790	163
May	217,667	315,186	145	266,426	361,167	136
June	153,283	176,830	115	207,564	197,208	95
July	118,157	136,898	116	155,321	155,372	100
Total	5,476,490			5,562,706		
Average	456,374	972,969	213	463,559	1,141,441	246

The largest monthly crush during the 4 seasons was 837,500 tons crushed in October 1951. The largest storage was 2,409,000 tons at the end of November 1952. From this it appears that the mills have storage space at least sufficient to store a 2.9-month seed supply for the most rapid crushing rate exhibited during the period. This is about the amount of seed storage required by a mill with an operating season equal to the average for the industry (about 7 months). A mill with a shorter season will store less; one with a longer season must store more.

Actually, the rate of operation for most individual mills falls off so significantly after the rush of seed receipts is past that storage in terms of the big month of crushing gives an erroneous conception of the mill's operating (economic) position. Averaged by months for the 4 seasons, the industry operated at a rate equal to 51 percent of the peak-month rate. Averaged similarly, seed storage, as contrasted with seed-storage capacity, equaled 2.1 months' concurrent monthly seed requirements. Assuming that all operating mills continued to crush seed at their January rates, the decrease in the number of mills operating from February through June as a percentage of the number in January is indicated as follows:

Month	Percent
February	10
March	5
April	25
May	15
June	10
Total	65

At the end of the season's operations these mills were mostly idle, with nothing in storage. Some integrated plants mixed feeds, ground fertilizer, or carried on some related business, and to some extent employed their storage space.

Seed storage for the 4 seasons by months averaged 47 percent of the highest month. This percentage represents a high degree of efficiency in the storage of a seasonal crop. The continued receipt of seed by mills after the autumn congestion had been relieved tends to offset the inclusion of short-season mills whose seed-storage space in some cases stood entirely empty as early as January. Despite the elements of inefficiency in these short-season mills, they require less storage per ton of seed crushed than do long-season mills because they crush such a large proportion of their season's total directly from receipts in the autumn. Long operating seasons, coupled with longer storage of seed, appear to lead to a net increase in mill economies and a decrease in the cost of processing. 4/

4/ Brewster, John M. Comparative Economies of Different Types of Cottonseed Oil Mills and Their Effects on Oil Supplies, Prices, and Returns to Growers. U. S. Dept. Agr. Mktg. Res. Rep. 54. 239 pp., illus. 1954, p. 142.

Cottonseed Oil

Cottonseed products are not generally stored at mills for an extended time. Crude cottonseed oil ordinarily loses quality faster than does refined oil. Consumption of cottonseed oil is spread fairly uniformly over the year. Consequently, if all cottonseed mills began operating on the same date and operated the average season (7 months), a quantity of oil equivalent to 5 months' consumption would need to be in storage on the last day of operation. This hypothetical figure gives what may be considered a ceiling above which maximum storage cannot go.

Actually, some mills operate nearly the year around, and the operating periods of the others are not all timed alike. Industry reports to the Bureau of the Census indicate that total cottonseed oil storage usually varies about a level equivalent to 2 or 2½ months' production, of which about 1 month's production is in the form of crude. A fourth of the crude oil, on an average, or about 1 week's production, is stored at cottonseed oil mills (table 3).

With perfect efficiency of use, the maintenance of that much mill storage of oil would require mill-storage capacity sufficient to handle half of the highest month's production. That capacity, in turn, would be about equal to full production for 25 days. This last fact checks in a rough way with the mill storage capacity survey, which showed oil storage capacity equal to about 30 days of capacity production. Table 6 shows the distribution of storage capacity at mills for the 4 principal cottonseed products. Of

Table 6.--Cottonseed oil mills: Distribution by storage capacity for cottonseed products, United States, 1951

Storage capacity in terms of daily production capacity	Oil mills storing cottonseed--							
	Oil		Meal		Linters		Hulls	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Under 11 days...	38	15.0	38	15.2	38	13.4	28	11.3
11 - 20.....	91	35.8	83	33.2	45	15.9	70	28.4
21 - 30.....	62	24.4	47	18.8	51	18.0	48	19.4
31 - 40.....	21	8.2	37	14.8	37	13.1	35	14.2
41 - 50.....	10	3.9	16	6.4	33	11.7	14	5.7
51 - 60.....	6	2.4	7	2.8	26	9.2	18	7.3
61 - 70.....	3	1.2	5	2.0	15	5.3	7	2.8
71 - 80.....	4	1.6	4	1.6	6	2.1	8	3.2
81 - 90.....	5	2.0	4	1.6	7	2.5	4	1.6
91 - 100.....	3	1.2	2	.8	8	2.8	5	2.0
101 and over....	11	4.3	7	2.8	17	6.0	10	4.1
Total.....	254	100.0	250	100.0	283	100.0	247	100.0

course, for the mills as a whole, efficiency in use of storage space can never approach closely to 100 percent; few mills can always fill and empty their oil storage rhythmically. And to the extent that they fall short of that goal the check between the capacity indicated by the Census data and that shown by the survey data is made closer.

The three-fourths of the crude cottonseed oil reported in storage elsewhere than at mills is, principally, a working inventory at refineries and other processing plants. Such a distribution of the stocks represents efficient storage because normally cottonseed oil at a refinery will be refined as soon as possible in order to reduce the rate of deterioration. Even aside from this aspect, mill storage of oil represents a relatively inefficient use of storage space; concentrating the oil at refineries or further processing plants not only permits refining of the oil to reduce deterioration but also economizes on storage space. The fact that the oil is drawn from mills with somewhat different processing schedules reduces the relative excess capacity required for peak periods. Similar joint use of facilities by oil from different oilseeds still further economizes on total storage capacity required. Table 7 relates monthly stocks of cottonseed oil to its monthly consumption. Interrelations of seasonal variations in cottonseed oil production, crude oil consumption (including refining), and crude oil stocks in all positions are shown in figure 3; total production, consumption, and stocks of cottonseed oil are shown seasonally in figure 4.

Individual cottonseed oil mills differ greatly in the relative amounts of oil storage they provide. Several mills reported more than a 100-day oil-storage capacity. This amount would furnish the total storage capacity required for a season's oil from an average mill with a 9-month operating season. By similar assumptions the average mill storage capacity of 30 days would about furnish all the oil storage required for the production of a mill with an 11-month season. And many mills do operate 11 months or more. Oil storage capacities of as little as an 8-day requirement were reported; in such cases oil must be shipped as soon as possible after production.

In some cases, data on oil storage reflect integration of mill and refinery. Cases are known where no mill storage is required. Newly produced oil is pumped directly to the refinery--possibly in the same building. No data are available directly on the extent of such integration. From scattered evidence, such as number of cottonseed oil mills in the immediate neighborhood of refineries, however, it is estimated that roughly 10 percent of the crude oil is refined close by the mill, mostly in integrated or otherwise allied plants.

An analysis of railway tank car loading records for the 10 years 1940-49 indicates further that 70 percent of the refined oil goes into utilization or further processing without the use of tank cars. A great part of it undoubtedly goes into plants integrated with the refineries, thus obviating the necessity for the storage capacity otherwise required to hold oil awaiting shipment. The difference is reflected in the general tank storage situation, but does not affect mill-storage figures.

