AGRICULTURAL APPROPRIATIONS FOR 1963

SUPPLEMENT TO HEARINGS

BEFORE THE

SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS UNITED STATES SENATE

EIGHTY-SEVENTH CONGRESS

SECOND SESSION

ON

H.R. 12648

MAKING APPROPRIATIONS FOR THE DEPARTMENT OF AGRICULTURE AND THE FARM CREDIT ADMINISTRATION FOR THE FISCAL YEAR ENDING JUNE 30, 1963, AND FOR OTHER PURPOSES

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AGRICULTURAL APPROPRIATIONS FOR 1963

SUPPLEMENT TO HEARINGS

DEPARTMENT OF AGRICULTURE,
Washington, D.C., September 19, 1961.

Hon. RICHARD B. RUSSELL,
Chairman, Subcommittee on Agricultural Appropriations,
U.S. Senate, Washington, D.C.

DEAR SENATOR RUSSELL: In Senate Report No. 394, pages 5 and 6, on the 1962 agricultural and farm credit appropriation bill, the Senate Committee on Appropriations included the following directive:

"The committee has considered a number of requests for additional research facilities, but has taken no action to approve funds for additional construction. The Secretary of Agriculture is requested to submit reports on two items which were considered by the committee. The first item is with regard to a national electrification research center. The Department is requested to examine into this matter as to the need, function to be performed, cost of construction, and the cost of operation thereafter; together with alternatives including whether research could be expanded in existing research locations and done by contract. If it is finally determined that a research facility is needed, the committee would like to know whether the proposed research work is of such nature that it would be feasible to divide the research effort to carry it out in two or more facilities. After this matter has been thoroughly reviewed the committee will appreciate receiving a report on this subject, including recommendations of the Secretary on the matter."

There is submitted herewith the Department's report on needs, function to be performed, cost of construction, and the cost of operation thereafter of a national farm electrification research center. Consideration has been given to alternatives of expanding research in existing research locations and doing the work by contract.

The Department recognizes the need for an expansion of farm electrification research, with attention focused primarily on basic research; and considers that research at a national center would be more effective than expanding work at existing locations or undertaking large-scale research by contract. While there would be some advantages in having laboratories located in areas differing markedly in climate and crop production, it is believed that concentration of work at one location would be more effective and less costly. The report includes estimated costs of construction and staffing the proposed single laboratory, as well as alternative costs for two complementary laboratories in northern and southern areas.

In developing the information, a group of research specialists from the Agricultural Research Service assembled pertinent available material. Contacts were made with interested Federal and State research agencies and representatives of power supplier groups, farm and electrical machinery manufacturers, farm organizations, and individuals. Information received from them was considered in developing the recommendations contained in this report and several lists of research needs have been appended to the report.

The importance of farm electrification research was discussed in my letter of April 3, 1961, to Senator Ellender, chairman, Committee on Agriculture and Forestry, when a report was made on S. 859 which would provide for a national research center in Minnesota. This letter appears on page 1085 of the 1962 Senate hearings.

Sincerely yours,

ORVILLE L. FREEMAN, *Secretary.*

REPORT ON PROPOSED NATIONAL FARM ELECTRIFICATION RESEARCH CENTER

U.S. Department of Agriculture, August, 1961

SUMMARY

Electric service is now available from central stations on 96.5 percent of all farms in the United States, as compared with 1.6 percent in 1919 and 10.9 percent in 1934. Thus, farm electrification is a relatively new development, and its application to and potentialities in agriculture are relatively unexplored by research. However, the use of nearly 27 billion kilowatt-hours in 1959 at a cost of more than $616 million indicates the importance of electric energy to the farm families of this country. The investments of more than $5 billion to provide electric service to farms and of many more billions by farmers to use the service have been of economic importance to the entire Nation.

The total amount expended in farm electrification research by the States and by the Federal Government is slighly more than $1,200,000 a year. Slightly less than 60 percent of this is State-supported research; approximately $500,000 is provided by the Federal Government. Some 60 percent of the Federal funds are expended for cooperative work with 13 State experiment stations. Progress has been made toward solving some problems in which electrical applications are involved, but more fundamental research on the use of electricity in plant and animal production and insect control is urgently needed.

The following organizations have urged expansion of farm electrification research: Rural Electrification Administration (REA), American Society of Agricultural Engineers (ASAE), Edison Electric Institute (EEI) and National Rural Electric Cooperative Association (NRECA). The program suggested provides for: (1) constructing and staffing a central farm electrification research laboratory and (2) strengthening projects at several existing locations.

The purpose of such a laboratory or laboratories would be to undertake research to increase the number and variety of physically sound and economically favorable uses to which farms and nonfarm rural households can directly apply the electric energy available to them. Basic research necessary to solve problems limiting the number and variety of such uses would also be undertaken.

If additional funds are available, research could be strengthened at existing locations, particularly those at which a single Federal engineer is located, by the addition of a junior engineer. However, research can be widely expanded at very few, if any, of the existing locations, including Beltsville, unless additional facilities are provided. Research facilities of the State agricultural experiment stations, as well as the Department are crowded. Facilities, adequate for conducting the farm electrification research planned, are practically nonexistent at State stations. The Department believes that one or more laboratories will make a greater contribution than could be accomplished by strengthening the 13 existing field stations.

Contracting for the farm electrification research proposed is believed, in general, to be less desirable and satisfactory than by use of one or more laboratories at which Department engineers and various biological scientists would cooperate. Another important factor favoring the laboratory is that special instruments, equipment, and machines used in a research project there would continue in service while those used under contract would not be available after contract termination.

Basic and applied research on the major groups of electrical applications should include the following broad lines of study:

1. Development of automatic or semiautomatic electric labor-reducing equipment and controls, including automatic systems involving several machines.
2. Development of electric equipment with supplementary use of solar radiation for modification of environments for plant and animal production by controlling lighting, heating, cooling, and air-gas mixtures.
3. Development of electromagnetic radiation devices (ultraviolet, infrared, microwave, radiofrequency, X-ray and gamma ray) useful in direct treatment of soils, plants, and animals and their products, and in reducing losses due to insects and plant and animal diseases.
4. Development of functional requirements and performance characteristics of electric equipment as a basis for establishing adequacy in design and safety in operation.

5. Determination of effects of new electric applications on the demand and diversity characteristics of the farm electric system.

6. Development of technical measurements and instrumentation to detect bioelectric phenomena which, though imperceptible to man, may influence the behavior of animals, plants, insects, and plant and animal pathogens.

To conduct research on these problems, both engineers and the full-time cooperative effort of physiologists from the animal, plant, and entomological specialties would be needed. Close cooperation will also be necessary with animal and plant pathologists, biochemists, agricultural engineers in the States, and with industry.

Basic and applied research on broad problems along lines proposed for the major applications of electricity could be conducted at one central laboratory or at two, located in areas differing in climate and nature of crops produced. If provision is made for two laboratories, one Northern and one Southern location is desirable. Information from either one or two laboratories would be made available to Department engineers, cooperating biological scientists, and other investigators on farm electrification for consideration and guidance in connection with research in other areas.

The type of research on farm electrification problems considered appropriate for Federal attention and the estimate of the number of senior scientists required to conduct the research needed are listed below for a single laboratory and for each of two complementary laboratories. Included are estimated costs for the construction of each laboratory and for their operation.

Type of research	Number of senior scientists		
	Single laboratory	Two laboratories	
		North	South
Agricultural and electrical engineers:			
Labor equipment, controls	3	2.0	1.0
Environmental modification equipment	4	2.5	2.5
Electromagnetic radiation equipment	4	2.0	3.5
Equipment performance characteristics	2	1.5	1.5
Electric demand and wiring	2	1.5	1.5
Instrumentation development	3	.5	3.0
Total agricultural and electrical engineers	18	10.0	13.0
Biological scientists	4	2.0	2.0
Total	22	12.0	15.0

	Estimated construction cost	Annual operating cost
One laboratory	$1,875,000	$880,000
Complementary laboratories:		
North	1,100,000	480,000
South	1,260,000	600,000

INTRODUCTION

Purpose of report.—This is a report on a national farm electrification research center requested by the Senate Subcommittee on Agricultural Appropriations in its report on the appropriation bill for the fiscal year 1962. The request of the committee was as follows:

"The Secretary of Agriculture is requested to submit reports on two items which were considered by the committee. The first item is with regard to a national electrification research center. The Department is requested to examine into this matter as to the need, function to be performed, cost of construction, and the cost of operation thereafter; together with alternatives including whether research could be expanded in existing research locations and done by contract. If it is finally determined that a research facility is needed the committee would like to know whether the proposed research work is of such nature that it would be feasible to divide the research effort to carry it out in two or more facilities. After this matter has been thoroughly reviewed, the committee will appreciate receiving a report on this subject, including recommendations of the Secretary on the matter."

Prior to the issuance of this Senate committee report, two bills were introduced in the 1st session, 87th Congress, to provide for a Farm Electrification Research Laboratory. S. 589 introduced in the Senate February 9, 1961, by Senator Humphrey, specified the State of Minnesota as the site of the proposed Laboratory. H.R. 7005, introduced in the House of Representatives May 11, 1961, by Congressman Coad omitted reference to a location.

History.—Studies on the application of electricity to the farm were begun in the United States in 1923 in Minnesota under the sponsorship of the Committee on the Relation of Electricity to Agriculture. The CREA was organized with the support of the National Electric Light Association, American Farm Bureau, National Grange, and the U.S. Department of Agriculture. The CREA assisted by local groups organized study programs in 28 States including a National Rural Electric Project at Sandy Spring, Md., with headquarters at the University of Maryland. Economic conditions in the early 1930's forced discontinuance of most of these projects although several have been continued without interruption, particularly in California, New York, and Texas.

Funds specifically appropriated by the Congress for research in farm electrification by USDA became available for the first time in July 1938. A research program organized in cooperation with State experiment stations in Georgia, Indiana, Missouri, New York, and Virginia was just well started when the onset of World War II necessitated transfer of available personnel to problems considered more urgent at the time.

Conferences held by the Agricultural Research Administration and the Rural Electrification Administration during 1944 on cooperation in research on farm and rural-home uses of electricity led to the formulation of an agreement that it was the function of ARA to conduct basic research work on the development, improvement, and testing of farm and household electrical equipment. The Department research program in farm electrification was resumed more actively early in 1946 with continuation of work in Virginia, and initiation of new work in North Carolina, and at the Beltsville Research Center.

Financial support has been gradually increased by the Congress for USDA farm electrification research to the extent that cooperative work is being conducted in 13 States and at Beltsville by a professional staff of 24 agricultural and electrical engineers in cooperation with biological scientists.

The Department of Agriculture has recognized for the past decade the importance of a facility for conducting basic research essential to the support of its farm electrification research program cooperative with the States. The National Rural Electric Cooperative Association has presented a request for funds for such a facility to the Congress each year for the past 5 years; these requests were based on recommendations of its research committee comprised of one representative from each of the 10 regions of the United States.

The Division of Agricultural Engineering, ARS, which conducts much of the farm electrification research in the Department consults each year with research committees of various organizations concerned with farm electrification activities in planning its future program. These organizations include the REA, ASAE (electric utilization research conference committee), NRECA, and EEI. These organizational committees are in active accord with the proposal for a National Farm Electrification Research Laboratory.

Importance of farm electrification to the Nation.—Electric service is now available on 96.5 percent of the farms in the United States. The number of unserved farms exceeds only slightly those served—100,000 (.6 percent)—in 1919. An attached chart shows the progress in extension of service to farms during the period, 1919–60. Table 1 shows the number of farms with central station service by States for selected dates.

An estimated amount of more than $5 billion has been expended to serve these farms. Many more billions of dollars have been expended for electric wiring and equipment to utilize the service on farms. Surveys of intent to purchase additional equipment indicate an additional annual investment of approximately $2 billion primarily for household appliances. The following chart shows the total amount of electric energy used on farms by year for the period 1926 to 1959. During 1926, 278,000 farm customers used 723 million kilowatt-hour costing $21,638,000.

In 1959, 4,549,520 customers used 26,953 million kilowatt-hour at a cost of $616,408,000. Of particular interest has been a rather steady increase in average annual use per customer at a gradually decreasing cost per kilowatt-hour. In the area east of the 100th Meridian (east of the High Plains area) average farm use has increased 400 percent in the past 17 years.

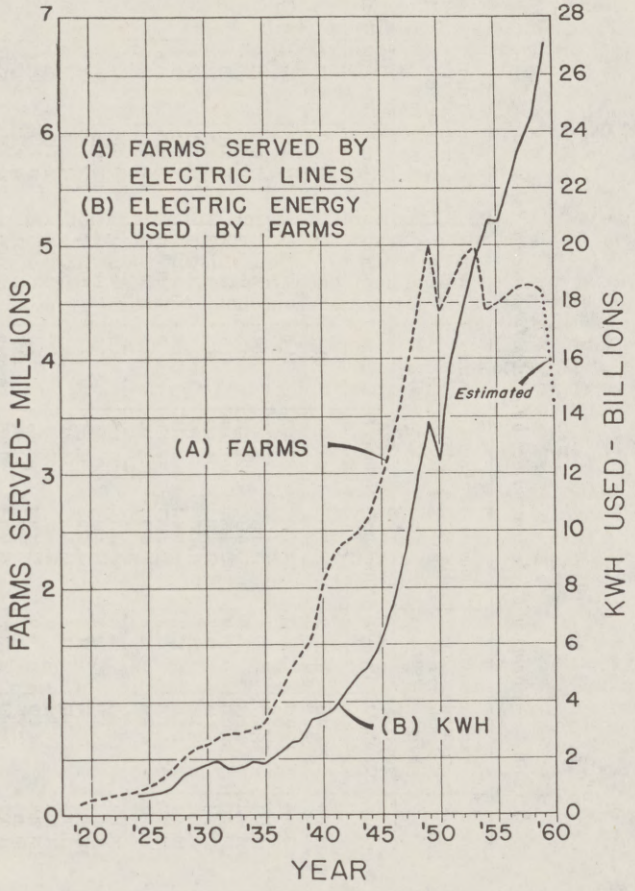
(A) FARMS SERVED BY ELECTRIC LINES
(B) ELECTRIC ENERGY USED BY FARMS
(A) FARMS
(B) KWH
Estimated
FARMS SERVED - MILLIONS
KWH USED - BILLIONS
YEAR
0
1
2
3
4
5
6
7
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
'20
'25
'30
'35
'40
'45
'50
'55
'60