Table 7.--Cottonseed oil: Consumption and stocks as percentages of season averages, United States, by months, August 1949-July 1953

Year and month	Consumption			Stocks at end of month		
	Total	Crude	Refined	Total	Crude	Refined
	Percent	Percent	Percent	Percent	Percent	Percent
1949-50						
August	78	53	105	37	38	36
September	84	84	85	51	83	34
October	114	131	96	80	116	62
November	126	144	107	110	154	87
December	117	134	99	132	172	111
January	123	137	107	138	162	125
February	124	130	117	143	148	141
March	126	124	129	124	94	140
April	87	86	87	119	78	140
May	84	73	96	102	62	124
June	72	60	85	94	48	118
July	65	44	87	70	45	82
Average	100	100	100	100	100	100
1950-51						
August	123	86	162	61	67	58
September	107	94	122	59	99	44
October	137	157	117	85	140	64
November	149	174	122	109	154	92
December	123	132	112	117	156	102
January	132	138	125	123	164	108
February	109	121	96	126	137	122
March	92	104	80	123	94	135
April	68	70	65	121	76	138
May	62	58	66	111	47	135
June	52	39	67	93	35	115
July	46	27	66	72	31	87
Average	100	100	100	100	100	100
1951-52						
August	57	32	87	30	23	32
September	81	74	90	45	72	34
October	126	136	112	71	123	51
November	131	146	109	95	148	74
December	127	143	106	111	149	96
January	136	146	121	124	153	112
February	120	131	105	132	140	128
March	104	109	96	136	130	138
April	97	99	95	133	104	145
May	81	78	98	123	78	141
June	80	63	101	107	47	131
July	60	43	80	93	33	118
Average	100	100	100	100	100	100

Continued -

Table 7.--Cottonseed oil: Consumption and stocks as percentages of season averages, United States, by months, August 1949-July 1953 - continued

Year and month	Consumption			Stocks at end of month		
	Total	Crude	Refined	Total	Crude	Refined
	Percent	Percent	Percent	Percent	Percent	Percent
1952-53						
August	58	31	100	46	31	49
September	75	52	112	51	84	44
October	127	125	130	66	132	53
November	120	136	93	82	153	69
December	132	149	104	96	150	86
January	129	139	113	107	147	99
February	119	126	108	116	139	111
March	113	122	98	124	122	125
April	109	114	100	129	94	136
May	86	87	86	129	68	141
June	74	70	82	128	46	144
July	58	49	74	126	34	143
Average	100	100	100	100	100	100

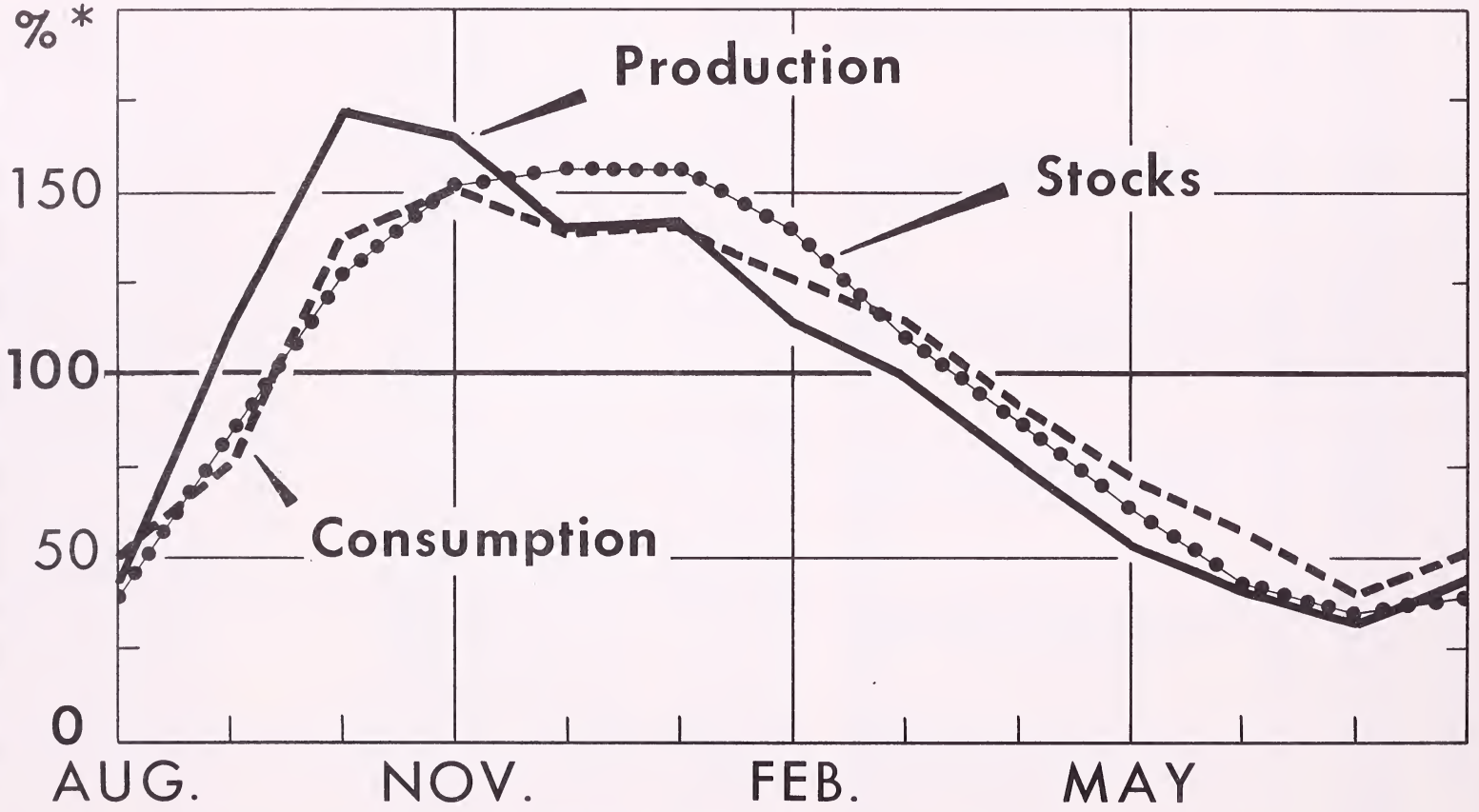
Variations in cottonseed production from season to season, and the related fact that many mills will usually be operating at less than capacity, permit a normal storage availability for many more days of production than the data from the mill-storage study directly indicate.

Storage policy at the cottonseed oil mills in the short run could be expected to be limited by storage capacity only at times of peak storage. In fact, a comparison of estimates of capacity with actual stocks, as shown by the Bureau of the Census, indicates that the maximum never is closely approached for the industry as a whole. The largest stock reported to the Bureau of the Census between August 1949 and July 1953, however, was 260 million pounds. Evidently not many mills held capacity stocks at any one time. Furthermore, average month-end stocks reported for individual mills during these 4 years varied between about 50 and 60 percent of the 260 million pounds maximum.

Cottonseed Meal

Storage capacity for meal (and cake) at the cottonseed oil mills, as computed from the survey returns, was equal to 28 days of full production. The State averages varied considerably, from 8 days in Missouri to 41 days in Arizona. No regional pattern is readily discernible, although there undoubtedly were various regional influences involved. For example, California processors normally sell meal directly to livestock producers. This calls for storage until the period of feed deficiencies in the summer. Surplus meal areas from which sales are normally made to feed mixers in other areas have no need for extensive meal storage, unless for trading (or speculative) purposes. Some of the State averages would seem to reflect that situation.

SEASONALITY OF CRUDE COTTONSEED OIL SUPPLY AND CONSUMPTION



* % OF AV. FOR SAME MONTH DURING AUG. 1949 - JULY 1953 PERIOD

U. S. DEPARTMENT OF AGRICULTURE NEG. 3123-56 (4) AGRICULTURAL MARKETING SERVICE

Figure 3

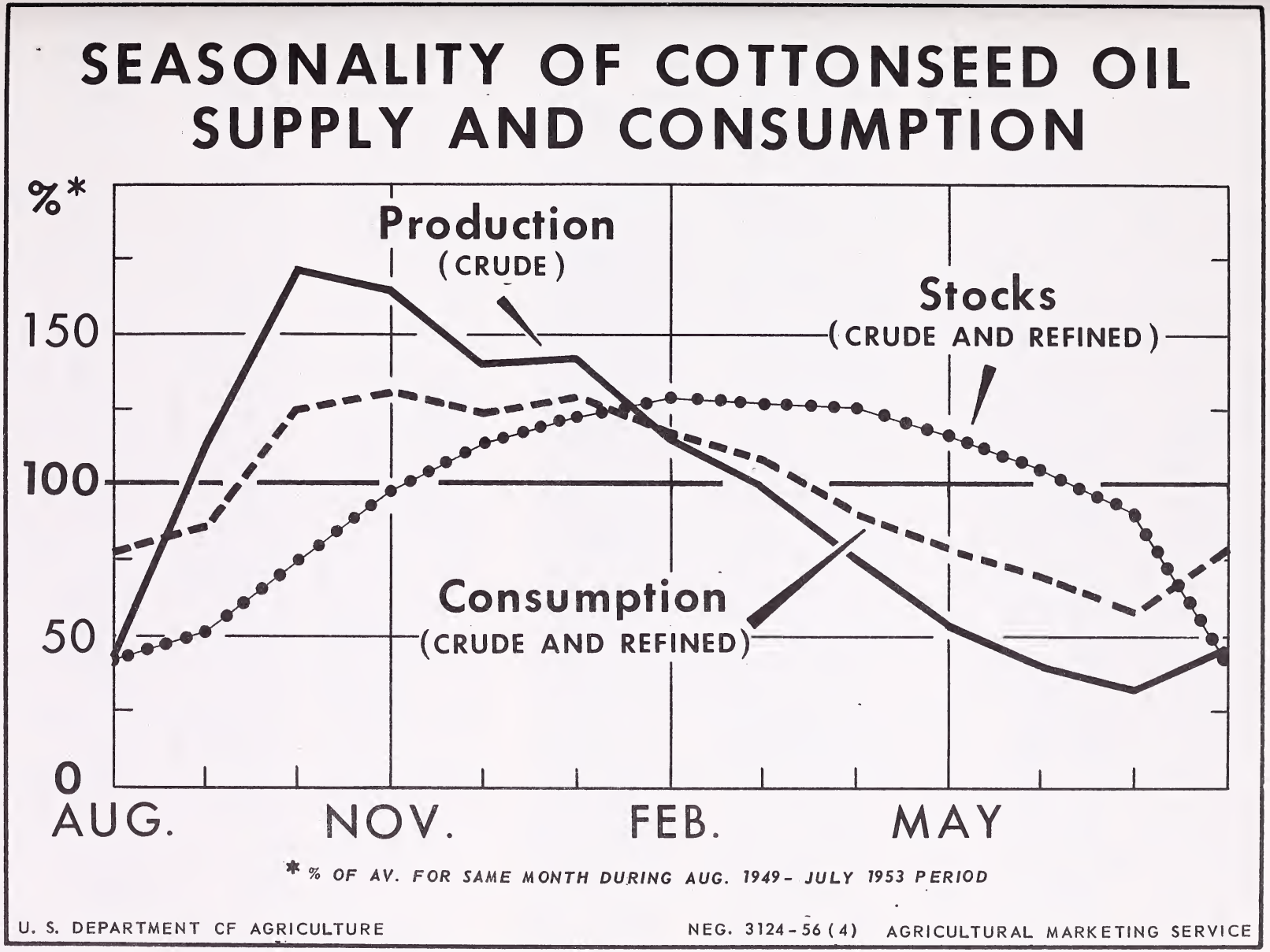

SEASONALITY OF COTTONSEED OIL SUPPLY AND CONSUMPTION
%*
Production
(CRUDE)
Stocks
(CRUDE AND REFINED)
Consumption
(CRUDE AND REFINED)
150
100
50
0
AUG.
NOV.
FEB.
MAY
* % OF AV. FOR SAME MONTH DURING AUG. 1949 - JULY 1953 PERIOD
U. S. DEPARTMENT OF AGRICULTURE
NEG. 3124-56 (4) AGRICULTURAL MARKETING SERVICE

Figure 4

Variations in meal storage space at individual mills obviously are far greater than were shown by State averages. Response of individual mills in the survey showed cottonseed meal storage space varying from zero to the equivalent of over 200 days of capacity production. A third of the mills, however, each had meal storage space for 10 to 20 days of capacity production. Only 15 percent had space for less than 10 days, two-thirds had space for less than 30 days, and four-fifths had storage space for less than 40 days (table 6). Census data for individual mills have not been tabulated in this form, but comparison of State averages for the two series (Census and survey) suggests about the same distribution for them both. Actual average production usually is sufficiently below capacity production to allow adequate space for the alternate buildup and depletion of stocks at the ratios indicated and still make nearly half of the existing storage capacity available for trading stocks.

Storage capacities, and storage stocks for individual mills, are frequently affected by two factors. One is the desire of some to hold their meal for a favorable market. The other is the integration of some oil mills with plants for further processing of meal. One mill may move all meal to its allied feed-mixing plant for storage; another may store all its meal until the feed-mixing plant needs it. Either practice gives an unjustifiable concept of mill-storage requirements.

Compared with a storage capacity of 400,000 tons of meal, shown by the survey, the largest month-end stock of meal actually held at cottonseed oil mills, as reported to the Census during the 4 seasons 1949-50 through 1952-53, was the 214,000 tons on hand at the end of October 1950. The only other months during the period at the end of which 200,000 tons or more were stored at mills were February and November 1950, January 1951, and February and March 1953.

In a further comparison of actual operation with capacity, average monthly meal production for the 4-year period was 210,000 tons of the estimated 426,000-ton mill capacity. Average monthly meal storage amounted to 90,000 tons, or 22 percent of meal storage capacity. In order for an inventory to average 90,000 tons, however, there would be required more space than sufficient to hold 90,000 tons maximum at one time. Actual inventories ranged from 45,000 to 214,000 tons.

Furthermore, not all mills would have their largest meal stocks at the same time. The 214,000-ton actual maximum storage figure is simply the largest monthly industry total and is certain to include relatively small figures for some mills. The summation of the largest monthly stock for individual mills normally will yield a considerably larger total.

Insofar as inventories represent operating stocks, they can be assumed to require a minimum storage space equal to twice the average stock held, in order that storage may regularly be filled and emptied. Because efficiency in use of storage space will be less than maximum, the space used for operating stocks must, in fact, be expected to be somewhat more than double the average volume of stock held. Space for trading stocks need not be estimated with the same liberality.

Without being able to separate working stocks and trading stocks, it is impossible to state with certainty the amount of excess meal storage space, in terms of operating needs, that is being maintained at cottonseed oil mills. Nevertheless, the appearance is that a large portion of the average month-end holding is trading stock.

For the two seasons 1949-50 and 1951-52, monthly average meal production was approximately the same. But average monthly stocks in the earlier year were 148,000 tons; in the latter year, under price ceilings, they were 57,000 tons. In 1950-51, with meal production one-third under 1949-50 and 1951-52, average monthly meal stocks were 146,000 tons.

In 1950-51, however, stocks were exceptionally high during the early part of the year. This was shortly after the outbreak of the Korean conflict. In 1951-52, stocks were exceptionally low all season. Only 2 times during the 2 preceding seasons were month-end stocks as low as the largest one in 1951-52. Seasonal production and month-end stocks of meal at cottonseed oil mills from August 1949 through July 1953 are shown in table 8. In brief, the 1951-52 meal stocks appear to have been adequate for operating purposes. The largest month-end stock reported that season was 73,000 tons. For the preceding season (1950-51) average month-end stocks were just double the size of this figure, and the largest stock (at the end of October 1950) was approximately triple the 1951-52 maximum, or 214,000 tons.

This comparison suggests that, for 1950-51, half of the amount of the meal inventories held at the mills was trading stock. In fact, this statement probably is quite conservative because cottonseed meal produced in 1950-51 was 1,670,000 tons, compared with 2,500,000 tons the following season. Somewhat smaller working stocks should be required with a production a third smaller.

Cottonseed Linters

The most usual linter storage capacity at cottonseed oil mills, as shown by the survey, was sufficient to hold 20 to 30 days' full production. The median mill (that one with as many above as below) had a 32- or 33-day storage capacity, and the average for all mills was 38 days. A third of the mills had capacity for between 10 and 30 days of production, 60 percent had storage for less than 40 days, 72 percent for less than 50 days, and 80 percent for less than 60 days. Nevertheless, 6 mills had storage capacity for more than 150 days of maximum linter production (table 6).

As calculated from mill reports to the Bureau of the Census, actual linter storage at month-ends averaged 21 days of actual current production in 1950-51, 32 days in 1949-50, 36 days in 1951-52, and 40 days in 1952-53. These figures do not vary significantly with production between seasons or with linter-price trend (table 9).