TABLE 1.—*Farms with electric service by States for selected dates*

Area	Farms Jan. 1, 1935	Farms receiving central station electric service Dec. 31, 1934		Farms Apr. 1, 1940	Farms receiving central station electric service Apr. 1, 1940		Farms Apr. 1, 1950	Farms receiving central station electric service Apr. 1, 1950		Farms fall, 1959	Farms receiving central station electric service June 30, 1960	
	Number [1]	Number [2]	Percent	Number [1]	Number [1]	Percent	Number [1]	Number [1]	Percent	Number [3]	Number [4]	Percent
United States	6,812,350	743,954	10.9	6,096,799	1,853,249	30.4	5,382,134	4,154,359	77.2	3,709,913	3,578,300	96.5
Alabama	273,455	11,053	4.0	231,746	33,907	14.6	211,542	144,267	68.2	115,610	111,200	96.2
Alaska										[4] 525	300	61.9
Arizona	18,824	5,577	29.6	18,466	5,607	30.4	10,412	7,535	72.4	7,219	6,700	92.9
Arkansas	253,013	2,943	1.2	216,674	21,303	9.8	182,429	121,587	66.6	95,009	92,350	97.2
California	150,360	81,093	53.9	132,658	107,904	81.3	137,168	123,311	90.0	99,258	97,450	98.2
Colorado	63,644	7,145	11.2	51,436	14,823	28.8	45,578	32,827	72.0	33,390	30,100	90.2
Connecticut	32,157	10,138	31.5	21,163	16,995	80.3	15,615	14,393	92.2	8,292	8,200	98.8
Delaware	10,381	1,791	17.3	8,994	3,545	39.4	7,448	6,092	81.8	5,207	5,000	96.3
Florida	72,857	5,700	7.8	62,248	15,476	24.9	56,921	40,292	70.8	45,098	43,950	97.5
Georgia	250,544	6,956	2.8	216,033	42,409	19.6	198,191	149,105	75.2	106,347	104,750	98.5
Hawaii										[5] 5,750	[5] 3,850	67.0
Idaho	45,113	13,433	29.8	43,663	25,439	58.3	40,284	36,901	91.6	33,667	32,700	97.2
Illinois	231,312	28,379	12.3	213,439	80,027	37.5	195,268	168,658	86.4	154,640	152,000	98.3
Indiana	200,835	23,476	11.7	184,549	91,127	49.4	166,627	152,528	91.5	128,160	127,500	99.5
Iowa	221,986	32,047	14.4	213,318	73,308	34.4	203,159	183,508	90.3	174,707	172,450	98.7
Kansas	174,589	13,224	7.6	156,327	27,960	17.9	131,394	91,747	69.8	104,345	96,100	92.1
Kentucky	278,298	8,480	3.0	252,894	38,607	15.3	218,476	144,796	66.3	150,984	148,100	98.1
Louisiana	170,216	2,826	1.7	150,007	16,058	10.7	124,181	82,932	66.8	74,438	73,200	98.3
Maine	41,907	13,959	33.3	38,980	20,221	51.9	30,358	25,990	85.6	17,360	16,600	95.6
Maryland	44,501	6,791	15.3	42,175	17,170	40.7	36,107	30,164	83.5	25,121	24,000	95.6
Massachusetts	35,094	14,494	41.3	31,897	26,220	82.2	22,220	20,256	91.2	11,178	11,000	98.5
Michigan	196,517	42,152	21.4	187,589	131,126	69.9	155,589	146,549	94.2	111,817	110,700	99.0

Minnesota	203,302	13,783	6.8	197,351	50,075	25.4	179,101	148,328	82.8	145,662	143,900	98.8
Mississippi	311,683	2,802	0.9	291,092	26,078	9.0	251,383	140,212	55.8	138,142	123,800	89.6
Missouri	278,454	17,893	6.4	256,100	39,204	15.3	230,045	157,930	68.7	168,673	162,750	96.5
Montana	50,564	2,768	5.5	41,823	7,947	19.0	35,085	22,915	65.3	28,957	25,950	89.6
Nebraska	133,616	9,544	7.1	121,062	22,832	18.9	107,183	77,354	72.2	90,475	86,150	95.2
Nevada	3,696	946	25.6	3,573	1,555	43.5	3,110	1,811	58.2	2,350	1,900	81.2
New Hampshire	17,695	9,495	53.7	16,554	10,845	65.5	13,391	12,675	94.7	6,542	6,400	98.0
New Jersey	29,375	15,162	51.6	25,835	21,298	82.4	24,838	23,174	93.3	15,458	15,350	99.2
New Mexico	41,369	1,350	3.3	34,105	4,479	13.1	23,599	12,997	55.1	15,919	13,950	87.6
New York	177,025	57,825	32.7	153,238	102,283	66.7	124,977	116,888	93.5	82,355	80,800	98.1
North Carolina	300,967	9,672	3.2	278,276	67,627	24.3	288,508	218,897	75.9	190,567	186,200	97.7
North Dakota	84,606	1,968	2.3	73,962	3,218	4.4	65,401	35,646	54.5	54,928	46,800	85.2
Ohio	255,146	48,048	18.8	233,783	137,680	58.9	199,359	185,297	92.9	140,353	137,400	97.9
Oklahoma	213,325	5,648	2.6	179,687	20,149	11.2	142,246	91,990	64.7	94,675	88,450	93.4
Oregon	64,826	17,839	27.5	61,829	36,369	58.8	59,827	53,425	89.3	42,573	41,450	97.4
Pennsylvania	191,284	45,182	23.6	169,027	94,081	55.7	146,887	133,467	90.9	100,051	97,750	97.7
Rhode Island	4,327	1,975	45.6	3,014	2,457	81.5	2,598	2,411	92.8	1,395	1,350	97.5
South Carolina	165,504	3,796	2.3	137,558	27,568	20.0	139,364	94,842	68.1	78,171	75,050	96.0
South Dakota	83,303	2,939	3.5	72,454	3,981	5.5	66,452	37,487	56.4	55,726	49,150	88.2
Tennessee	273,783	9,727	3.6	247,617	38,884	15.7	231,631	165,005	71.2	157,688	154,050	97.7
Texas	501,017	11,466	2.3	418,002	79,127	18.9	331,567	258,899	78.1	227,054	217,500	95.8
Utah	30,695	16,130	52.5	25,411	17,411	68.5	24,176	21,427	88.6	17,811	17,450	98.1
Vermont	27,061	7,945	29.4	23,582	12,213	51.8	19,043	17,463	91.7	12,099	11,900	98.3
Virginia	197,632	14,954	7.6	174,885	42,144	24.1	150,997	113,949	75.5	97,623	94,600	96.9
Washington	84,381	40,060	47.5	81,686	58,283	71.4	69,820	64,161	91.9	51,575	51,000	98.9
West Virginia	104,747	3,647	3.5	99,282	25,199	25.4	81,434	58,789	72.2	44,011	41,400	94.1
Wisconsin	199,877	39,206	19.6	186,735	87,556	46.9	168,561	155,545	92.3	131,215	128,600	98.0
Wyoming	17,487	527	3.0	15,018	3,474	23.1	12,614	7,937	62.9	9,743	9,050	92.8

[1] U.S. Census of Agriculture.
[2] Edison Electric Institute.
[3] U.S. Census of Agriculture, preliminary.
[4] REA estimate.
[5] U.S. Census of Agriculture, 1950.

Source: U.S. Department of Agriculture, Rural Electrification Administration.

NATURE AND SCOPE OF CURRENT RESEARCH

Recent advances.—As a result of research conducted in cooperation with State agricultural experiment stations, progress has been made in the application of electricity to farm problems as power to replace hand labor around the farmstead; as light, heat, or power to modify or control plant or animal environment; and as electromagnetic radiation to influence growth and production responses of plants, animals, and insects.

Much of the research to develop methods and equipment for reducing hand labor has been focused on adapting electric power, on either an automatic or semiautomatic basis, to feed preparation and distribution, feeding, watering, and manure removal. Of the various classes of livestock, greatest progress has been made with equipment for poultry (both layers and broilers); then with equipment for dairy cows, and meat animals, in this order. Automatic systems which include two or more farm electric machines are just being developed. The key to successful development of such systems is the integration of the operation of several automatic machines by automatic controls.

The increase in research attention of recent years to determine the effects of controlling light, temperature, humidity, and air purification in plant and animal production has provided some basic requirements for new or improved electric equipment which may be of use in farm operation.

The value of cooling hogs, cattle, and poultry to increase rate of gain, reduce mortality, or maintain production has been indicated, and some progress has been made in the development of equipment for cooling animals. Following many years of research on photo-periodism in plants, during which the wavelengths of visible light used by plants were established, a lamp manufacturer has very recently produced an electric lamp that emits very little green, a portion of visible light spectrum which plants reflect and hence are unable to use.

Discovery of the attraction to a near ultraviolet (blacklight) lamp of adult economic insects such as the European corn borer, corn earworm, armyworm, European chafer, pink bollworm, cotton bollworm and tobacco and tomato hornworms has provided the basis for design of an electric insect survey trap for detection of these and other insects. Results of insect surveys with such traps provide information on the need for use of control measures or extension of quarantines.

While considerable progress has been indicated, research on the application of electricity to animal and plant production is still relatively recent, and many possible developments await future attention.

Current farm electrification research.—One or more wholly State-controlled projects on farm electrification research are conducted by each of 15 State agricultural experiment stations. The Department conducts farm electrification research at Beltsville and in cooperation with 13 State agricultural experiment stations.

Nature of department research.—Farm electrification research is conducted by the Department of Agriculture at 14 locations. Approximately 26 professional man-years are devoted to this work which includes the following line projects:

1. Automatic electric control systems for livestock production.
2. Electric and other labor-saving and honey-conditioning equipment for the Southwest.
3. Electric equipment for reducing labor in dairy production.
4. Electric and other labor-saving and honey-conditioning equipment for North Central States.
5. Improved equipment for curing dark-fired and air-cured tobaccos.
6. Electric equipment for reducing young pig losses.
7. Electric heat-pump equipment for air-conditioning of farm homes and farm buildings.
8. Electric light and temperature control systems for turkey breeding flocks.
9. Electric and other equipment for curing bright-leaf tobacco.
10. Electric equipment for efficient hog production (chiefly cooling).
11. Electric equipment for attracting and destroying grain and vegetable insects.
12. Radiofrequency radiation for insect control and crop conditioning.
13. Electric equipment for attraction and destruction of cotton and other insects of the South.
14. Electric devices for trapping tobacco insects.
15. Physical (electric, sonic, etc.) equipment for controlling flies and other livestock pests.

16. Electromagnetic radiation equipment for plant, seed, and plant product treatment.
17. Electric demand characteristics of farm equipment.
18. Electric milk cooling and handling equipment performance characteristics.
19. Performance characteristics of unloaders for vertical silos.
20. Higher voltage for increased farm wiring capacity.
21. Instruments for measurement of fat and lean on live animals.

Headquarters for the Department's research on electric equipment and controls is at Urbana, Ill., with related work at Pullman, Wash.; Tucson, Ariz.; Madison, Wis., and Beltsville, Md. This research is conducted by a total of five professional agricultural engineers, two at Urbana and one each at the other three stations.

Research concerned with modification and control of environment is headquartered at Manhattan, Kans., with associated work at Athens, Ga.; Blacksburg, Va.; Lafayette, Ind., and at Beltsville, Md. Six professional agricultural engineers conduct this research.

Electromagnetic radiation research is conducted at Lincoln, Nebr., with one professional agricultural engineer there. Other engineers engaged in electrical and other physical methods of insect control include two at College Station, Tex., on cotton insects, 1½ at Lafayette, Ind., on grain and vegetable insects, one at Beltsville on animal insects, and one-half at Blacksburg, Va., on tobacco insects. Research on radiation of seeds and plant products is conducted by two engineers at Knoxville, Tenn., and one at Pullman, Wash. The entire group totals 8.5 professional agricultural or electrical engineers.

Research on determination of performance characteristics is centered at St. Paul, Minn., with one engineer there; related work is also conducted at Beltsville, Md., by one half-time professional agricultural engineer.

Research on electric wiring and demand is conducted at Ames, Iowa, by one professional agricultural engineer. Active cooperation from power suppliers has enabled him to plan work and analyze results on farm electric demands from five States in the north central area. Additional work has been initiated in two Southern States.

Research on instrumentation and technical measurements is conducted with headquarters at Beltsville, Md., by two professional agricultural engineers.

Nature of research by State experiment stations.—Research is being conducted by the State agricultural experiment stations on 39 projects utilizing approximately 27 man-years. A large majority of these projects involve research directed toward solution of problems of a statewide nature involving temperature and humidity regulation by heating, cooling or ventilation. As shown in table 2, two-thirds of all State projects are devoted to this general topic as compared to 28.5 percent for Federal research projects. Research activity of State agricultural engineers is heavily concentrated on temperature control in poultry houses and animal shelters by either heating or cooling as shown in table 3.

State research projects concerned with electromagnetic radiation devices comprise only 10.2 percent of the total as compared with 28.5 of the Federal projects in that group. The greatest activity in this field by both State and Federal engineers is that of insect survey and control by electric traps and direct radiation of infested grain. Research by Federal agricultural engineers is devoted to six of the major groups of insects while State projects include cotton, vegetable and grain insects.

States doing research on farm electrification projects have been grouped by region and line of work in Table 3. The total number of States reported doing work by region are: North Central 18; Western 13; Southern 10; and Northeastern 4. Distribution of the 24-man Federal staff of professional agricultural engineers at 13 field stations and the Beltsville laboratory by region is: North Central 37.5 percent; Northeastern 29.2 percent; Southern 20.8 percent; and Western 12.5 percent. All of these Federal engineers, with the exception of those at the Beltsville laboratory work in direct cooperation with the Agricultural Experiment Stations of the States in which they are located.