Table 8.--Cottonseed meal: Quantity produced and mill stocks, United States, by months, August 1949-July 1953

Month	1949-50			1950-51		
	Quantity produced	Stocks at end of month	Stocks as percentage of production	Quantity produced	Stocks at end of month	Stocks as percentage of production
	Tons	Tons	Percent	Tons	Tons	Percent
August	94,081	52,759	56	106,389	121,955	115
September	253,635	98,076	39	182,503	153,549	84
October	333,376	116,912	35	278,361	214,315	77
November	353,906	123,518	35	253,823	208,246	82
December	308,123	142,801	46	195,373	192,194	98
January	288,745	178,192	62	199,994	200,827	100
February	234,115	200,070	85	146,611	167,389	114
March	221,928	190,967	86	106,323	130,717	123
April	163,904	187,373	114	74,216	105,949	143
May	126,026	184,095	146	48,437	94,795	196
June	95,051	166,912	176	43,989	89,767	204
July	82,570	137,105	166	32,880	71,645	218
Total	2,555,460			1,668,899		
Average	204,622	148,232	72	139,075	145,946	105

	1951-52			1952-53		
August	92,222	57,343	62	70,069	47,886	68
September	251,099	71,003	28	249,716	81,984	33
October	387,447	72,854	19	382,208	115,282	30
November	361,949	60,316	17	351,667	144,608	41
December	303,841	55,430	18	319,967	155,796	49
January	323,098	57,185	18	311,611	194,238	62
February	253,208	56,176	22	264,266	212,088	80
March	201,182	47,336	24	233,813	210,512	90
April	146,191	46,396	32	181,730	178,690	98
May	101,133	57,870	57	129,515	140,897	109
June	70,149	58,946	84	99,667	122,619	123
July	56,206	45,104	80	75,673	91,549	121
Total	2,547,725			2,669,902		
Average	212,310	57,163	27	222,492	141,346	64

Table 9.--Cottonseed linters: Quantity produced and mill stocks, United States, by months, August 1949-July 1953

Month	1949-50			1950-51		
	Quantity produced	Stocks at end of month	Stocks as percentage of production	Quantity produced	Stocks at end of month	Stocks as percentage of production
	1,000 bales	1,000 bales	Percent	1,000 bales	1,000 bales	Percent
August	63	109	173	70	53	76
September	182	140	77	134	73	54
October	229	187	82	209	91	44
November	234	242	103	191	84	44
December	202	265	131	147	105	71
January	193	218	113	153	123	80
February	157	174	111	106	84	79
March	148	129	87	77	62	80
April	108	110	102	52	53	102
May	80	102	128	36	44	122
June	59	78	132	31	39	126
July	51	68	133	21	38	181
Total	1,706			1,227		
Average	142	152	107	102	71	70

	1951-52			1952-53		
August	64	52	81	47	113	240
September	176	95	54	168	186	111
October	267	136	51	258	233	90
November	247	174	70	235	281	120
December	205	199	97	212	279	132
January	223	249	112	208	291	140
February	175	238	136	176	277	157
March	140	256	183	154	199	129
April	99	234	236	119	148	124
May	70	200	286	83	107	129
June	46	148	322	66	88	133
July	36	107	297	49	63	128
Total	1,748			1,775		
Average	146	174	119	148	189	128

Minimum linter storage requirements for the operation of a mill, assuming a linter market is always available, are for something more than one freight carload of baled linters. This quantity should be produced by processing about 300 tons of cottonseed. For the average-size mill in 1951-52 this amount would have required less than 4 days of operation. Storage space for 7 days of production would allow for about twice this minimum and should be sufficient to allow for such uncertainties as delays in obtaining cars. Compared with these figures, the lowest estimated seasonal average appearing in the reports to the Census during 1949-50 through 1952-53 was about 21 days. This indicates the holding of requisite working stocks plus trading stocks of from 3 to 5 times the size of the working stocks.

The survey returns showed the mills had an average linter storage space for 38 days' capacity operation. This would permit nearly the 21 days of storage on an average if practice were followed of alternately filling all storage space, then emptying it completely. No logical reason for a policy such as this is apparent in the data. The cost and effort of shipping linters, moreover, appears too small to account for such a schedule.

Expectation of price increases at times in a free market is a normal reason for holding back stocks of finished goods by producers. But most of the time linter prices show no such fluctuations as to justify the size of the stocks found by the reports to the Census, or those provided for by the linter storage facilities reported in the survey.

Internal evidence suggests a widespread mill practice of holding linters until they are called for by the linter buyers. Insofar as that actually may be a condition that cottonseed oil millers have to accept, the large amount of mill linter storage found may be necessary. Nevertheless, it is a market, or trading, necessity rather than a mill-operating necessity.

Cottonseed Hulls

Hull storage at cottonseed oil mills presents a situation similar to that for cottonseed meal. Returns from the survey showed that 73 percent of the mills reporting had storage capacities for 40 days, or less, of production, nearly 60 percent had less than 30 days of storage capacity, and about 40 percent had hull storage space for 20 days or less (table 6).

Actual month-end stocks of hulls during the 4 seasons studied averaged about 27 days in each of the years 1949-50 and 1950-51, 10 days in 1951-52, and 19 days in 1952-53. The amount of hulls produced was approximately the same in 3 of these 4 years, but in 1950-51 was about a third less. The 1951-52 season, with nearly 50 percent greater production, had average stocks about half as great as 1950-51. In June and July of 1950-51 the ratio of stocks to production fell, in contrast to the June and July increases in each of the other 3 years. The ratio continued low throughout 1951-52 and into the winter of 1952-53. This reduced level of inventory of hulls from the spring of 1951 till about February 1953 appears to have, to a great extent, the characteristics of the movement of mill stocks of cottonseed meal during the same period (table 10).

Table 10.--Cottonseed hulls: Quantity produced and mill stocks, United States, by months, August 1949-July 1953

Month	1949-50			1950-51		
	Quantity produced	Stocks at end of month	Stocks as percentage of production	Quantity produced	Stocks at end of month	Stocks as percentage of production
	Tons	Tons	Percent	Tons	Tons	Percent
August	48,136	84,793	176	55,393	76,566	138
September	139,986	111,394	80	94,136	85,905	91
October	173,867	164,264	94	142,390	99,304	70
November	177,820	120,624	68	128,165	84,527	66
December	156,725	110,166	70	100,331	84,641	84
January	151,243	107,319	71	102,089	88,626	87
February	124,079	102,583	83	75,048	68,128	91
March	117,747	87,056	74	55,180	54,410	99
April	86,775	85,226	98	35,975	40,159	112
May	65,868	82,724	126	27,301	34,413	126
June	51,534	84,786	165	23,990	29,324	122
July	43,957	77,192	176	16,963	20,157	119
Total	1,337,737			856,961		
Average	111,478	101,511	91	71,413	63,847	89

	1951-52			1952-53		
August	44,104	18,914	43	31,867	25,780	81
September	120,365	23,457	19	107,222	42,402	40
October	183,193	35,269	19	160,999	49,608	31
November	172,561	32,741	19	155,821	52,600	34
December	149,459	36,285	24	149,310	48,967	33
January	158,376	41,200	26	145,628	53,336	37
February	125,007	44,948	36	122,293	65,726	54
March	99,628	36,325	36	106,762	83,924	79
April	70,456	28,820	41	80,855	93,139	115
May	48,234	29,148	60	57,412	82,177	143
June	35,883	30,676	85	46,731	67,992	145
July	27,196	24,615	90	32,526	48,318	149
Total	1,234,462			1,197,426		
Average	102,872	31,867	31	99,786	59,497	60

During the period from April 1951 to September 1952, the highest month-end stock of hulls at mills was 45,000 tons. At no other month-end within the 4-year period studied was so small a stock reported. Average stock in thousands of tons for the 4 seasons examined were as follows:

Operating season	Average stocks (tons)
1949-1950	102,000
1950-1951	64,000
1951-1952	32,000
1952-1953	59,000

It appears that for production at the level of these 4 seasons 32,000 tons was adequate storage of hulls at cottonseed oil mills. Inventories above that level appear to be, in large part, trading stocks. The movement to reduce stocks is recognizable from the time of the imposition of price control.

Such average working stocks--10 days' production, or 32,000 tons--would require something over 20 days of storage space and maximum stocks in 1951-52 were nearly 50 percent larger than the 10-day season average. In terms of these data, therefore, stocks equal to somewhat over 30 average days of production would be necessary at certain times. This is not too different from the ratio of hull storage space to mill capacity reported in the survey of mill storage capacity, i.e., production for 34 days. Thus the excess of hull storage space over working-stock requirement is essentially the same as the general excess of mill-processing capacity over need. Maintenance of the trading stocks (ratio of stocks and storage space to production in excess of working-stock requirements) in the space available appears to have been possible principally because the volume of seed processed was usually much less than the industry's processing capacity.

STORAGE OF SOYBEANS AND SOYBEAN PRODUCTS AT OIL MILLS

Soybeans

In the soybean processing industry, raw material storage is somewhat different from what it is in cottonseed processing. Soybean processing is a comparatively new industry. For this reason storage facilities cannot be classified usefully by age. Soybean production, until now, has been located predominantly in a relatively cool climate where deterioration from heat and moisture is less devastating than in the Cotton Belt. Furthermore, differences in physical character of the seed permit freer air circulation through a pile of soybeans than through an equivalent pile of cottonseed. Also, the previous development of grain storage in the principal soybean production area made storage facilities available for trial before the soybean crop became a major marketing and storage problem. As a result, it soon became apparent that, except for minor adjustments, the storage of soybeans could be treated principally as an added volume of grain storage.