TABLE 2.—*Federal and State projects devoted to each major line of farm electrification research*

Major project	Number of projects		Percent of total devoted to each major project	
	Federal	State	Federal	State
Labor reduction equipment	4	5	19.1	12.8
Environmental modification equipment	6	26	28.5	66.7
Electromagnetic radiation equipment	6	4	28.5	10.2
Equipment performance characteristics	3		14.3	
Electric demand and wiring	1	1	4.8	2.6
Instrumentation development	1		4.8	
General		3		7.7
Total	21	39	100.0	100.0

TABLE 3.—*Farm electrification research projects underway by State and Federal professional agricultural engineers by line of work*

Line of work	Federal projects	Number of States doing project work in each region			
		North Central	Southern	North-eastern	Western
Labor reduction:					
Meat animals	1	3			1
Milk cows	1	1			
Poultry					1
Bees and honey	2				
General		1			
Environmental control:					
Light:					
Plants					1
Chickens and turkeys	1				3
Dairy		1			
Heat:					
Farmhouse by heat pump	1				
Animal shelters	1	1		1	1
Poultry houses, brooding	1	1	1	1	
Greenhouse					2
Sweetpotato storage			1		
Grain drying			1		
Solar energy	1	2			2
Cooling and Refrigeration				1	
Fruit				1	
Animal shelters	1	1			1
Poultry houses	1	1	3		
Electromagnetic radiation:					
Insect survey and control		1	1		
Cotton insects	1		1		
Vegetable and grain insects	1	1			
Tobacco insects	1				
Animal insects	1				
Harvested grain insects	1				
Seed and plant radiation	1	1			1
Functional requirements	1				
Electric wiring and demand	2		1		
Electric instrumentation	1				
General		2	1		
Total	21				

Nature of research by industry.—Electric power suppliers seldom conduct research in farm electrification. They have provided limited funds to State agricultural experiment stations for specific projects that in some cases were cooperative with Federal research. Manufacturers of electrical components for farm electric equipment as well as manufacturers of complete units such as automatic water pumps and automatic feed grinders obtain many ideas and suggestions from State and Federal engineers by frequent personal contact and consignment of their machines. No estimate was made of funds expended by farm electric equipment manufacturers. It is estimated that electric power suppliers devote approximately $75,000 annually to support State farm electrification research.

FARM ELECTRIFICATION RESEARCH NEEDED

Research needed in the application of electricity to agriculture varies widely in nature and scope because of the manifold methods by which electric energy may be employed. No other source of energy available on American farms can equal electricity in its diversity of application and use. It produces light with electric lamps, power with electric motors, heat with resistance or radiant units, and wireless communication with electron tubes from the same set of wires.

The Department has grouped research in farm electrification under six major lines of work listed in table 2. The research needed in these six lines of work follows:

1. Replacing hand labor with electric motor power for doing work in livestock production around the farmstead is a major research need. Development of new power-driven machines to do daily repetitive jobs in and around farm buildings has been far less rapid than that of field machines to produce and harvest the crops. A comparison of the increases in farm production per man-hour for the period 1910–60 readily confirms this situation. While this increase during the past 50 years for all crops was 393 percent, that for poultry was 252 percent, for milk cows 156 percent, and for beef cattle a mere 36 percent.

2. The problems of controlling or modifying the environment, in which plants and animals are produced, need continued research on electric lighting, heating, cooling, and ventilation equipment. The evaluation and improvement of light sources for plant growth, and for poultry and livestock production must accompany discoveries of new effects of light stimulation or retardation. Similarly, effective heating, cooling, and ventilating equipment must be developed and evaluated to provide near-optimum, healthful conditions established by biological research. Greater control and use of solar energy, as a source of supplementary heat, for direct generation of electricity by photovoltaic cells, and to provide energy for thermoelectric cooling must be included as a part of this problem.

3. Other important research needed is the development of a better understanding of the biological effects of different electromagnetic radiations on plants, animals, insects, bacteria, and pathogenic organisms. Much has been learned about the visible and parts of the infrared and ultraviolet regions of the electromagnetic spectrum. Much is yet to be learned of possible useful biological applications of the far ultraviolet, far infrared, microwave, radio wave, X-ray, and gamma-ray regions. An increasing number of economic insects are found to be attracted to near-ultraviolet radiation. Infrared and radiofrequency radiation may overcome dormancy in hard seeds. The need for correlating animal, insect, and plant behavior with air ionization and atmospheric electricity is another example of needed research in this problem area.

4. Development of functional requirements and performance characteristics essential to the design of improved or new farm electric equipment is another general need to which greater research attention must be devoted in the future if potential farm applications of electric energy are to become reality. Designs based on inadequate functional requirements have resulted in unnecessary hazards and expense to users. For example, electric motors on some makes of silo unloaders have burned out because the additional power load on them created by the freezing of silage had not been included in the original design. Humans, as well as animals, have been and are still being killed on wires charged by electric fencers of inadequate design.

5. The provision of electric service, adequate to farm needs, is the power supplier's problem, but providing the electric wiring adequate to satisfactorily operate his farm electric equipment is the farmer's problem. For many farmers, this is an ever-changing one because the addition of new electric equipment may mean heavier wiring. Information needed to aid them can be obtained only through a countrywide research program on the demand and diversity of use of electric energy for various types of farming and equipment used. Total farm use of electric energy by the farm consumer differs from that of the city or suburban user, both in amount and the times during the day and seasons of the year when it is used. Such research, conducted primarily for the benefit of farmers, yields information important to suppliers of electricity to rural areas in determing proper sizes of transformers and line designs.

6. Common to all problems of development and application of electric energy is the need for methods and instruments to supplement or extend the perceptual and sensory facilities of man. The detection and measurement of magnetic and electrostatic fields, the measurement of power, heat, and radiation and the detection of bioelectric phenomena require systematic procedures with specialized in-

struments and facilities. Frequently more than 50 percent of a research investigation is concerned with instrumentation.

Four recent reports on farm electrification research needs are included in the appendix. The first was submitted to the Department by the Farm Research Section, EEI, in March 1961, and the second is a portion of a talk by the head of a western agricultural engineering department delivered at the 1960 meeting of the Farm Section, EEI. The third and fourth reports were compiled and submitted to the Department by farm electrification research committees of ASAE and NRECA. These reports, while not individually all inclusive, do indicate many similar research problems. The individual items have not been grouped according to the six major farm electrification research problems mentioned previously. However, all of them can be identified as belonging to one or more of these groups.

The four reports list several major fields of basic research that require the combined efforts of agricultural engineers and scientists of related biological disciplines. One such field is concerned with investigations on the qualitative and quantitative evaluation of electromagnetic radiation on the growth and production of plants, animals, and insects. A second is concerned with development of electronic controls (listed in all four reports) for creating environments for plants, animals, and fowls, for soil treatment and for automatic control of electric power units. Other fields include: basic information for design of seed drying equipment; ultrasonic applications to attract or repel rodents or insects and possibly to clean farm products; applications of the heat pump; maintenance of quality of farm products under new methods of refrigeration and handling; and continuous studies on the effect of new electric applications on the demand and diversity of the farm electric system.

Eighteen of the twenty-six Federal professional agricultural engineers engaged in farm electrification research are headquartered at 13 cities at which the main office of a State agricultural experiment station is located. All of the Federal engineers are provided office and laboratory space by the experiment station with which they cooperate. There are two Federal professional agricultural engineers at six locations and one each at the other seven. In two States with two Federal engineers, the salary of one of them is shared by the State. A Federal building provides shop space at one location for a Federal engineer in addition to that available from the cooperating State station.

Farm electrification research is conducted at Beltsville by six professional agricultural engineers working in direct cooperation with biological scientists. Four of these engineers are provided office and laboratory space in a 2,500-square-foot section of the agricultural engineering laboratory. Planned construction of a small combination office and laboratory building will house a fifth engineer to conduct research on physical methods and equipment for control of flies and other livestock insects. Temporary office space is being arranged for the sixth engineer who will engage in research on the engineering phases of photoperiodism in plants. Laboratory facilities for this work are not yet available.

If additional funds are available, research could be strengthened at existing locations, particularly those at which a single Federal engineer is located, by the addition of a junior engineer. However, research can be widely expanded at very few, if any, of the existing locations, including Beltsville, unless additional facilities are provided. Research facilities of the State agricultural experiment stations, as well as the Department, are crowded. Facilities, adequate for conducting the farm electrification research planned, are practically nonexistent at State stations. The Department believes that one or more laboratories will make a greater contribution than could be accomplished by strengthening the 13 existing field stations.

Contracting for the farm electrification research proposed is believed, in general, to be less desirable and satisfactory than by use of one or more laboratories at which Department engineers and various biological scientists would cooperate. Another important factor favoring the laboratory is that special instruments, equipment, and machines used in a research project there would continue in service while those used under contract would not be available after contract termination.

The Department has recognized for some time the need for and importance of a central farm electrification research laboratory to implement its farm electrification research program by undertaking basic research that present facilities at Beltsville and cooperating stations will not permit. The building of a facility of this kind would permit the concentration of a group of specialists at one location to cooperate directly with one another on problems of mutual interest to provide adequate research equipment for common use and to provide unique or unusual equipment essential to basic research.

PROPOSED LABORATORY LOCATION

Consideration has been given by the Department to the choice of location for the proposed Laboratory. Initially Beltsville was indicated as the desired site. Also listed were possible alternate locations at or near a land-grant college with strong schools of engineering and agriculture and an agricultural engineering department having active farm electrification interest. Preference for Beltsville was based on the ready accessibility of the proposed Laboratory staff to biological scientists located there and to other research organizations located in the same area, such as the Bureau of Standards.

Location of the proposed Laboratory adjacent to a State agricultural college and experiment station is agreeable to the Department. The need for full-time services of cooperating scientists is recognized and would be met at Beltsville directly through implementing existing staffs or at other locations by assignment from cooperating Department agencies.

It is the viewpoint of the Department that it would be feasible to divide the proposed research work and carry it out in more than one facility, provided that the locations would differ as to crops grown and climate. If two facilities should be provided, the Department prefers locations in the North and the South. The proposal to have more than one laboratory has been examined by the Department in relation to a single laboratory. Each proposal has its advantages and these are listed.

A. Advantages of two laboratories (North and South)

1. A variety of weather conditions is possible with a northern location offering severe winter conditions for development of heating equipment, unloaders for frozen silage, and equipment for other farmstead operations.
2. A companion southern laboratory would offer conditions for development of cooling equipment required in southern areas to prevent losses of poultry resulting from severe summer temperatures.
3. The application of the heat pump and other automatic cooling equipment which is beneficial to livestock production could be developed in southern areas.
4. Diverse agriculture in northern and southern areas offers additional research capabilities including proximity of various crops and economic insects.
5. The proximity of cooperating scientists from two universities offers some advantage.
6. The option of research assignment in either a northern or southern area offers advantages for employing qualified research engineers and scientists.

B. Advantages of single laboratory

1. Initial cost of one laboratory would very probably be less than that of two to provide comparable facilities.
2. Total staff requirements would be less for single laboratory.
3. Some savings in overhead cost could be anticipated.
4. Single laboratory would make possible a more concentrated staff of scientists who would be available for greater project flexibility, consultation, and research seminars.
5. More convenient availability and efficient use of certain equipment and facilities could be anticipated.

PROPOSED RESEARCH AND LABORATORY REQUIREMENTS

The versatility and economy of electric energy justify its use for practically all farm operations when and where it can be applied. Research can provide ways of applying electric energy to all agriculture. Particular diseases, certain insects, and many individual crops have warranted special research, but electric energy can be used to improve the efficiency and help avoid losses and wastes of almost every farm enterprise.

The fact that much of the work around the farmstead is now done by hand labor, is borne out by the figure of 45 man-hours required to produce $100 worth of dairy products. The 2,134 million man-hours required in 1960 on dairy farms represented 46 percent of all the labor in livestock and poultry production. It was also equal to 47 percent of all labor in the production of all crops including grain, forage, fruit, vegetables, sugar, cotton, and tobacco. This labor requirement is one of the biggest challenges of research in electrification today.

Additional research will enable the farmer to substitute a few cents' worth of electricity for an hour's hard labor to make his operation more efficient and to help him increase his economic return for the hours of labor he uses.

Expansion of research in the following problem areas is especially needed and could be conducted in the proposed facilities:

Automatic electric farm equipment and control.—Automation on farms will be accomplished largely through development and utilization of electronic controls on farm machines. This is a relatively new field for applying electricity to agriculture but the potentialities are very extensive. An electronics section in this proposed laboratory, manned by capable engineers, experienced in electric controls as well as farm machines, can contribute much to the future development of fully automatic labor-reducing farm equipment.

Design fabrication and construction of primary equipment and apparatus for prototype use in field stations or cooperating farms, including functional control, protective and safety controls, and operating instrumentation would also be undertaken.

Electric equipment for environmental modification.—Equipment for maintaining optimum environmental conditions for plants and animals must still be developed in the majority of cases. Applications of the heat pump (reverse-cycle refrigeration) offer many possibilities for the heating and cooling of farm structures with one unit. The heat-pump principle with solar supplementation offers possibilities of improved efficiency in the application of electric energy to meet the cooling and heating requirements of a large number of farm operations and situations. Thermoelectric refrigeration will have farm application as more efficient alloy semiconductors are produced by metallurgists and its possibilities developed by application to farm refrigeration equipment. A temperature and humidity controlled facility to do this research would be included in a laboratory.

Electromagnetic radiation in agricultural application.—Many unsolved problems exist on the relation of visible light to fertility and productive capacity of animals and poultry which will require the combined research attention of animal physiologists and engineers trained in optics and illumination. Determination of specific spectral requirements in the visible spectrum has been made for plants and to a limited extent for insects and poultry but very little has been accomplished for large animals. Despite the accomplishments with plant stimulation by electric lighting more research is needed to establish the engineering specifications for lamps and lighting equipment for plant growth regulation in experimental growth chambers and in grower application.

Much remains to be done in the field of farm sorting or grading of farm products by the use of supplementary electric light. A section of the proposed laboratory equipped with instruments for measuring visible radiation and reflectance is necessary for adequate engineering participation and support for the work outlined.

An echo-proof chamber will be provided for research on ultrasonic equipment for stimulation of insects, animals, and plants.

Electric equipment performance and requirements.—Selection of an electric motor of the proper design for operating a particular machine must be based on engineering determination of the power requirements for starting and operating that machine under a wide variety of situations. Thus the establishment of motor requirements and specifications for new or improved machines requires research attention for satisfactory and efficient application of electric power on the farm. A section of the proposed laboratory would be devoted to electric power application.

Electric demand and energy distribution.—Prevention of lightning damage to farmstead electric distribution systems and appliances; protection of wiring materials from damage by weathering, animal wastes, or mechanical abrasion; the application of new electric generation devices as fuel cells, solar batteries, and thermoelectric generation and cooling; the use of higher utilization voltages; and the improvement of electrical safety would be studied.

Research instrumentation and technical measurements.—Improvement of instruments and methods of measurement for research equipment under development.