From the viewpoint of availability of raw materials, this situation gives the processing-plant management a greater freedom of choice in procurement practices. Monthly mill operations, as reported by soybean processors to the Bureau of the Census for the 4 crop seasons 1949-50 through 1952-53, show an average month-end storage of soybeans at the mills equal to from 2 to 2.5 months average processing requirement. This is roughly equivalent to the corresponding figure for seed storage at cottonseed oil mills.

However, many of the soybean plants operate 11 or 12 months. This obviously requires more soybeans than an average supply sufficient for 2.5 months or a total supply sufficient for 5 months of operation. Because nearly all of the crop is harvested by the end of November, it seems a reasonable assumption that essentially all soybeans moving as rapidly as transportation facilities would handle them would reach the crushing plants by the end of December. Yet on December 31, in the 4 years examined, two-thirds of the country's soybean stocks, or about 48 percent of the season's crush, were still stored elsewhere than at the crushing plants.

This should be the equivalent of a storage stock for 90 to 100 days of operation. By the end of December the industry's stocks at mills have already been decreasing for about 60 days, however, and so storage space used is significantly greater than would appear from these figures for the end of December. The comparisons cannot be closely accurate for any single mill or season because they represent totals for the industry and averages for the 4 seasons 1949-50 through 1952-53. Nevertheless, they clearly indicate the extensive use that the soybean processing industry makes of storage along the marketing channel between the farm and the processing plant. In fact, in a proximate way the position of this storage away from the plants is regularly recorded. Table 11 shows the principal positions of soybean storage in the United States by quarters. Processing plants and farm storage accounted for almost exactly equal amounts of stocks on December 31, for the 4 years shown, and between them accounted for 75 percent of all stocks.

For the 3 seasons 1949-50, 1950-51, and 1952-53, average month-end stocks were 2.6, 2.4, and 2.5 average months' requirements, respectively, whereas the 1951-52 season, when price controls were in effect, showed stocks of only 1.9 months' processing requirements. The occurrence of the smallest stocks in the year when price regulations prevented any great increase in value of inventories, and not in the year of least processing, indicated that the processors manage their soybean inventories partially as trading stocks rather than entirely as a physically determined operating requirement (table 12).

For the industry as a whole it is clear that about half of the season's soybean supply moved to the plants after December. It is equally clear, however, that the management of an individual plant might during harvest obtain and store at the plant a sufficient supply for the entire season, or he might only store a working inventory. A conclusion apparently can be drawn that, normally, these two extreme methods of procurement are closely competitive when all costs and all advantages are considered. Among individual plants, however, there are wide variations. Commercial grain elevators were scattered throughout the Soybean Belt (fig. 5).

Table 11.--Soybeans: Quantity stored by position, United States, by quarters, October 1949-July 1953

Year and quarter	Total		Crushing plants		Terminal markets		Interior mills - elevators		Farms		CCC	
	Quantity stored	Percentage	Quantity stored	Percentage	Quantity stored	Percentage	Quantity stored	Percentage	Quantity stored	Percentage	Quantity stored	Percentage
	1,000 bushels	Percent	1,000 bushels	Percent	1,000 bushels	Percent	1,000 bushels	Percent	1,000 bushels	Percent	1,000 bushels	Percent
1949-50												
October	3,181	100.0	285	9.0	462	14.5	213	6.7	2,221	69.8		
January	179,803	100.0	66,508	37.0	16,133	9.0	35,203	19.6	61,959	34.4		
April	121,553	100.0	47,991	39.5	10,241	8.4	17,517	14.4	45,804	37.7		
July	46,217	100.0	28,478	61.6	6,190	13.4	4,359	9.4	7,190	15.6		
1950-51												
October	2,907	100.0	502	17.3	920	31.6	244	8.4	1,241	42.7		
January	231,751	100.0	77,163	33.3	13,915	6.0	38,945	16.8	101,728	43.9		
April	143,329	100.0	63,137	44.1	12,513	8.7	19,594	13.7	48,085	33.5		
July	52,143	100.0	33,584	64.4	4,201	8.0	4,362	8.4	9,996	19.2		
1951-52												
October	4,159	100.0	552	13.3	670	16.1	262	6.3	2,675	64.3		
January	220,178	100.0	61,852	28.1	9,760	4.4	44,399	20.2	104,167	47.3		
April	130,118	100.0	42,708	32.8	5,457	4.2	21,858	16.8	60,095	46.2		
July	45,151	100.0	30,838	68.3	3,809	8.4	4,640	10.3	5,864	13.0		
1952-53												
October	3,575	100.0	611	17.1	710	19.9	296	8.3	1,958	54.7	0	0
January	226,250	100.0	79,852	35.3	13,394	5.9	48,346	21.4	83,621	37.0	1,037	.4
April	147,062	100.0	49,613	33.7	9,048	6.2	27,926	19.0	59,660	40.6	815	.5
July	62,289	100.0	26,905	43.2	3,245	5.2	11,390	18.3	20,393	32.7	356	.6

Table 12.--Soybeans: Quantity crushed and mill stocks, United States, by months, August 1949-July 1953

Month	1949-50			1950-51		
	Quantity crushed	Stocks at end of month	Stocks as percentage of crushed	Quantity crushed	Stocks at end of month	Stocks as percentage of crushed
	1,000 tons	1,000 tons	Percent	1,000 tons	1,000 tons	Percent
August	407	196	48	462	270	58
September	360	318	88	409	75	18
October	526	1,907	362	587	1,736	296
November	514	2,127	414	684	2,436	356
December	519	1,995	384	741	2,315	312
January	509	1,782	350	753	2,372	315
February	466	1,627	349	675	2,201	326
March	544	1,440	265	743	1,894	255
April	516	1,250	242	659	1,629	247
May	506	1,042	206	639	1,274	199
June	419	854	204	537	1,008	188
July	469	579	123	535	685	128
Total	5,755			7,424		
Average	480	1,260	263	619	1,491	241

	1951-52			1952-53		
August	565	293	52	526	272	52
September	443	128	29	449	349	78
October	647	1,751	271	675	2,565	380
November	692	2,042	295	660	2,693	408
December	697	1,856	266	642	2,396	373
January	721	1,527	212	646	1,972	305
February	674	1,483	220	560	1,675	299
March	646	1,281	198	613	1,488	243
April	604	969	160	576	1,343	233
May	590	855	145	620	1,031	166
June	559	925	165	519	807	155
July	526	670	127	490	566	116
Total	7,364			6,976		
Average	614	1,148	187	581	1,430	246

Figure 5.--Silo type commercial grain elevators

This conclusion is supported also by results of the survey of storage capacities at soybean-processing plants. Average storage capacity at the surveyed plants was equal to about that required for 143 days of operation at the rated oil-extraction capacities of the plants. The reports received do not permit a simple statement of a specific capacity most frequently found. Even a mathematical calculation of the most frequent capacity could not be trusted to portray the industry position accurately. It appears to be close to 120 days (table 13). The storage structure must, of course, accommodate

Table 13.--Soybean oil mills: Distribution by storage capacity for soybeans, United States, 1951

Storage capacity in terms of daily crushing capacity	Mills	
	Number	Percent
Under 21 days	8	9.9
21 - 40	3	3.7
41 - 60	7	8.7
61 - 80	10	12.4
81 - 100	7	8.5
101 - 120	10	12.4
121 - 140	8	9.8
141 - 160	4	5.0
161 - 180	9	11.1
181 - 200	3	3.7
201 - 220	0	0
221 and over	12	14.8
Total	81	100.0

the maximum stock held at any time; but average stocks in the 3 seasons compared were only 59 percent of the maximum stocks, as shown by the Census reports (table 12).

Reducing the average capacity of 143 days accordingly would give an estimated average stock of 112 days, or 3.7 months' supply, if the maximum stock held was equal to capacity. Actually, both operation and storage were far below capacity, with average storage equaling between 2 and 2.5 months' average processing requirement. A check of the 4 seasons 1949-50 through 1952-53 shows, however, that, on the average, the November 30 stocks at processing plants equaled the amount processed from November 30 till about March 15.

Comparison of storage at processing plants for soybeans and cottonseed is shown in figure 2. The chart shows, as averages for the 4 seasons 1949-50 through 1952-53, monthly seed receipts at soybean and cottonseed oil mills. Two general differences appear between the situation with the two types of seed.

First, cottonseed storage had a more extended period of heavy receipts at mills, due to differences in climatic conditions and cotton-picking seasons in the Cotton Belt. Secondly, through the use of farm and commercial storage, the soybean movement along the marketing channels continued through the winter with greater strength than the cottonseed movement.

In the months December through July, for the 4 seasons compared, soybean plants received 45 percent of their season's supply. In the same months cottonseed oil mills received 23 percent of their supply, approximately half as great a part. If the soybeans making up this difference had been received at processing plants before November 30, they would have increased the industry's maximum stocks by more than 150 percent, and, by a very conservative estimate, doubled the storage space required at soybean-processing plants. The use of such additional storage space not only would have been restricted to a short period but transportation and handling facilities would have been heavily taxed to deliver so many soybeans without, at least, brief storage at some preceding point.

Soybean Oil

Industry reports to the Bureau of the Census indicate that soybean oil stocks at the oil mills represent production for an even shorter period than is the case with cottonseed oil. Total end-of-month soybean oil stocks, both crude and refined, in all positions were the equivalent of 27 percent of average monthly crude oil production for the years studied. Stocks of crude oil at soybean-processing plants fluctuated roughly from a fourth to a half of the crude stocks. As an average these stocks of crude soybean oil at processing plants were the equivalent of a sixth to two-fifths of a month's production, or 5 to 12 days' output. The figures represent the 4 seasons 1949-50 through 1952-53, as reported by the industry (table 14).

Usually, refiners hold crude oil longer than oil millers do. They probably prefer to refine it as soon as possible in order to minimize deterioration, but this appears to be much less important with soybean oil than with cottonseed oil. Neither at the oil mill nor at the refinery is there any indication that the oil is held in its crude form longer than necessary to get it into the refining process. Of course, owing to the fact that soybean receipts at mills are less seasonal than cottonseed receipts, and that soybeans have better keeping qualities than cottonseed, soybean oil mills average longer operating seasons and less variation in volume output. As a consequence there is relatively less storage of soybean oil in all forms and positions than is necessary for cottonseed oil (table 15). Figure 6 shows monthly stocks of crude soybean oil in relation to its production and consumption. Consumption in this case included refining. Figure 7 shows in a similar way monthly storage of all soybean oil (crude plus refined) in relation to production of oil (crude) and consumption of crude and refined oil (refining omitted). Figures 6 and 7 are strictly parallel to figures 3 and 4 for cottonseed oil.

Table 14.--Soybean oil: Quantity produced and mill stocks, United States, by months, August 1949-July 1953

Month	1949-50			1950-51		
	Quantity produced	Stocks at end of month	Stocks as percentage of production	Quantity produced	Stocks at end of month	Stocks as percentage of production
	1,000 pounds	1,000 pounds	Percent	1,000 pounds	1,000 pounds	Percent
August	136,015	26,574	19.5	157,026	27,478	17.4
September	120,756	20,012	16.5	137,695	19,959	14.4
October	172,491	29,840	17.2	190,723	29,983	15.7
November	165,473	25,881	15.6	216,217	31,532	14.5
December	166,855	30,589	18.3	235,609	42,220	17.9
January	165,776	32,678	19.7	240,961	43,483	18.0
February	153,714	31,329	20.3	216,183	50,257	23.2
March	177,724	27,804	15.6	240,668	50,490	20.9
April	170,251	35,044	20.5	212,383	51,004	24.0
May	169,001	36,447	21.5	209,657	43,807	20.8
June	141,705	36,927	26.0	177,888	38,569	21.7
July	159,261	53,731	33.7	176,597	47,729	27.0
Total	1,899,022			2,410,907		
Average	158,252	32,238	20.4	200,909	42,209	21.0

	1951-52			1952-53		
August	188,398	44,529	23.6	178,795	53,585	29.9
September	148,969	42,931	28.8	155,632	53,672	34.4
October	215,053	65,977	30.6	238,300	49,562	20.7
November	224,983	77,149	34.2	230,755	45,262	19.6
December	221,798	96,650	43.5	226,935	36,178	15.9
January	234,386	113,711	48.5	231,000	43,234	18.7
February	222,247	110,673	49.7	200,412	43,812	21.8
March	218,381	109,645	50.2	221,783	48,618	21.9
April	204,138	112,344	55.0	208,414	53,046	25.4
May	199,022	95,224	47.8	226,293	73,967	32.6
June	189,977	86,276	45.4	190,096	68,758	36.1
July	179,498	81,159	45.2	179,492	65,709	36.6
Total	2,446,850			2,487,907		
Average	203,904	86,356	42.3	207,326	52,950	25.5

Table 15.--Soybean oil: Quantity produced and stocks, United States, by months, August 1949-July 1953

Year and month	Quantity produced	Stocks at end of month				Stocks as percentage of--		
		Total	Refined	Crude		Production	Total stocks	Total crude stocks
				Total	At mills			
	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	Percent	Percent	Percent
1949-50								
August	136,015	148,309	76,384	71,925	26,574	20	18	37
September	120,756	113,013	56,790	56,223	20,012	17	18	36
October	172,491	122,724	55,410	67,314	29,840	17	24	44
November	165,473	127,381	57,976	69,405	25,881	16	20	37
December	166,855	150,101	59,985	90,116	30,589	18	20	34
January	165,776	149,612	66,650	82,962	32,678	20	22	39
February	153,714	145,716	66,791	78,925	31,329	20	22	40
March	177,724	151,346	64,118	87,228	27,804	16	18	32
April	170,251	173,037	71,651	101,386	35,044	21	20	35
May	169,001	166,271	74,809	91,462	36,447	22	22	40
June	141,705	165,866	77,528	88,338	36,927	26	22	42
July	159,261	177,810	73,387	104,423	53,731	34	30	51
Year	1,899,022							
1950-51								
August	157,026	143,092	67,121	75,971	27,478	17	19	36
September	137,695	113,474	60,116	53,358	19,959	14	18	37
October	190,723	117,170	51,274	65,896	29,983	16	26	46
November	216,217	132,207	51,045	81,162	31,532	15	24	39
December	235,609	154,065	54,237	99,828	42,220	18	27	42
January	240,961	178,680	65,175	113,505	43,483	18	24	38
February	216,183	201,761	70,495	131,266	50,257	23	25	38
March	240,668	226,512	95,790	130,722	50,490	21	22	39
April	212,383	255,506	129,607	125,899	51,004	24	20	41
May	209,657	244,490	119,641	124,849	43,807	21	18	35
June	177,188	221,105	113,715	107,390	38,569	22	17	36
July	176,597	212,091	93,343	116,748	47,729	27	23	41
Year	2,410,907							
1951-52								
August	188,398	193,255	85,236	108,019	44,529	24	23	41
September	148,969	170,777	79,870	90,907	42,931	29	25	47
October	215,053	196,591	75,261	121,330	65,977	31	34	54
November	224,983	238,229	73,602	164,627	77,149	34	32	47
December	221,798	281,391	83,920	197,471	96,650	44	34	49
January	234,386	328,042	97,092	230,950	113,711	49	35	49
February	222,247	343,252	102,742	240,510	110,673	50	32	46
March	218,381	354,486	109,459	245,027	109,645	50	31	45
April	204,138	354,306	130,234	224,072	112,344	55	32	50
May	199,002	324,193	126,720	197,473	95,224	48	29	48
June	189,977	296,402	111,280	185,122	86,276	45	29	47
July	179,498	296,748	116,618	180,130	81,159	45	27	45
Year	2,446,830							
1952-53								
August	178,795	260,636	124,222	136,414	53,585	30	21	39
September	155,632	194,307	96,020	98,287	53,672	34	28	55
October	238,300	200,306	75,677	124,629	49,562	21	25	40
November	230,755	213,233	73,545	139,688	45,262	20	21	32
December	226,935	237,390	83,716	153,674	36,178	16	15	24
January	231,000	253,669	87,465	166,204	43,234	19	17	26
February	200,412	244,583	88,275	156,308	43,812	22	18	28
March	221,783	256,536	98,342	158,194	48,618	22	19	31
April	208,414	260,903	103,952	156,951	53,046	25	20	34
May	226,293	291,737	100,864	190,873	73,967	33	25	39
June	190,086	273,223	106,456	166,767	68,758	36	25	41
July	179,503	270,274	95,343	176,495	65,709	37	24	37
Year	2,487,908							