Exploration and discovery of bioelectric phenomena to increase the flow of new ideas, methods, and inventions in the use of electricity in agriculture. The discovery of such phenomena is a scientific function cooperative with the various related disciplines and the application in agriculture is an engineering function.

Many of the engineers at field stations require assistance with problems in instrumentation and in development of special devices. This assistance could be effectively given at a central laboratory if space and manpower were available. A section of the laboratory would be devoted to this work.

ESTIMATED CONSTRUCTION COSTS

Single laboratory: A total area of approximately 30,000 square feet will provide the necessary office and laboratory space. An estimate of the space and cost requirements by function follows:

A facility with lamp capacity to produce 10,000 footcandles for research on lighting equipment for plant growth stimulation	$107,000
Facilities for research on lighting equipment for animal and insect application	171,000
Facilities for research on equipment to modify and/or control environmental conditions by heating, cooling, and addition or reduction of gas concentration, and facilities for ultrasonic application to insects, etc	306,000
Facilities for research on electromagnetic radiation, ionization, bio-engineering, instrumentation and electronic equipment	128,500
Machine shops, refrigeration equipment space, and laboratories for research on higher voltages in farm electric wiring and protection, electric motors, electric controls and protective devices, solar radiation, and pilot plant area for automatic machine and system development	307,000
Offices for professional staff (22), secretarial (4), business (1), conference room, library, drafting and file room	144,500
Halls and other passageways, lavatories, stairs, janitorial, storage	156,500
Basement storage, utilities and compressor room	77,000
Air conditioning	96,000
Vehicle storage and service	48,500
Design and construction contracting, including supervision	158,000
Contingencies	150,000
Land and site work	25,000
Total	1,875,000

Complementary laboratories (south):

A facility with lamp capacity to produce 10,000 foot-candles for research on lighting equipment for plant growth stimulation	107,000
A facility for research on lighting equipment for insect application	128,000
Facilities for research on electromagnetic radiation, ionization, bioengineering, instrumentation, and electronic equipment	128,000
A facility for solar energy equipment, machine shop and refrigeration equipment, and an equipment component assembly area	225,000
A sound facility for ultrasonic application to insects	85,500
Offices, conference room, library, drafting, and filing room	107,000
Halls and utilities	102,000
Storage	57,500
Air conditioning	56,500
Vehicle storage and service	38,500
Design and construction contracting, including supervision	105,000
Contingencies	100,000
Land and site work	20,000
Total	1,260,000

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Complementary laboratories (north): Original cost estimate for a northern farm electrification laboratory to operate in conjunction with a southern laboratory:

A facility for research on lighting equipment for animal application	$128,000
A facility for research on equipment to modify and/or control environmental conditions by heating, cooling, and addition or reduction of gas concentration	214,000
Machine shops, facilities for research on high voltages in farm electric wiring and protection, electric motors, electric controls and protective devices, and pilot plant area for automatic machines and system development	235,500
Offices for staff, conference room, library, drafting, and filing room	85,500
Halls, utilities, etc	88,000
Storage	58,000
Air conditioning	52,500
Vehicle storage and service	38,500
Design and construction contracting, including supervision	90,000
Contingencies	90,000
Land and site work	20,000
Total	1,100,000

ESTIMATED STAFFING AND OPERATING COSTS

One central laboratory

Professional staff: 22 senior research scientists to include agricultural and electrical engineers, 1 plant physiologist, 1 insect physiologist, 1 animal physiologist, and 1 biochemist.

Funds to operate: $880,000 per year.

Northern Research Laboratory

Professional staff: 12 senior research scientists to include agricultural and electrical engineers, 1 animal physiologist, and 1 biochemist.

Funds to operate: $480,000 per year.

Southern Research Laboratory

Professional staff: 15 senior research scientists to include agricultural and electrical engineers, 1 plant physiologist, and 1 insect physiologist.

Funds to operate: $600,000 per year.

	Senior scientists	Facility cost	Estimated funds to operate
1 central laboratory	22	$1,875,000	$880,000
Total north and south laboratory	27	2,360,000	1,080,000

APPENDIX

SUBJECTS ON WHICH EEI MEMBERS RECOMMEND FARM ELECTRIFICATION RESEARCH, MARCH 6, 1961

1. Heating and cooling greenhouses electrically.
2. Environmental control and feed handling in poultry (broiler production and laying).
3. Ventilation requirements of windowless poultry houses and hog farrowing houses.
4. The economy of air-conditioning animal shelters such as hog feeding units.
5. Design of low-cost single-phase motors larger than 5 horsepower for rural lines.
6. Heating milking parlors, milking houses, and contamination of milk from foreign particles on other heat sources.
7. Silo unloaders and bunk feed stations with emphasis on a design that will eliminate motor burnouts.
8. Water heating requirements in the dairy barn.
9. Test out principle of scavenging heat from milk cooling.

10. Heat pump applications on providing optimum temperature control for farm livestock operations. Who is doing research and what results.
11. Engineering data on power equipment to lift different amounts of silage and hay at different heights and amounts, as well as similar data for various types of conveyors. Relative efficiency of the three types of conveyors, namely, chain and flight, auger, and blower.
12. Environmental control for dairy and livestock.
13. Basic information for design and installation on drying equipment for agricultural seed.
14. Economics of mechanical handling of liquid manure in dairy and other livestock operations; cost of and best suited types of equipment; operational procedures and costs; best design of buildings and holding tanks; benefits in terms of sanitation, labor-saving, and added returns from treated crops.
15. Durability of electric controls, especially photoelectric cells, time switches, thermostats, humidistats, pressure switches; design of inexpensive, reliable humidistats; design of thermostatic controls which include radiation-sensing elements.
16. Installation of electric heat in aeration systems of grain storage buildings.
17. Amount of light for laying hens.
18. Poultry brooding under cold weather conditions.
19. Lighting levels and farm labor efficiency.
20. Thorough study of the systems approach as applied to all types of agricultural production. USDA could coordinate in an effort to study and try experimentally the several systems for materials handling and livestock housing as relates to the maximum efficiency and use of labor, capital, and production. This should include a coordinated effort on the part of agricultural engineers, animal husbandrymen, biologists, economists, house suppliers, etc.
21. Cost of operating electrical equipment and the overall cost of electricity as it relates to total production costs. This data should be available for different climatic conditions, different conditions of electrical wiring, power supplier voltage, and management practices.
22. Light trap control of insects harmful to agricultural products production.
23. An economical way to cure tobacco electrically.
24. Research on modernization of farm homes and the insulation of these homes with the reduction in heat losses that will permit the use of electric resistance home heating.
25. Research on selecting materials from which a 20- by 20-foot tobacco barn can be constructed and equipped turnkey for bulk curing for $1,000.
26. Precooling fresh fruits and vegetables.
27. Determination of amount of hot water required for various farm operations.

EXCERPTS FROM "NEEDED RESEARCH IN FARM ELECTRIFICATION"

(By Roy Bainer, University of California, and presented at farm section, annual EEI council meeting, March 1960)

Sponsored research programs in land-grant institutions, power company programs, and USDA research continue to uncover new uses for electricity in agriculture. Additional research will be justified by further improvements in efficiency and further lowering of production costs.

Chores when done by hand are labor consuming. Research is highly justified on adapting electric power, on either an automatic or semiautomatic basis, to feed preparation, feeding, watering, manure removal, etc. The problems are actually in the field of materials handling. Some installations have been made by ingenious farmers. Assistance is still required to make livestock production in general a pushbutton affair.

Studies in several areas indicate that egg handling often requires as much as 60 percent of the poultryman's time. Research is still needed to improve egg gathering, cleaning, candling, and color-sorting equipment. One important unsolved problem with eggs is the determination of interior quality. Some electronic, supersonic, or light transmission method is needed to grade eggs without having to break them.

Continued research is needed in the field of controlled environment in livestock production under temperature extremes. The whole environmental control field is challenging. Electricity is the ideal power for operating this type of equipment because of its adaptation to automatic operation. For reasons unknown, some types of livestock have not responded to controlled environments. With chickens, environmental control studies have reduced mortality but induced little change in either meat or egg production.

Norris of the USDA, and Jacob at the California Experiment Station, have done enough work on light transmission through fruits and vegetables to indicate its merit for determining interior quality. Much more work is needed to develop this important tool. Interior defects in fruits—from heat injury, internal bruising, etc.—cannot now be detected without destroying the fruit. A sorting operation that would detect internal defects could greatly improve standardization and also be a valuable research tool in studies of the causes of such defects.

A revolution is now underway in the packaging and handling of fresh fruit. Research is needed to maintain quality under new methods of handling. Studies are needed on precooling to maintain fruit quality in transit. Hydrocooling, plus icing, for example, holds considerable promise.

Considerable work has been done by Borthwick at Beltsville on the behavior of plants under variations of light. Kofranick at UCLA has been able to modify the blooming characteristics of chrysanthemums, daisies, and asters in open fields by supplying artificial light of low intensity. Much more research should be encouraged in this area.

There is a need to correlate air ionization with animal behavior. Rate of gain and efficiency of feed utilization may be related to atmospheric changes.

Research is needed in the field of ultrasonics. There is some indication, although not positive, that rodents and birds can be repelled with sound waves. Applying the method to insect control should also be explored. Even egg cleaning might possibly be solved with ultrasonics.

One of the greatest contributions that research in rural electrical application can make in the future, is in the field of automatic controls, telemetering, and analysis of data. Preliminary work in this field indicates unlimited opportunities. Some of the potential uses for electronic controls are on headgates for irrigation systems, on the blades of machines used in preparing land for irrigation, on combines to regulate the flow of material for optimum performance, guiding systems on cultivating and harvesting equipment, feed processing and mixing machinery, etc.

Some of the other areas needing research include: Applications of the heat pump, supplemental irrigation, improvement of milking equipment for control of incidence of mastitis in dairy cattle, finishing of chopped hay by atmospheric drying, etc.

Areas of Work Needed in Farm Electrification

The following areas of work needed in farm electrification are listed by Lowell Endahl, secretary of the Research Conference Committee, Society of Agricultural Engineers:

1. The problem of labor reduction alone will require much research on controls, control systems, and equipment before the production per man-hour around the farmstead can be increased to a level comparable to that presently existing in the production and harvesting of field crops. For instance, the production per man-hour of labor in meat animals is up only 36 percent since 1910. During this same period the production per man-hour in field crops has increased from 6 to 19 times this amount.

2. Scientific investigations on the effects of electromagnetic radiation and the growth and production responses of plants, animals, and insects. Particular emphasis should be given to qualitative and quantitative evaluations. The following are definite problems in this area where there is immediate demand for information:

(*a*) Quality and intensity of light in controlling fruiting, stem growth, etc., and in controlling germination and rate of maturity for flower and horticulture crops.

(*b*) Qualitative and quantitative values of radiant energy needed in providing heat and light for plant growth.

(*c*) Destruction of seed-borne diseases by the use of radiant energy; limited studies indicate that this is definitely feasible.

(*d*) Determine if the activities of insects may be controlled by radiation—possibly photoperiodism; some insects are known to be active only in certain light cycles.

(*e*) Use of high frequency radiation and induction heating for maturing and processing of farm products.

(*f*) Qualitative and quantitative values of radiant energy needed in supplying heat and light to animals and fowls.

3. Basic dvelopment and refinement of electric, manual, automatic, and remote controls and systems for each of the following:

(*a*) For creating environments for plants, animals, and fowls.

(1) Develop controls for radiant energy applications to respond to the effects of radiation in the same manner that plants and animals do.

(2) Develop control systems for controlling the environment of animals and fowls, to include elimination of ammonia, moisture, and dust.

(3) To develop automatic control systems for shading and other environmental control units for plant protection.

(*b*) For soil treatment.

(1) Soil sterilization with electric energy—high frequency or other.

(2) Expand present procedures for electric processes for breaking down or neutralizing excessive salt accumulations in agricultural soils.

(3) Develop an accurate, easy-to-use, low cost moisture tester for use on soils.

(*c*) For labor reduction.

(1) On phases of materials handling involving the development of controls and systems for automatic operation of livestock feeding, ventilation, milking, and general grain handling.

(2) Development of systems and controls for automatic operation of installations, to include handling of feed, water, waste, and eggs.

4. Agricultural applications of electricity with particular emphasis on performance characteristics of electrical equipment and the effects of new electric applications on the demand and diversity characteristics of the farm electric systems.

These are needed to—

(*a*) Provide necessary basic information of the design of economical efficient farmstead electrical systems.

(*b*) To provide basic, factual information on farm load characteristics to enable power suppliers to render service and rates that are appropriate.

The following are applications of electrical equipment where work is needed at present:

(1) Crop and feed elevators and conveyors.

(2) Dehydration of agricultural products and dehumidification of air for drying farm crops other than by heating.

(3) Water heating for poultry and livestock.

(4) Electric brooding equipment.

(5) Electric fence controllers.

(6) Systems for utilizing radioactive isotopes in soil treatment and insect destruction.

(7) The use of solar and electrical energy for heating milkhouses, homes, and other buildings. This would also include the use of the heat pump.

(8) Development of equipment for resistance and inductive heating.

(9) The development of a high energy electrical storage battery that would enable the farmer to receive high line electrical energy, store in a battery, then use it in driving portable equipment such as perhaps even tractors. This would also include developing a system for applying the electric wheel principle to agricultural machines.

(10) Continue studies on the effect of new electric applications of the demand and diversity characteristics of the farm electric system.

Research Needs in Field of Farm Electrification

The National Rural Electric Cooperative Association with the assistance of the Statewide Associations of Electric Cooperatives list the following research needs in the field of farm electrification:

I. Demand characteristics

1. What effect have new applications of electricity in the home and on the farm had on demand and diversity characteristics of the farm electric system?

2. Is lower demand and better diversity of ice bank coolers sufficient justification for power suppliers to make special rates available for this load and thus benefit farms with lower operating costs?

3. Is it practical to increase availability of electric power to perform farm tasks by—

(*a*) Changing to 3-phase supply?

(*b*) Using higher secondary voltages?

II. Further automation of feed processing and distribution of concentrates, roughages, and silages, including—

1. Size of farming operation necessary to justify the change from hand methods to automatic methods of farm materials handling.
2. Automatic controls for silo top unloaders.
3. Optimum trough and bunk design for limited feeding.
4. Metering of roughages and silages from storage.
5. Perfection and adaptation of equipment for moving high moisture grains.