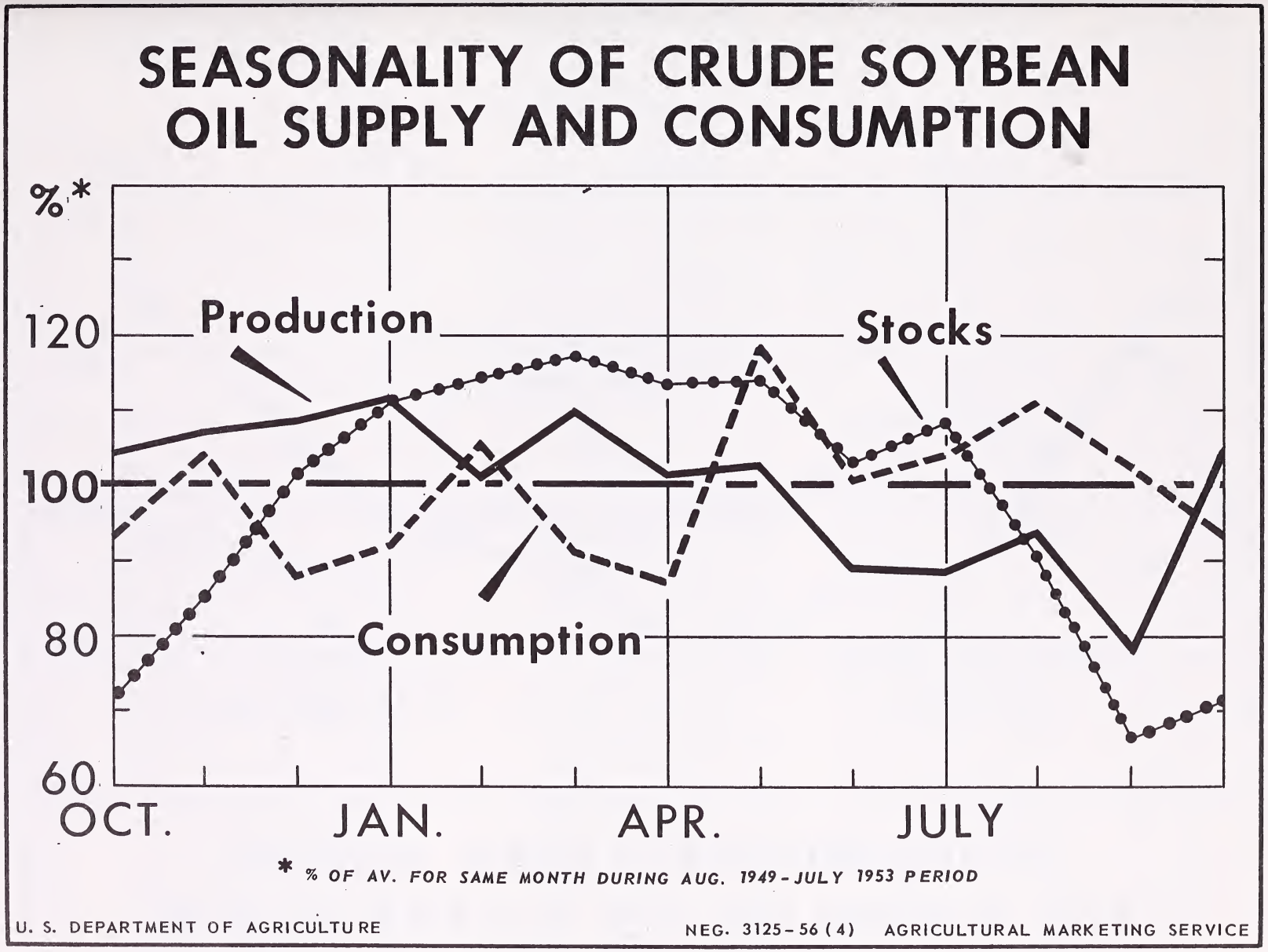

SEASONALITY OF CRUDE SOYBEAN OIL SUPPLY AND CONSUMPTION
%*
120
100
80
60
Production
Stocks
Consumption
OCT.
JAN.
APR.
JULY
* % OF AV. FOR SAME MONTH DURING AUG. 1949 - JULY 1953 PERIOD
U. S. DEPARTMENT OF AGRICULTURE
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Figure 6

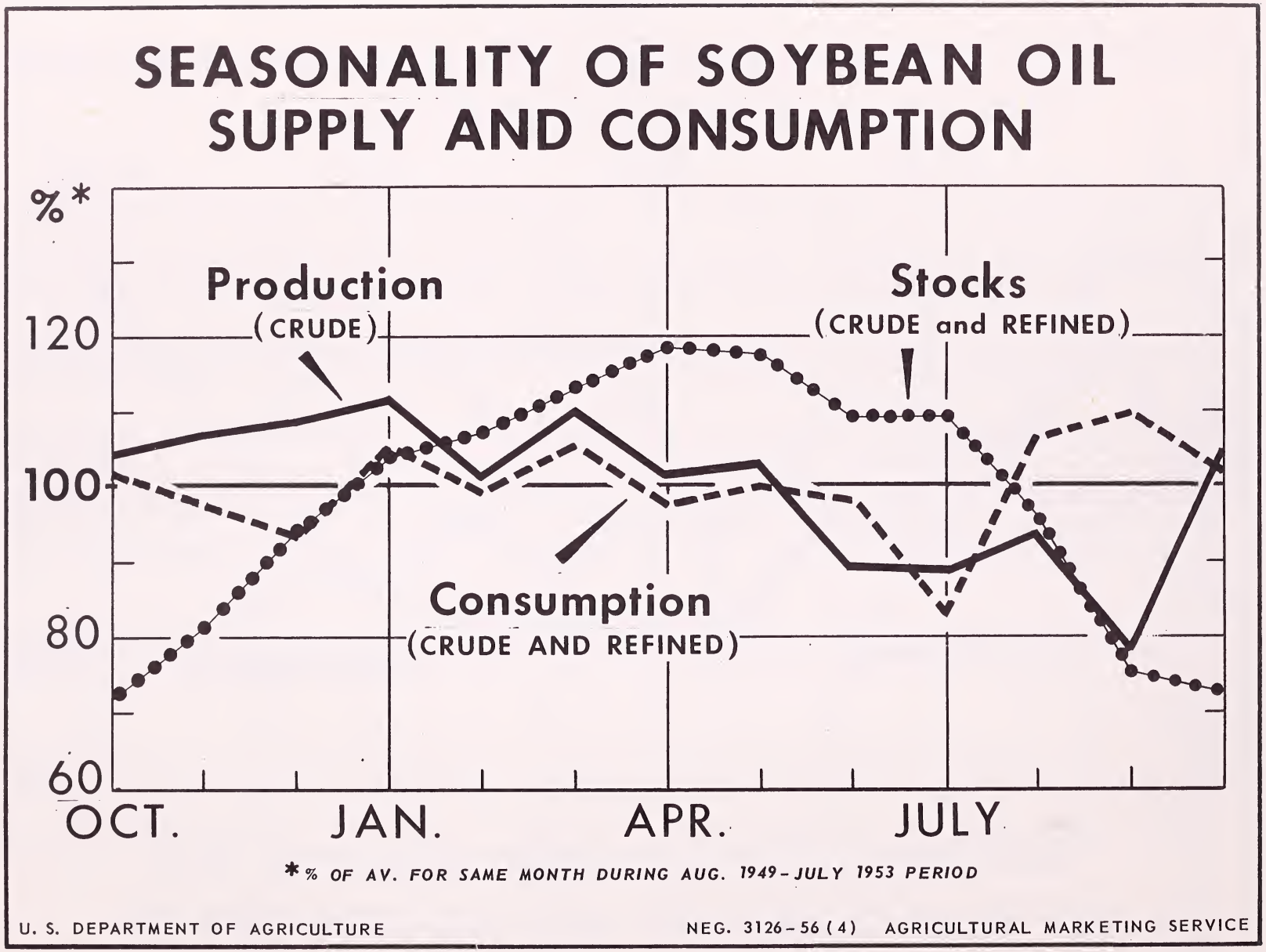
SEASONALITY OF SOYBEAN OIL SUPPLY AND CONSUMPTION
%*
120
100
80
60
Production
(CRUDE)
Stocks
(CRUDE and REFINED)
Consumption
(CRUDE AND REFINED)
OCT.
JAN.
APR.
JULY
* % OF AV. FOR SAME MONTH DURING AUG. 1949-JULY 1953 PERIOD
U. S. DEPARTMENT OF AGRICULTURE
NEG. 3126-56 (4) AGRICULTURAL MARKETING SERVICE

Figure 7

The survey of mill storage capacity shows oil storage facilities adequate to hold about 27 days' rated capacity output of oil, on the average. With the industry operating at 80 percent of capacity, as has been assumed here, this figure would be raised to about 34 days. With regular filling and emptying, at maximum efficiency, this capacity would permit average stocks of nearly 17 days' output, or nearly twice the reported average month-end stocks.

Twice during the 4-year period, however, in the spring of each 1951 and 1953 month-end stocks amounted to more than twice the average stocks for the period. To carry such an amount as revolving working stocks would require the total amount of oil storage space found at the mills. Nevertheless, throughout the 1950-51 and 1952-53 seasons, the month-end stocks of oil at mills were persistently higher than appears to have been necessary for operating stocks. In 1951-52, with production only 4 percent lower, stocks averaged less than 50 percent of the preceding or following season. These figures suggest that at least a half of the 1950-51 and 1952-53 stocks must be considered as trading stocks, which were not necessary to the physical operation of the milling process.

Here and there, a mill has storage space for only 2 or 3 days' output of oil; but such cases are to be expected where integration is as common as in soybean processing. Where the oil is refined near the mill, and by an allied plant, the question whether storage is considered to be at the oil mill or refinery may be purely a formal one requiring an arbitrary answer. There are also a few mills with several times the oil storage space that is needed for good operation of the oil mill. This too is unusual and requires little consideration as a part of the overall picture. The usual situation is for the soybean-processing plants to have a good deal more oil-storage capacity than needed for operating stocks, the excess of which must be considered as facilities for trading stocks (table 16).

Soybean Meal

Industry reports of soybean-meal stocks held by processors at month-end averaged from a tenth to a fourth of an average month's production. If 1952-53 is omitted, however, the variation is from one-sixth to one-fifth. The ratio of 1 to 10 under price controls in 1951-52 again helps to arrive at a reasonable minimum operating stock. In 1952-53, with average meal production smaller than the average for the preceding year, the average stocks were equivalent to 250 percent of the preceding year's average. In only 3 months of 1952-53 were stocks less than the maximum stock of 1951-52. It seems reasonable to expect, of course, that under price regulation, with no rise in price anticipated, processors would see no marketing advantage in holding their output. If that expectation is accepted, then stocks under such circumstances should be a good measure of operating requirements.

In this year of minimum stocks, 1951-52, the average amount of stored meal reported monthly was equivalent to 10 percent of the average month's production, and the maximum stock during the season was 17 percent of

Table 16.--Soybean oil mills: Distribution by storage capacity for soybean oil, United States, 1951

Storage capacity in terms of daily crushing capacity	Mills	
	Number	Percent
Under 6 days	28	34.7
6 - 10	19	23.5
11 - 15	7	8.6
16 - 20	3	3.7
21 - 25	3	3.7
26 - 30	4	4.9
31 - 35	3	3.7
36 - 40	0	0
41 - 45	0	0
46 - 50	3	3.7
51 - 100	4	4.9
101 and over	7	8.6
Total	81	100.0

average monthly production. As working stocks these amounts must be built up and shipped out regularly; with maximum efficiency this would require twice as much space as the average stock to be held, or 34 percent of a month's production. In addition, a reserve of storage capacity for emergencies would be necessary. If 20 percent is added to the capacity for that purpose, the storage space requirement becomes about 40 percent of the average month's output of meal (table 17).

Table 17.--Soybean oil mills: Distribution by storage capacity for soybean meal, United States, 1951

Storage capacity in terms of daily production capacity	Mills	
	Number	Percent
Under 11 days	15	18.5
11 - 20	33	40.8
21 - 30	17	21.0
31 - 40	7	8.6
41 - 50	4	4.9
51 and over	5	6.2
Total	81	100.0

A check of the mill survey for 5 principal soybean States (Illinois, Iowa, Missouri, Indiana, and Ohio) indicates that meal storage capacity at the mills equaled about 29 days' production at rated capacity. At the rates of soybean processing during the period 1949-50 through 1952-53 this was somewhat more than twice the meal storage requirements indicated by the monthly operating reports (table 18).

Table 18.--Soybean meal: Quantity produced and mill stocks, United States, by months, August 1949-July 1953

Month	1949-50			1950-51		
	Quantity produced	Stocks at end of month	Stocks as percentage of production	Quantity produced	Stocks at end of month	Stocks as percentage of production
	Tons	Tons	Percent	Tons	Tons	Percent
August	318,938	20,376	6.4	363,695	49,182	13.5
September	279,859	13,317	4.8	318,339	35,224	11.1
October	414,499	35,892	8.7	453,278	41,238	9.1
November	406,444	42,490	10.4	536,087	54,601	10.2
December	407,182	47,381	11.6	575,979	72,432	12.6
January	402,882	62,444	15.5	590,371	92,688	15.7
February	364,849	70,733	19.4	529,309	104,400	19.7
March	422,853	77,728	18.4	580,950	141,245	24.3
April	403,477	86,837	21.5	512,308	172,254	33.6
May	394,162	83,622	21.2	499,875	179,953	36.0
June	323,249	65,965	20.4	418,251	148,841	35.6
July	364,048	49,995	13.7	413,416	108,694	26.3
Total	4,502,442			5,791,858		
Average	375,204	54,732	14.6	482,653	100,063	20.7

Month	1951-52			1952-53		
August	441,914	68,461	15.2	418,562	63,737	15.5
September	344,966	35,505	14.7	351,374	51,546	10.3
October	500,391	27,093	11.2	539,465	60,469	5.4
November	536,506	30,496	15.1	518,539	78,110	5.7
December	542,334	34,077	17.6	506,695	89,231	6.3
January	563,756	32,690	21.6	506,471	109,174	5.8
February	525,048	46,702	31.5	442,738	139,399	8.9
March	494,712	53,988	31.8	485,562	154,223	10.9
April	467,227	57,023	36.7	456,080	167,319	12.2
May	457,917	59,041	35.4	488,621	172,836	12.9
June	435,114	57,784	41.7	404,204	168,715	13.3
July	410,779	71,315	17.4	387,583	118,388	30.5
Total	5,720,664			5,505,894		
Average	476,722	47,848	10.0	458,824	114,429	24.9

This meal-storage capacity was very unevenly distributed among the plants, however, with about 30 percent of the plants having less than 5 days' output equivalent in meal storage, and about 65 percent having less than 15 days. A few had meal storage sufficient for several months' production. It is believed that a substantial proportion of those reporting less than 5 days' storage capacity were oil mills integrated with feed-mixing plants. Their data for holding bins cannot be considered as typical of mill storage but probably represented largely either emergency facilities or a bookkeeping allocation between the allied operations.

STORAGE OF FLAXSEED AND PEANUTS AT OIL MILLS

Regarding flaxseed and peanut storage at oil mills, the general situation is that storage capacities are adequate except in isolated instances. Such capacities at flaxseed mills and peanut oil mills cannot be analyzed in the same manner as cottonseed and soybean oil-mill storage capacities. The number of mills processing only flaxseed or peanuts for oil is so small as to give little opportunity for classification. A majority of the mills that process either of these two oilseeds also process at least one other variety of seed--usually soybeans or cottonseed. For flaxseed in the Northern Lake States the principal companion seed is the soybean; for flaxseed in the Southwest and for peanuts, it is cottonseed.

Thus there are no separate and distinct oil-mill storage structures or problems for flaxseed and peanuts, except in a few cases. The survey indicated that mill storage space for the seed, the oil, and the meal was generally adequate but could not be considered separately from the other materials (and their products) processed in the same plants. The most troublesome problems in flaxseed storage at mills appear to be those related to spoilage. They often become especially acute in the Southwest when spring-harvested flaxseed is held in storage into warm weather. Special techniques, different from the practices here surveyed, require investigation in relation to those problems.

Oil-stock peanuts are not usually stored at the oil mills for long periods or in large amounts. In common practice they first appear as discards of some sort at the various plants where peanuts are carried, shelled, sorted, and graded for direct edible use. The oil stock moves to the oil mills intermittently during the season as it accumulates. 5/

5/ Agnew, Donald B. and Jackson, Donald. Storage in Marketing Farmers' Stock Peanuts. U. S. Dept. Agr. Mktg. Res. Rpt. No. 88, 55 pp., illus. 1955.

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