III. Improved methods and control of grain conditioning, including—

1. Application of electrical energy to supply heat of vaporization for moisture reduction in grains and hay.
2. Use of heat pump or dehumidifier to condition atmospheric air for crop drying in much the same way supplemental heat conditions it. Using dehumidification, grain temperature would be lowered instead of raised and longer drying time should be permissible, resulting in less cfm per bushel and less horsepower on the fan.
3. Use of small amounts of supplemental heat in crop drying, provided it can be done with little or no additional hazard. Because of poor drying conditions which often occur at hay harvest time, natural air is not always satisfactory.
4. Use of solar energy as a source of heat for crop conditioning.
5. Development of simple, accurate, inexpensive meters for moisture determinations of grains and hay.
6. Adaptations of motors and fans for other corps to reduce investment and overhead costs for the farmer.

IV. Greater benefits of electricity in farm homes

1. Development of an automatic electric water softener.
2. Development of an electrically operated filtration system for conditioning pond water for domestic use.
3. Use of combination solar collector and heat pump for low cost home heating.
4. Application of electricity as a source of heat under extreme cold conditions, including insulation requirements by regions.

V. Improved livestock environmental control

1. Developing methods of summer cooling for swine and poultry.
2. Storage of solar heat for utilization in conjunction with heating and ventilation of poultry and livestock buildings.

VI. Agricultural applications

1. Use of artificial lighting in the growth of plants and animals.
2. Use of electricity for heating soil in truck farming and other intensive farming practices (tobacco, strawberries, etc.).
3. Application of electricity in improving productivity of alkaline soils.
4. Use of electricity in control of insects around farmstead.

VII. Related applications

1. Reevaluation of sizes and application of standby power units based on increased use of electricity. Should they be designed for single farms or one unit for several?
2. Field studies of electric shock accidents.

DEPARTMENT OF AGRICULTURE,
Washington, D.C., February 1, 1962.

Hon. RICHARD B. RUSSELL,
Chairman, Subcommittee on Agricultural Appropriations,
U.S. Senate, Washington, D.C.

DEAR SENATOR RUSSELL: In the Senate Appropriations Committee Report on the Agricultural and Farm Credit Administration Appropriation Bill, 1960, the committee requested, on page 4, paragraph 3, under the section entitled "Utilization Research," of Report No. 330:

"Further, the committee specifically requests that it be kept advised by an annual summary report on research developments, including the work in progress at these laboratories, proposed new work, and on projects to be discontinued due to completion of work or lack of results with the reasons for discontinuance. It is the hope of the committee that it will be kept better advised not only as to specific accomplishments in the field of utilization research but also as to fiscal requirements at these installations."

In response to this request, there are attached 30 copies of our third annual report covering the fiscal year 1961. This report relates principally to the domestic utilization research and development program of the Department, and also includes data on utilization research initiated at foreign laboratories under the authority of title I of the Agricultural Trade Development and Assistance Act of 1954, as amended, with foreign currencies generated by the sale of surplus agricultural commodities.

We shall be glad to provide any additional information that may be desired relating to this report.

Sincerely yours,

FRANK J. WELCH,
Assistant Secretary.

SUMMARY REPORT ON UTILIZATION RESEARCH, FISCAL YEAR 1961

Agricultural Research Service, U.S. Department of Agriculture

I. WHAT DOES UTILIZATION RESEARCH SEEK TO ACCOMPLISH?

The Department's utilization research and development program seeks, through systematic chemical and other scientific research, to create new and improved uses for agricultural commodities. By this means, utilization research strives to maintain traditional outlets and to develop new products and processes utilizing the products of American farms, particularly those in surplus. There is increasing emphasis on developing large-volume industrial uses for agricultural materials. These new and improved products—extending across the entire horizon of food, feed, and industrial uses—are developed to meet specific needs of domestic markets and of foreign consumers. Successful utilization research enhances the use-value and competitive position of American farm products, thus benefiting the farmer, aiding industry, and providing consumers with better products.

II. WHAT HAS UTILIZATION RESEARCH ACCOMPLISHED?

In its two decades of operation, USDA utilization research and development has added over $2.5 billion of value to farm commodities at a cost of less than $200 million—representing a benefit-to-cost ratio of 15 to 1. Although there has been an increasing cost per man-year of research throughout this period, this continuing program of fundamental research and applied technology has resulted in spiraling advantages, with each succeeding year giving more return per year for the total expenditure. For example, during the past 5 years utilization research enhanced agricultural commodities $1.75 billion, which is 70 percent of the total gain made in the two decades of this program. This increasing rate of return is expected to continue, as the storehouse of scientific and technologic information is accumulated.

III. HOW DOES UTILIZATION RESEARCH OPERATE?

USDA's utilization research is conducted in 4 regional laboratories (Albany, Calif.; New Orleans, La.; Peoria, Ill.; and Wyndmoor, Pa.) and 10 related field laboratories (Prosser and Puyallup, Wash.; Pasadena, Calif.; Weslaco, Tex.; Houma, La.; Winter Haven and Olustee, Fla.; Raleigh, N.C.; Beltsville, Md.; and Washington, D.C.). These utilization laboratories are operated in close association with other Department research. Much of the research is undertaken cooperatively with State experiment stations, colleges and universities, manufacturers, and other agricultural groups. Cooperative work is achieved in various ways; some is under contract.

Utilization research includes both basic and applied investigations in chemical, biological, physical, engineering, and other sciences necessary to accomplish the objectives. Much of the fundamental laboratory research is extended to pilot plant studies, and those showing promise are cooperatively evaluated under commercial manufacturing and use conditions. A product and process evaluation staff assists in formulation of research projects to better assure that the work is constantly directed to find timely, economic solutions to urgent problems of American agriculture. During this past year, 16 technical reports, concerning the present consumption and potential new uses of agricultural materials, were reported by the PPE staff to assist in formulating utilization research projects.

About 3 years ago a foreign program of utilization research was initiated, supported by funds generated under Public Law 480, to supplement the domestic

efforts to find new uses for farm products. This foreign program, stressing basic research, is now established in 10 countries of Europe, Asia, and South America. New concepts and basic information emanating from these foreign laboratories already are proving helpful in finding new uses for American agricultural crops. Twenty-eight new utilization research projects were started in foreign laboratories during fiscal year 1961, bringing the total to 75 such grants. Additional foreign research projects are under consideration, and many of these are expected to be put into effect during fiscal year 1962.

IV. HOW IS UTILIZATION RESEARCH INFORMATION MADE AVAILABLE?

Scientific knowledge and technologic advances developed by the USDA utilization research and development program are made available for public use as rapidly as practical. In the past 20 years these scientific efforts have resulted in over 9,000 research publications and more than 1,000 patents. Among the many ways of disseminating this technical knowledge, it is interesting to note the following statistics for fiscal year 1961:

Patents obtained	75
Research papers published	600
Speeches, press releases, and appearances on radio and television	608
Formal conferences with industry	38
Public service exhibits	27
Technical visitors to U.R. & D. laboratories	5, 500

Three examples are illustrative of the breadth and scope of USDA efforts to make the new scientific information available and useful for the public benefit.

A. Formal meetings with experiment stations

In addition to frequent conferences and correspondence covering specific work, the utilization research and development divisions usually participate in two types of formal annual meetings with representatives of the State agricultural experiment stations. One of these is the 2- or 3-day meeting with the State experiment station collaborators (one or two technical personnel from each station) at which scientific techniques and findings are thoroughly reviewed in selected research areas.

Others are the annual regional meetings held by the directors of the State experiment stations. At the 1961 eastern regional meeting, the UR program discussion included potatoes and other vegetables, deciduous fruits, honey, maple products, and tobacco. The research being done at the Southern Utilization Research and Development Division in fiscal year 1961 to improve cotton quality—concerning fundamental studies on fiber, mechanical processing, effect of short fibers, and wash-wear fabrics—was presented at the directors' meeting of the southern experiment stations. During this past year the directors of the western experiment stations heard Western Utilization Research and Development Division representatives discuss research on easy-care wool treatments, new industrial oilseed crops, dehydrated egg products, and new wheat foods (based on WU-developed bulgur) which have good potential for increasing food use of wheat both domestically and abroad.

B. UR exhibit at Midwest business opportunities meeting

Under the auspices of six Midwest States, a 4-day meeting was held in St. Paul, Minn. (October 1961), to inform leading manufacturers of the opportunities for commercializing newly developed products, processes, and equipment. In addition to commercial firms, 10 Federal agencies, including USDA utilization and development, participated. These discussions centered around well-planned, sizable exhibits depicting the latest developments.

C. Liaison activities related to national emergencies

Fiscal year 1961 saw an accelerated effort to exchange research knowledge with Federal groups concerned with preparedness for national emergencies. The growing interest in construction and supplying of fallout shelters has given impetus to seeking more information on USDA-developed ready-prepared foods. Of particular concern is the bulgur wheat wafer, developed at the Western Utilization Research and Development Division, for feeding shelter inhabitants.

USDA, U.S. Atomic Energy Commission, and U.S. Public Health Service have undertaken a joint research effort to develop a feasible commercial-scale process, to be used in case of national emergencies, for the removal of radioactive contamination from milk. A continuous pilot plant process, using commercially

obtainable equipment, has been developed which removes over 90 percent of strontium 90 with little or no effect upon the flavor and stability of the milk. The research is continuing in an effort to refine the resin regeneration phase, to explore other removal procedures that might be more efficient, and to study the problems of adapting a pilot plant process to commercial use.

Liaison with the Quartermaster Corps has been intensified so that the military will be able to take immediate advantage of USDA research and development. A cotton technologist from the southern division has been assigned to work at the research laboratory of the QM Research and Development Command at Natick, Mass., in order to improve the exchange of technical information on new ways to chemically and mechanically modify cotton fibers to give special performance characteristics to cotton fabrics. Real interest has been evinced by the military in the new utilization research processes for giving wool and cotton wash-wear properties. The exchange of technical information on new UR processes for tanning leather has continued in an effort to broaden the use of animal hides and to better serve any military need.

V. PROGRAMING TO MEET CHANGING NEEDS

A. Planning

Utilization research planning, as an integral part of the Agricultural Research Service program, is a continuously changing pattern of finding efficient ways to convert imaginative ideas to tangible, economic products and processes through coordinated scientific studies. This research planning has the benefit of the advice and cooperation of many organizations and individuals both within and outside the Department of Agriculture.

One of the foremost sources of assistance in research planning is the newly created Product and Process Evaluation Staff, a segment of the staff of the Administrator of ARS which focuses the talents of economists, chemists, and engineers on the commercial and industrial promise of utilization research and development projects proposed to the Administrator from all sources. Its function is to bring together those pertinent economic and technical facts which bear on the usefulness of the proposed research and to make recommendations based on them which will assure the commercial usefulness of the development program.

Another major source of assistance in research planning is provided by the Research and Marketing Act of 1946, whereby the Secretary of Agriculture appoints an overall policy committee (currently known as the National Agricultural Research Advisory Committee consisting of 11 members) and a number of commodity and functional advisory committees (at present 24).

Of inestimable value in research planning are the extensive contacts maintained with growers, processors, transportation and storage organizations, distributors, and consumers to obtain detailed information on the needs for new products and processes, on the success or shortcomings of previous developments, and on the long-range outlook affecting all farm commodities.

About 40 carefully selected specialists are retained on a "when employed" basis to give advice and to supply information in various fields of research. These consultants render invaluable assistance in research planning.

Aided by the information and ideas emanating from these many sources, the utilization research program is constantly under critical review, and modifications made in the program to keep pace with the changing needs. Unproductive research efforts are curtailed or discontinued, and new lines of investigation initiated, to the extent resources permit, to find additional ways of converting agricultural materials into products for large-volume, profitable uses.

B. Program modifications

All phases of utilization research are under constant review to assure that the efforts are directed to timely solving of significant problems. The following examples illustrate redirection of research activities to maximize fruitful achievements.

Completion of studies on quality factors of foreign rices, the discontinuance of cooperative studies on the processability of rice varieties grown under varying cultural conditions, and completion of a phase of developing improved methods for evaluating wheat flours, made resources available for the initiation of exploratory studies on preparation of new food products from the wheat protein mixture, gluten, with the aim of extending export markets for U.S. wheat.

Successful completion of studies which led to the isolation and identification of a powerful estrogenic growth-promoter in forages, made possible expanded research on biologically active components in processed forages and applied studies

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on enhancing favorable factors and ameliorating the effects of unfavorable components.

Contract research on improved bleaching of wool, in order to make domestic off-color wools more competitive with imports, were initiated by resources available upon the successful completion of studies which yielded improved finishing treatments for fabrics that had been resin-treated to impart shrink-resistance.

Successful development of commercially practical process for shrinkproofing of wool with epoxy resins released resources to expand studies on the interfacial polymerization treatment—a process that yields shrinkproofed, muss-resistant fabrics that can be further processed to produce durable pleats and creases.

The successful completion of an important phase of frozen fruit research, in which added stability of products packed in bulk containers was clearly demonstrated, allowed initiation of studies on improved processing methods for dried fruits.

Identification of the polyunsaturated fatty acids present in egg yolk was successfully completed, and released resources for increasing basic studies on the characterization of oxidative mechanisms in the egg lipid system—information important in interpreting and correcting undesirable flavor deterioration induced by processing.

Completion of the major phases of work on potato flakes, and wide industrial adoption of the process, have enabled shifting of engineering personnel to expedite the pilot plant development of the new process for "instantizing" dehydrated vegetables and fruits.

Work on the preparation from animal fats of resinous copolymer materials has been curtailed since the preparation of coplymers of vinyl stearate carried out in this field has attained commercial production. Research on monomers and polymers from animal fats is being redirected toward the synthesis of new monomers and other more basic lines of investigation.

On completion of studies of indigenous meat components as factors determining binding in meat and meat products, a new investigation was initiated which is concerned with study of the chemical activity on meat of curing ingredients, the substances which control binding in processed meats.

Completion of exploratory studies on the substances responsible for meat flavor and aroma indicated that these substances are derived from precursors consisting of carbohydrates, polypeptides, and amino acids and led to a reorientation of the direction of the research effort to concentrate on the problem of isolating and characterizing these specific precursor compounds.

Research on the isolation of maple sap fractions which are responsible for color and flavor of maple sirup was completed as a prelude to chemical characterization of the color and flavor constituents.

Research on the hexane-soluble constituents of Flue-cured tobacco was completed and personnel were reassigned to work on the correlation of lipid constituents with tobacco quality.

Development of a successful method for detecting antibiotics in milk was successfully accomplished, and the personnel have been reassigned to new research on methods for making low-fat cheese.

Research on development of a machine for rapidly determining the foreign matter content of lint cotton was successfully completed and the resources transferred to new research to develop a machine for removing short fibers from cotton.

With the development of an experimental apparatus for spinning cotton yarns without rings or travelers, the research was terminated and the effort transferred to augment research on the design of optimal structures for cotton fabrics for wash-wear products.

Engineering studies on the development of a process for making dialdehyde starch were successfully completed and personnel reassigned to expanding investigations on dry-milling hard wheat and to developmental studies on the chemical modification of wheat flour and flour fractions.

Cooperative studies with oat breeders to increase the vitamin content of oats were successfully completed and personnel reassigned to developing new chemicals from cereals.

A fermentative process for preparing carotene (vitamin A precursor for food and feed) from grains was successfully achieved, and personnel reassigned to explore fermentative processes for the production of xanthophylls (a feed supplement).

Studies on characterization of sterols in wheat were successfully completed, showing the presence of physiologically active sterols that are important to the feeding value of the milled feed fractions of wheat, and resources diverted to exploratory studies on the reaction of acetylene with starch to produce new starch products.

Engineering studies on the development of a process for preparing linseed and soybean oil vinyl ether resins were successfully completed and personnel reassigned to the development of a process for recovering erucic acid oil and feed meal from mustard seed, a potential new crop for the Montana region.

Laboratory studies on the preparation of plasticizers from soybean and safflower oils were successfully completed and personnel reassigned to expand work on the development of linseed oil water-emulsion paints.

Exploratory studies on the fermentative conversion of vegetable oil fatty acids to new hydroxy fatty acids showed this approach to be economically unfeasible, and efforts were redirected toward the fermentative production of amino oil derivatives.

Work was successfully completed to develop pulping processes for timber bamboo to produce paper and paper products, and personnel were reassigned to study the pulping properties of kenaf and other potential annual fibrous crops, and to expand investigations on new oilseed crops.

C. New research initiated with increased funds

Additional research was made possible by an increase in appropriated funds in fiscal year 1961:

(*a*) Expanded basic studies on wheat proteins and polysaccharides to increase food and feed uses of wheat.

(*b*) Exploratory studies to convert wheat flour into water-resistant, plasticlike chemical derivatives having properties suitable for industrial use in structural and insulating products and in molding compositions.

(*c*) Development of mass production methods for growing bacterial spores for controlling Japanese beetle infestations.

(*d*) Broadened development of optimal structures for cotton fabrics to produce wash-wear products having maximum recovery from wrinkling, maximum resistance to abrasion and tearing, good tenacity and drapability when resin treated, and improved soil resistance.

(*e*) Development of new types of yarns and fabrics from the coarser grades of wool, which represent the bulk of domestic wool production, and application of new physical and chemical treatments to obtain products suitable for a wide variety of garment uses.

(*f*) Expanded research on the chemical and biological properties of castorseed proteins for use in developing effective deallergenation methods for castor-meal, thus broadening the use of this oilseed crop.

(*g*) Develop new outlets for surplus inedible animal fats through (1) chemical research investigations on the synthesis of new fatty compounds and (2) evaluation of these products for industrial uses, such as special type lubricants and plastic chemicals.

D. Utilization research projects terminated

A total of 124 research projects were terminated in fiscal year 1961 for the following reasons:

Research objectives attained	62
Research objectives partially attained	29
Research results unpromising	3
Superseded by research of high priority or of more productivity	9
Exploratory research completed to define specific phases of a problem	21
Total terminated	124

E. Utilization research projects initiated

One hundred twenty-five new utilization research projects were initiated in fiscal year 1961. Of this 125, new domestic projects totaled 97, with 28 new projects being placed in foreign laboratories.

Commodity	Industrial uses	Food uses	Feed uses	Total
Cereal grains and forages	19	8	4	31
Cotton and wool	20			20
Fruits and vegetables		12		12
Oilseeds	10	7	9	26
New and special crops	6	5	1	12
Poultry, dairy and animal products	7	17		24
Total	62	49	14	125

VI. COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS

A dynamic utilization research and development program must consistently seek new ideas, get suggestions for new needs, and have real-use appraisals of the products and processes under development. One of the best ways of achieving such objectives is through cooperative undertakings with outside organizations. Below are outlined some examples of current collaborative work with industry, State experiment stations, academic institutions, and other Federal agencies.

Research in cooperation with Archer-Daniels-Midland Co., an industrial protective coatings manufacturer, is providing important information on evaluation of linseed and soybean vinyl ether coatings for use as can coatings.

High-amylose corn, needed as a source of high-amylose starch for a wide range of industrial uses being developed by utilization research, is being developed through cooperative research with the Missouri Agricultural Experiment Station and the Bear Hybrid Corn Co.

The utilization research cooperative program with the National Flaxseed Processors Association on the development of emulsion-type paints using polymerized linseed oil products, is resulting in new commercial outlets for linseed oil products.

In cooperation with the Florida Citrus Commission, Department research is directed toward commercial adaptation of its newly developed "foam-mat" drying process for production of high quality citrus powders that readily reconstitute with cold water.

Research conducted by the Department, in cooperation with the Canvas Products Association International and the Foundation for Cotton Research and Education (affiliated with the National Cotton Council of America), has demonstrated that suitable blends of pigments impart outstanding protection to cotton against biologic deterioration and degradation due to sunlight.

Research sponsored by the Office of the Surgeon General, and conducted in cooperation with the Louisiana State University Medical School and several research groups, has developed new and improved fat emulsions for intravenous feeding.

Better soybean meals for animal and poultry feeding are being developed in a three-way cooperative venture by USDA Utilization Research, Mississippi Agricultural Experiment Station (crops and animal husbandry), and an industrial processor.

Cooperative work with the National Cottonseed Products Association (which supports a fellowship in USDA) has led to the isolation and determination of some of the properties of the physiologically active Halphen-positive fatty acid in cottonseed oil and meal, a material found to accentuate egg yolk discoloration problems in stored shell eggs.

Excellent progress has been made in developing special intumescing fire-retardant protective coatings from tung oil and other domestic oils in cooperation with the U.S. Army Engineer Research and Development Laboratories.

In cooperation with the Pesticide Chemicals Research Branch, Entomology Research Division, a unique type of phosphorus compound called "APN", prepared by utilization research scientists in the course of work on chemical modification of cotton, has been found in initial tests to be a promising chemosterilant.

USDA's utilization research to develop new uses for leather is being materially assisted by industry cooperation, and gives promise of early adoption of a new tanning process that should broaden use of leather as outer garments.

The USDA, U.S. Atomic Energy Commission, and U.S. Public Health Service have a joint program for developing processes for removal of radioactive contaminants from processed foods, with initial efforts devoted to removal of strontium 90 contamination from milk.

The Agricultural Research Service, the Agricultural Marketing Service, and a manufacturer have cooperatively conducted a retail market test on full-flavor superconcentrated (7-fold) apple juice, developed in utilization research laboratories, which indicates high acceptance.

Fruit juice concentrates and concentrated fruit aromas (essences) recovered, by processes developed in utilization research, have been cooperatively evaluated with the University of Maryland for use in frozen dairy products.

Through cooperation with State experiment stations, State and Federal Extension personnel, State foresters, county agents, and industrial representatives in New York, Vermont, New Hampshire, Pennsylvania, Ohio, Michigan, Wisconsin, and Minnesota, new USDA processes for making better maple products are being rapidly adopted by the maple industry.

In cooperation with the Kansas Wheat Commission and the Trenton Foods Co., the first commercial manufacture of canned whole-kernel bulgur products,

a new use for wheat developed by utilization research, was successfully accomplished. The marked success of a market test, made cooperatively with the Agricultural Marketing Service, has resulted in the present commercial distribution of this new product.

Industry cooperation, through supplying sera from employees sensitized to handling castorseed, has assisted greatly in the Department's development of a diagnostic test for allergenicity—a vital link in broadening the uses for castorseed products.

A collaborative research program, consisting largely of studies of composition and stability of dried fruit products, is being conducted at one of the Department's utilization laboratories with financial support from the California Raisin Advisory Board, California Prune Advisory Board, California Dried Fig Advisory Board, and the Dried Fruit Association.

Cooperative studies on improved processing, feeding experiments, and crop genetics concerning the estrogenic growth promoter, coumestrol, present in fresh and processed forage legumes, have been conducted by utilization research of USDA, Nebraska, and Oregon State Experiment Stations, and the American Dehydrators Association.

In cooperation with the California Rice Experiment Station—and jointly supported by private, State, and Federal funds—a comprehensive study has been undertaken to determine the relationships between stage of maturity at harvest and processing characteristics of western grown rices.

VII. CURRENT UTILIZATION RESEARCH PROGRAM (FISCAL YEAR 1962)

Utilization research and development employed 958 scientific and technical personnel in its 4 regional and 10 associated field laboratories as of July 1, 1961.

The current program—at the beginning of fiscal year 1962—consisted of:

Projects in theUSDA utilization laboratories supported by regular appropriations (exclusive of projects under domestic contracts)	228
Projects under domestic contracts	64
Projects in USDA utilization laboratories supported by funds transferred from other Federal agencies	12
Projects directly supported by industry (fellowships)	27
Projects in 10 foreign countries under Public Law 480	75

Each field of utilization research encompasses a broadening base of fundamental studies, engineering investigations including pilot plant work for converting laboratory findings to practical commercial applications, and pharmacological evaluations to assure safe usage.

Cereal grains and forages

Principal interest is focused on wheat and corn, with substantial research on rice, barley, sorghum, oats, alfalfa, and other forages.

New processes for converting cereal grains into easy-to-prepare foods that have high flavor and texture appeal plus long shelf life.

Development of flavorful foods, nutritive feeds, and economical industrial derivatives from cereal grain fractions obtained by newly developed air-classification methods.

Development of processes for converting wheat derivatives into insulating materials, hard boards, and foamed structures formed at place of use.

New industrial uses through chemical modifications of the different major components of cereals, such an dialdehyde starches for improved wet-strength paper and tanning agents for leather, and high-amylose starch derivatives for films and paper coatings.

Microbial transformation of cereal grain constituents (principally starch and protein fractions) for use in toxicants, repellents, and attractants for control of insects; antibiotics for plant diseases; organic acids useful in a wide variety of industrial products; feed supplements such as modified carotenoids; and industrial products such as phosphomannans and other polysaccharides.

Fundamental and engineering investigations to develop more stable processed feed products of acceptable nutritive content from cereal grains and forages.

Cotton and wool

Chemical, physical, and mechanical processing research on cotton and wool and supporting fundamental and exploratory studies of their fiber properties and their modifications.

Chemical modification of cotton to give desired properities and uses such as wash-wear garments with crease resistance, smooth-drying and shape-holding properties; processes to impart water and oil repellency and flame, weather and rot resistance.

Development of cotton yarns and fabrics with stretch, bulk, and crepe properities.

Improved processing equipment for blending, weaving, and removing short fibers.

Chemical modification of wool to impart dimensional stability, permanent creasing, and other characteristics necessary for minimum-care garments; to improve resistance to acids and alkalies; to minimize carbonizing, bleaching, heat and light damage; to achieve more efficient felting for special uses.

Studies of the mechanical behavior of wool fibers, yarns, and fabrics as a basis for improved performance and new uses for wool.

Fundamental studies of chemical and physical properties of cotton and wool fibers necessary to the development of new products and new processes.

Oilseeds

Research primarily on soybean, cottonseed, and linseed oils, meals, and related products; investigations also include castor, tung, and selected oilseeds resulting from the new crops screening program. Research stresses new and broadened industrial uses, and seeks to improve feed and feed uses.

New chemical products derived from vegetable oils for new industrial uses—polyvinyl ether polymers; linseed oil emulsion paints; acids, aldehydes, and organometallic derivatives of industrial importance from soybean, linseed, and cottonseed oils; urethane foams from castor oil; fire-retardant coatings from tung oil.

Improved methods for extraction of oilseeds to achieve broadened industrial, food, and feed uses.

Investigations to remove any toxic and allergenic constituents of castorseed and cottonseed to permit wider usage of these oilseeds in foods, feeds, and industrial products.

Fundamental studies on composition and properties of vegetable oils, as required for developing industrial products of economic utility and food products of higher quality, including oxidative modifications, color and flavor changes, fermentative transformations, selective hydrogenation, and polymerization reactions.

Poultry, dairy, and animal products

Research directed to develop new industrial outlets for animal fats and hides, and to develop new food products—of high quality, convenience, and consumer appeal—from milk, poultry, eggs, and the more economical cuts of meat.

Research on milk products to develop processes for improved flavor, for gelation control, for removal of any radioactive contaminants, for producing a stable, full-flavored, foam-dried whole milk powder, and for improved concentrated sweetened cream.

New ways to utilize animal fats in lubricants, in detergents, in plastics, and other polymeric products.

Faster and more efficient tanning processes to make leather more useful, especially in the garment field; chemical processes for improving water repellency of leather.

Ways to retain and improve flavor, increase stability, and impart tenderness to meat and poultry products.

Development of egg-yolk-containing and egg-white-containing products with acceptable dispersability, functionality, and flavor stability; methods for better control of micro-organism, for example, *Salmonelle.*

New and special crops

Investigations directed to develop compositional data on crops from worldwide sources in an effort to find alternate crops to fill needs not now met by domestic sources; and to develop new and more economic uses for domestic special crops.

Screening of large numbers of plant materials, from both domestic and foreign sources, (*a*) for alternate crops, with special emphasis on sources of new types of oils for industrial uses that are not competitive with domestic vegetable oils and animal fats; (*b*) for new protein sources; (*c*) for fiber plants suitable for pulp production; and (*d*) for new sources of mucilaginous materials.

Investigations of new oilseeds seeking oils with properties uniquely suitable for industrial uses not now found in domestic commercial oilseeds, and noncompetitive uses for the meals.

Improved techniques for the processing of sugarcane, sugarbeet, and maple sap, and developing new uses for honey.

Development of new industrial chemicals from naval stores.

Research on the chemical composition of tobacco and tobacco smoke to assist industry achieve desired quality in tobacco.

Fruits, nuts, and vegetables

Research to develop fruit, nut, and vegetable products that are attractive, economical, nutritive, and meet the increasing demand for convenience in use, and to develop processes and equipment for manufacture of these products.

New processes for concentrating, dehydrating (particularly foam-mat drying), freezing, dehydrofreezing, and dehydrocanning of fruits and vegetables.

Time-temperature-tolerance studies of frozen fruit and vegetable products as a basis for improvement of processes and products.

New processes for stabilizing shelled nuts against development of rancidity, darkening, and other deleterious changes.

Compositional and enzyme studies to give processed fruit, nut, and vegetable products greater color stability, better flavor, and improved textural properties.

VIII. FINANCIAL INFORMATION

The fiscal year 1961 and fiscal year 1962 domestic utilization research and development funds under "Salaries and expenses, Agricultural Research Service" including allotments from the special fund for additional labor, are as follows:

	1961 (obligations)	1962 (estimated)
Cereal and forage crops	$3,703,270	[1] $4,031,000
Cotton, wool, and other fibers	3,836,438	3,991,000
Fruits and vegetables	2,737,073	[1] 2,882,000
Oilseeds	2,187,136	[1] 2,165,000
New and special plants	1,618,802	1,744,000
Poultry, dairy, and animal products	3,934,953	[1] 3,980,000
Total	18,017,672	[2] 18,793,000

[1] Excludes amounts made available from the contingency research fund as follows:

Cereals and forages: Research contract to develop methods for producing water-dispersible dried preparations of wheat gluten	$100,000
Fruits and vegetables: Research contract on constituents of dry beans causing flatulence	45,000
Oilseeds: Research on cyclopropene acids (Halphen) in cottonseed products	21,400
Poultry, dairy, and animal products: Purchase of special equipment needed in new process for removing radioactive contaminants from milk	18,300
Total	184,700

[2] Fiscal year 1962 includes an increase of $600,000 provided by Congress which has been distributed as follows:

	Fiscal year 1962 appropriation increase
Cereal and forage crops: Research to increase industrial and food uses of wheat and corn	$300,000
Cotton, wool, and other fibers: Basic research on cotton	100,000
Fruits and vegetables: Basic research on flavor constituents and development of new citrus products	75,000
Oilseeds: Research on linseed and soybean oils	25,000
New and special crops: Basic studies on tobacco	100,000
Total	600,000

NOTE.—In addition to the domestic utilization research and development program, approximately $1.67 million was obligated in fiscal year 1961 for utilization research projects, largely extending over a 5-year period, in foreign laboratories financed by funds generated under the Public Law 480 program.

IX. IMPORTANT RESEARCH ACCOMPLISHMENTS—FISCAL YEAR 1961

New convenience food from wheat

A new convenience food, ready prepared canned whole grain wheat, has been developed by Department scientists. This product can be used to contribute desirable body and texture to a wide variety of dishes such as soups, stuffing for poultry, puddings, salads, pilafs, and other foods. The new food is being test-marketed by USDA's Economic Research Service in cooperation with the Kansas Wheat Commission. Two manufacturers are in regional distribution in the Midwest and Pacific Northwest on the canned product and national distribution of a similar dried product is underway. Only a few minutes heating in a little water

is needed before serving the canned product. The convenience food is cooked whole grains of wheat with only the rough outer layers of bran removed. It has a delicate whole-wheat flavor and essentially the same nutritive value as whole kernels of wheat.

Commercially feasible new use for dialdehyde starch

A process has been developed for the tanning of sole leather in which dialdehyde starch, a new chemical derivative of cereal grain, is used as a pretanning agent followed by retanning with vegetable tan. The process, evaluated in a commercial tannery, produces commercially acceptable leather. Cost studies show that with dialdehyde starch at 30 cents per pound, a figure which should be attainable when full commercial production is achieved, the cost of the new process is competitive with conventional tanning. The big advantage is about a 50-percent saving in processing time, a definite economic gain. The new process can be applied in existing tanneries with minimum investment in additional facilities. Another advantage of the new tanning process is that the waste disposal problem—a serious one—is greatly alleviated.

New cereal products serve as an integral part of paper

New wheat flour and cereal starch products have been discovered that can be economically incorporated as an integral part of paper and other pulp products. Wheat flour and starches have been converted into water-soluble chemical derivatives that can be added to slurries of paper pulp which after a simple chemical treatment are precipitated on the pulp fibers to become part of the paper sheet. Chemicals used to make the cereal product cost only 3 to 5 cents a pound. Papers have been made in laboratory experiments containing as high as 45 percent of cereal product. The papers had higher dry and wet tensile strengths than all-woodpulp papers. No operating conditions that would conflict with commercial paper processes were necessary. If initial findings are borne out in larger scale tests, it is expected that the cereal product might replace 10 percent of the long fiber pulp now used in newsprint; 3 percent of the coating adhesives used in coated paper; 20 percent of the pulp used in making coarse paper; and 10 percent of the pulp used in making building and insulation board. These conservative estimates would require the use of 100–180 million bushels of grain for applications not using cereal products today.

New cereal starch plastics successfully prepared

A wide variety of new plasticlike products (graft polymers) has been prepared from cereal starch by attaching to the starch molecules polymeric chains derived from commercially available petrochemicals. Some of the products have sharp melting points, while others soften with heat and appear suitable for molding. Some are soluble in water, others in organic solvents. Certain of the soluble graft copolymers appear to be film formers. This basic research points the way to preparation of many new products from starch that can be "tailor made" to meet specialized industrial requirements.

Dry milling and fractionation of cereals and cereal flours

Engineering studies on the fine grinding and air classification of flours from a wide variety of hard and soft wheats—and from sorghum, corn, rice, and soybeans—have shown that many new and potentially useful products can be obtained. By fractionation of cereal flours, materials differing over a wide range in chemical and physical properties become available. Some of these may be expected to find use in outlets that represent new markets for cereals and their flours. Soft wheats gave low-protein fractions suitable for use in products such as paper and gypsum board, and high-protein fractions for higher valued food uses. Hard wheat yielded fractions potentially useful in industry or in food products such as cake flours or high-protein concentrates for food fortification. Small changes were noted in the properties of fractions from rice and soybean flours. Sorghum and corn flours yielded fractions that varied considerably in properties, and the lower protein flours from each have increased industrial potential.

New species and strains of yeast collected abroad

About 200 specimens of yeasts have been collected in Spain under a Public Law 480 research grant and submitted for detailed study by experts associated with the ARS culture collection. This activity has resulted in a number of valuable additions to the collection. New species of yeast have been found. Some strains show carbon assimilation patterns unlike those of other yeasts. Other specimens have characteristics that should prove useful in research to develop stable inbred strains of yeast incapable of sexual reproduction that may have value for fermenta-

tive production of new chemicals. The new species and strains of yeast augment significantly resources of the collection for exploratory studies to provide basic information on industrial use of micro-organisms to obtain new products and processes by fermentation of agricultural commodities.

Visco-elastic properties of wheat gluten explained by basic discovery

Wheat gluten is unique among proteins in its visco-elastic properties which are responsible for the ability of bread dough to rise by entrapping gases. These properties were shown to reside in the glutenin component which makes up 50 percent of the gluten, and which is composed of large molecules ranging up to several million in molecular weight. Cleavage of the sulfur linkages in this component gave uniform protein molecules having a molecular weight of 21,000. This derived protein has no visco-elasticity. Thus, it is evident that glutenin is composed of polymers of the small protein molecules held together by sulfur linkages, and that this polymeric character is necessary for the unique visco-elastic properties. This basic information points the way to applied studies directed toward controlling gluten properties for both food and industrial applications.

New soluble gum from corn sugar

The ARS process developed for producing a water-soluble gum by bacterial fermentation of corn sugar is being adapted to commercial use by three manufacturers. The gum, called polysaccharide B–1459, dissolves in water to give clear, viscous solutions. These solutions have viscosities uniquely stable to heat, acids, alkalies, inorganic salts, and aging. The manufacturers foresee applications for the gum in adhesives, agricultural sprays, emulsions, oil-well drilling and flooding agents, paper and textile sizes and coatings, latex paints, leather pasting and finishing compositions, and preparations for use in the ceramics industry. The current market in the United States for water-soluble gums, which are almost entirely imported, amounts to 40 million pounds annually.

Nutrients in dehydrated forages protected by chemical stabilizer

The major producers of dehydrated forages have announced that their total production will henceforth be treated with ethoxyquin—a stabilizing agent whose use for this purpose was discovered by Department scientists. It is estimated that 80 to 90 percent of the dehydrated forage produced in the United States will be protected with this antioxidant, preventing severe losses of valuable provitamin A, vitamin E, and poultry and egg pigmenting factors (xanthophylls). Cooperative studies conducted at State experiment stations have shown that incorporation of ethoxyquin in mixed feeds also prevents certain diseases in poultry and lambs, as well as rancidification of fats in feeds. Development and commercial adoption of the ethoxyquin treatment is the result of a joint research effort involving scientists from the Agricultural Research Service, State experiment stations, and the industry. Extensive toxicity testing over a 5-year period led to Food and Drug Administration approval for the use of the compound in dehydrated forages and mixed feeds for all types of animals. A new commercially available water emulsion of ethoxyquin has reduced cost of treatment by one-half to less than 50 cents per ton of dehydrated forage or mixed feeds.

Growth promoter in forages

The compound, coumestrol, previously discovered by Department scientists, has been shown to be a powerful animal growth promoter. This substance has been found in certain lots of fresh and dehydrated alfalfa and other forage legumes. In recent cooperative studies, processed forages rich in this compound were fed to fattening steers at the Nebraska Agricultural Experiment Station. The rate at which the test animals gained weight was impressive. At the Oregon Experiment Station, sheep (wethers) whose diets included a coumestrol-rich dehydrated alfalfa showed marked increases in rate of gain over control animals receiving low-coumestrol dehydrated alfalfa. Development of methods for producing standardized, high-coumestrol forages for use in animal feeds, will provide farmers with a new, high-value market for forage crops.

New processes enhance wool usefulness

The new interfacial polymerization (IFP) treatment that gives wool fabrics markedly improved performance characteristics—including greater shrink-, muss-, and pill-resistance and increased wearability—is being rapidly adapted to commercially feasible processes. The process for applying the new finish, discovered by basic research, has been developed in standard commercial equip-

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ment, and the processing variables, including speeds, temperatures, and specific requirements for different fabrics, have been determined in the new wool processing plant at the western division. Announcement of this new IFP process, although less than a year ago, has resulted in the immediate initiation of intensive mill development studies by several of the country's largest wool mills, assisted by Department scientists and technologists. These cooperative studies are aimed at adapting the process to a continuous, high-speed treatment, under the particular conditions existing in the various plants. Many industry processors have expressed the opinion that the IFP treatment is superior to all existing commercial shrink-resist treatments.

In other utilization investigations, derivatives of corn sugar and related carbohydrates have been used successfuly as intermediates in synthesis of high-molecular-weight polyamide resins that have aroused industrial interest in possibilities of their use for shrink-proofing woolen fabrics. The resins also have promise for other industrial uses such as molded articles, and coatings to meet special requirements. This research was carried out in Scotland under a Public Law 480 grant.

Industrial uses for wool

A rapid chemical process has been developed which greatly simplifies wool feltmaking, eliminating the need for the slow, expensive mechanical beating traditionally used to produce dense wool felts. The process is based on the discovery that the chemical, dimethyl sulfoxide, causes wool fibers to contract in length. Thus, soft wool felt treated with hot dimethyl sulfoxide becomes dense and hard within a few minutes. Hardness can be controlled by varying either the time or the temperature of the treatment. Mechanical tests show that felts made by this new process are two to three times stronger than the original, untreated felts. The hardening and toughening of the felt are permanent, because the contraction in fiber length is the result of rearrangement of the wool molecules. The new method has an advantage over present batch practice since it is adaptable to continuous processing. Commercial evaluation of the process is underway. In addition, industrial users of felts are studying the increased utility of chemically produced felts over wool felts produced by traditional procedures.

New processes for producing stretchable and bulky cotton textiles

Textiles that have stretchable characteristics are receiving widespread acceptance in both wearing apparel and industrial applications. For wearing apparel, increased bulk may also be of importance. Department scientists have been investigating three methods of producing stretchable cotton textiles and each method has excellent commercial possibilities. In one method the cotton is crosslinked while under a twisting stress, and then crimp and bulk are imparted by a stress reversing twist. Several companies are interested in this method of treatment and one company considers their product ready for commercialization.

The second method being investigated is the application of standard false twisting techniques to thermoplastic cottons. These crimped, chemically modified cottons are reported by one company to be ideally suited for tropical wearing apparel.

The third method is that of completely relaxed shrinkage in mercerizing caustic solutions. Industry has demonstrated enthusiastic response to the slack mercerized products for both industrial and wearing apparel uses. Several companies have announced the availability of these products and one company is in the advanced stages of producing cotton fabrics with stretchable properties in both the warp and filling directions. Further research is in progress to perfect these processes and products so that products having the desired use-quality characteristics can be produced.

New aerodynamic cleaner improves quality of cotton products

A new lint cotton cleaning device, called the SRRL Aerodynamic Cleaner, has been developed by the Department to help the textile industry efficiently process cotton that has been harvested mechanically or by hand snapping. The cleaner is designed specifically to remove from cotton the motes and fine leaf (pepper) trash that are currently plaguing the cotton industry, and is used in combination with either of two lint cotton opening machines known as the SRRL Opener and the SRRL Opener-Cleaner. The combined Opener-Cleaner, Aerodynamic Cleaner units will remove up to about 45 percent of the trash from lint cotton. Although the new cleaner was just recently released, nine commercial firms are already licensed to use the development and two are known to be manufacturing

the cleaner. Reports from the textile industry indicate that the device is doing an excellent job of removing pepper trash (a material which conventional cleaning equipment has not been able to adequately remove). This will aid industry in producing higher quality cotton products.

New finishes for producing wrinkle-resistant and wash-wear cottons

A new class of agents for imparting wrinkle-resistance and wash-wear properties to cotton fabrics has been developed and tested on a laboratory scale by USDA scientists. The finishing agents employed are dimethylol monocarbamates. The treated fabrics have good wash-wear properties and the finish is durable to multiple launderings. A highly desirable feature is the resistance to the chlorine bleach almost universally used in laundering. Potential low cost, ease of preparation, standard methods of application, and the good appearance and durability of the finished cotton fabric combine to give the method great commercial promise. Specific agents of this general class are being investigated to determine their suitability for commercial use.

An investigation of the reaction of formaldehyde with cotton has provided fundamental information about the mechanism for changing the physical properties of cotton which has resulted in the development of several new processes for the production of wash-wear cottons. In one of these processes wet wrinkle resistance is imparted to cotton fabric, thus providing line-dry fabrics. Other processes produce fabrics having the desirable property of dry wrinkle resistance in addition to wet wrinkle resistance. The most recently developed vapor process achieves these results with very low amounts of formaldehyde combined with the fabric and may be applied to completed garments, such as shirts. The finishes are durable to laundering and to chlorine bleach, characteristics necessary for good wash-wear performance. Two of the processes have been applied on commercial type equipment and several textile mills are actively engaged in evaluating them. Because of the low cost of the chemicals employed, the formaldehyde processes should be very economical. This work has stimulated a reexamination of this type treatment by industry, and several companies are reported to be producing wash-and-wear cottons using formaldehyde.

Flame-resistant cotton products

Good progress has been made in research to improve the light and weathering resistance of the APO–THPC flame-retardant finish for cotton fabrics, a superior flame retardant previously developed in cooperation with the Quartermaster Corps. By changing the ratio of the chemicals employed in the APO–THPC treating formulation, the outdoor service life of medium-to-heavy fabrics has been increased by 40 to 50 percent (to approximately 18 months). This service life approaches the useful life of textiles subjected to intermittent exposure to weathering. Research is continuing to effect further improvements in this type flame-resistant finish for use on tents, tarpaulins, boat covers, and certain types of industrial fabrics.

Fundamental information on microbiological breakdown of cotton

Cotton fabrics in many applications are exposed to bacteriological and fungicidal attack. Fundamental research at the Shirley Institute, Didsbury, Manchester, England, involving Public Law 480 funds, has resulted in the development of important information on the biochemical pathways involved in the microbiological breakdown (hydrolysis) of cotton cellulose. Studies of the enzyme systems involved have shown that these systems consist of at least two types. One of these, less of which is present in isolated enzyme preparations, appears to penetrate the cellulose more readily. This would explain the significantly greater degradation of cotton by living organisms compared to the limited degradation by the isolated preparations. Research in progress should enable the development of laboratory test methods that will simulate more closely actual service conditions of cotton products, thereby aiding in obtaining information that will facilitate the development of more effective preservative treatments for cotton.

Practical method for imparting weather and rot resistance to cotton fabrics

A practical, low-cost treatment, developed for making cotton fabrics exposed to mildew, rot, and weathering last much longer, offers promise of maintaining a market of approximately 230,000 bales of cotton a year in canvas goods products such as awnings, tarpaulin, tentage, field coverings, beach umbrellas, ditch liners, and irrigation pipes. The treatment uses a chemical called acid colloid of methylolmelamine, and can be applied with equipment already available in a great many textile finishing plants. One finisher has produced the colloid-treated fabric and

supplied it to approximately six consumers who are using it as ditch liners, dam stops and in other applications. Other samples are under experimental exposure as seedbed covers in Florida. Further interest in the development is anticipated.

Machine for rapidly determining foreign matter content of cotton

A completely self-contained and compact machine, called the Trash Analyzer, has been developed for rapidly determining the foreign matter content of lint cotton. The machine is capable of 95 percent cleaning efficiency at 60 pounds per hour production. Trash content of a bale of cotton can be determined in less than 5 minutes with this machine, as compared with 1 hour with conventional machines. The Trash Analyzer is being evaluated over a wide range of grades and qualities of cotton. It is a tool long needed by the industry and its use will aid manufacturers in producing higher quality cotton products.

Basic information on fabric failure developed by microscopical study

Research employlng light and electron microscopy has contributed new information toward a better understanding of fabric failure. The results of flexural strain, compression, and frictional wear can be seen, especially at the submicroscopic level. In fabric-to-fabric flat abrasion tests on gray cotton, the surfaces of cotton fibers appeared considerably damaged when examined with the electron microscope by the replica technique. This study of fabrics, yarns, and fibers under varying conditions of abrasion should contribute to a better understanding of the breakdown of fabrics in everyday use and toward potential inprovement of abrasion-resistant treatments. Increased utilization of cotton should result from the development of fabrics having improved abrasion resistance.

Chemistry of meat flavors

The factors responsible for flavor and aroma in meats have been resolved into several principles. First, flavor is derived from some of the water extractable substances in meat. Second, the substances extracted are not flavors but precursors which develop flavor on heating. Third, lean beef, pork, and lamb have a similar flavor; but contributions from the fatty tissue confer flavor differences characteristic of the species. For example, lamb fat contains nontriglyceride material that on heating releases minute amounts of carbonyls responsible for most of the characteristic lamb aroma. Flavor substances, isolated and studied to date, include amines, sulfide compounds, carbonyls, and fatty acids. The substances from which these were derived have been identified as low molecular weight carbohydrates, polypeptides, and amino acids which produce flavor by their interaction. These new facts concerning meat flavor provide a basis for the development of improved processing, handling, and preservation aimed at the production of better flavor meat and meat products.

Removal of strontium 90 from milk

The U.S. Department of Agriculture, the U.S. Atomic Energy Commission, and the U.S. Public Health Service have undertaken a joint research effort to develop a feasible commercial-scale process., to be used in case of national emergencies, for the removal of radioactive contamination from milk. A continuous pilot plant process, using commercially obtainable equipment, has been developed which removes over 90 percent of strontium 90 in a single pass through a resin bed with little or no effect upon the flavor and stability of the milk. It is estimated from these pilot plant studies that such removal of strontium 90 would cost in the order of 5 cents, or perhaps higher, per quart of treated milk. The research is continuing in an effort (*a*) to refine the resin regeneration phase, (*b*) to explore other removal procedures that might be more efficient, and (*c*) to study the problems of adapting a pilot plant process to commercial use.

Dried cheese whey—A new product

Cottage cheese whey, which had hitherto not been dried, now can be successfully dried by a new ARS method of foam-spray drying. At present, 3 billion pounds of cottage cheese whey produced annually and containing half the solids of milk are wasted into sewers and streams. With the development of stream pollution control and urban charges for sewer use, cottage cheese plants are faced with heavy disposal expense and even forced closing. Following publication of the new method, inquiries were received from virtually every large dairy company and dairy equipment manufacturer in the United States. It is anticipated that the method will find wide commercial adoption. Its use may avoid the closing of factories and it will provide a new dairy ingredient for food manufacturers.

Autoxidation in fatty foods

Basic studies to determine the role of major food components, including fats, in autoxidation and off-flavor development, have shown that histidine, one of the common amino acids of proteins, has a profound effect on autoxidation of fats. In aqueous emulsions of fats it is a powerful prooxidant, and if traces of iron salts are also present the prooxidant effect is greater than when either histidine or iron salts only are present. Phosphates nullify the prooxidant effect of histidine. The findings are of importance to a better understanding of factors that promote or retard autoxidation in fatty foods, and should point the way to a practical solution of the off-flavor problems in many food products.

Surfactants from tallow

Utilization research has shown that alpha sulfoacids prepared from tallow are effective lime soap dispersing agents, and may be expected to be useful in the form of soap-detergent combinations. It has also been discovered recently that certain esters of the alpha sulfoacids are especially effective as wetting agents. Since they compare in effectiveness with the best known commercial wetting agents and are also potentially very cheap to manufacture, commercial interest in them seems assured. In the meantime, manufacture of alpha sulfoacids has been undertaken by several commercial concerns.

New apple juice product

A market test recently conducted by AMS in cooperation with ARS and industry has shown the USDA-developed sevenfold superconcentrated apple juice to have an excellent public acceptance. In consequence, a large Middle West processor will manufacture it this season for household use. This product rapidly reconstitutes to give a juice having the aroma and flavor of fresh juice. It has already been manufactured on a commercial scale for use by the jelly industry. However, this market test will open the way to expanding its use as a beverage.

Basic studies aid sausage manufacture

Excellent progress has been made in studies, conducted at the Research Institute of Meat Technology, Hameenlinna, Finland, under a Public Law 480 grant, on the effect of various micro-organisms on the development of flavor (aroma), color, and other desirable chemical changes occurring during sausage manufacture. Over 700 strains of organisms obtained from curing brines used for curing hams and sausage have been screened for their ability to affect certain qualities (color, flavor, etc.) in the finished product. The conclusions reached from the results obtained so far are that no single strain of bacteria can produce all the changes desired in the ripening of dry sausage, but a mixed culture composed of several strains will be required to effect these changes. This will entail a detailed study of a very large number of organisms, but the fundamental results obtained undoubtedly will be of great value in devising methods of manufacturing improved sausage and other cured meat products.

Research finds a major cause of egg spoilage

Basic studies of the nature of bacterial growth in egg whites have revealed that trace amounts of iron counteract the protective action of the protein, conalbumin, in egg white and thereby permits spoilage. Applied studies based on this finding have shown that iron in the water used to wash eggs can be high enough to markedly influence spoilage. With wash water containing 5 to 10 parts per million of iron, a level commonly found in well water, spoilage is threefold to eightfold that obtained with water containing less than 0.5 part per million of iron. This discovery is helping egg producers and processors reduce the serious shell egg spoilage that accounts for a loss of approximately $20 million annually. Major egg producers are starting to treat wash waters to lower iron content to 0.5 part per million before eggs are washed prior to shipment, in order to eliminate excessive spoilage.

Levopimaric acid from pine gum

Levopimaric acid is an important, reactive resin acid present in pine gum. It would be a valuable intermediate in the chemical industry if practical processes were available for isolating it from the gum in a pure form. Department scientists have succeeded in developing a laboratory procedure which produces levopimaric acid salt of 90 percent or higher purity in good yield, from pine gum. Indications are that it will be possible to isolate the pure acid without altering the composition of the turpentine or decreasing the value of the residual rosin. Additional research is underway to develop information needed for possible commercial-scale use of the procedure.

Basic compositional studies of tobacco

Significant progress has been made, in cooperation with the Cigar Manufacturers Association of America, in the isolation and identification of the numerous chemical compounds which account for the color, aroma, and leaf pliability of tobacco. Aliphatic and cyclic paraffins, terpenes, tocopherols, sterols, and at least 15 higher fatty acids and their esters were characterized. In addition to the fatty acids, which contribute to the flavor and aroma of tobacco smoke, other complex highly aromatic mixtures were isolated.

New crop seed oils containing epoxy-fatty acids for plastic composition

Ironweed seed, *Vernonia anthelmintica*, a potential new crop, contains 20 percent of oil the principal component of which is epoxy oleic acid, a compound which has application in plastic compositions. Research has shown that the oil from fresh seed, extracted promptly after grinding, contains 65 to 70 percent of epoxy oleic (vernolic) acid combined almost entirely as glycerides. The seed contains an active lipase which rapidly hydrolyzes the glycerides and produces free acids unless the extraction is done promptly after grinding the seed or unless the enzyme is deactivated. A process for deactivating the enzyme without destruction of epoxy acid has been developed. A method has also been developed for isolating the triglyceride of epoxy oleic acid from the crude oil in 95 percent purity and in good yields. This finding is an important step in providing a relatively pure material for future work in the evaluation of the trivernolin and its chemical derivatives for industrial use in the field of plastics, polymers and surface coatings.

Valuable chemicals found in wild plants

Substantial percentages of novel components, many having significant industrial potential, are present in a number of the 3,400 samples of uncultivated plants analyzed. Recently discovered products include vegetable oils unlike those commercially available and new carbohydrate seed mucilages. The new oils have been converted in the laboratory to plasticizers, foamed plastics, dibasic acids for polymers, and waxlike substances. Coproduct meals of some oilseeds have been upgraded for feed use by newly developed processes. The seed mucilages are effective as additives for increasing paper sheet strength. These uncultivated plant samples come from both domestic and foreign sources through cooperating agencies in the Department. Projects under Public Law 480 provide many foreign species. Species desirable both agronomically and industrially can lead to development of new crops offering greater latitude in farmers' choice of commodities for profitable land use.

Efficient plasticizers from cottonseed fatty acids

Attractive plasticizers for vinyl chloride plastics have been produced from the fatty acids of cottonseed oil. One of these plasticizers, the morpholide of selectively hydrogenated cottonseed fatty acids, is superior to the commonly used "DOP" plasticizer in efficiency, volatility and low-temperature performance, and comparable in thermal stability. Another type, the morpholide of partially epoxidized cottonseed fatty acids, has an even higher efficiency and lower volatility and imparts a markedly greater thermal stability to the vinyl chloride resin used in the plastics, though at some sacrifice in low-temperature performance. In addition to being a good plasticizer, it is also an efficient vinyl chloride stabilizer. Several industrial companies are evaluating the new products in various applications.

Cottonseed oil color improved

From 25 to 50 percent of domestically produced cottonseed oils contain reddish colorations that are not satisfactorily removed by present commercial refining, bleaching, and deodorizing methods. These oils are discriminated against and have reduced market value. Research by Department scientists has shown that activated alumina is a satisfactory bleaching agent for these off-color cottonseed oils. The activated alumina used in the new bleaching process has been found to be about 16 times more effective than Fuller's earth conventionally employed in bleaching cottonseed oil. The spent alumina can be reactivated and reused indefinitely without loss of its effectiveness as a bleaching agent and with little loss of alumina. The new process has no adverse effect on important oil properties. Pilotplant work on bleaching cottonseed oils with alumina is in progress to show whether the cost of alumina bleaching will be competitive with present refinery procedures for processing off-color oils, and to develop information necessary for possible commercial scale use of the process.

Solvent-blown urethane foams from castor oil

The preparation of lightweight plastics, known as urethane foams, based on castor oil, has resulted from earlier Department research. These foams were prepared by the foaming action of carbon dioxide gas produced as a result of the chemical reaction of water with one of the components of the polymerization mixture. A method for preparing improved castor-based foams has been developed in which the foaming is produced by vaporization of a low boiling solvent due to the heat of reaction generated during polymerization. Such foams may be used as upholstery materials, crash pads, for thermal and accoustical insulation, light weight structural materials and numerous specialty products. In general, such lightweight solvent-blown plastics are stronger and have better thermal insulation properties than the analogous water (carbon dioxide) blown foams. Commercial evaluation of such foams based on castor oil is underway.

Basic allergens research

Utilization of castor-seed meal, a rich source of protein, is limited because of the the presence of very potent allergens. Many humans become sensitized by extremely small amounts of the dust from the meal and thereafter react violently to exposure. Department scientists have demonstrated that castor meal contains at least six proteins which cause allergic reactions in monkeys sensitized with serum from humans allergic to castor. These findings have led to the development of a new diagnostic test for allergenicity, in which inexpensive Philippine Old-World monkeys, instead of allergic humans, can be skin tested repeatedly. In other studies, a process has been devised that appears promising as a commercial method for inactivating the principal allergenic constituents in castor-seed meals.

Solution of the castor-seed allergen problems, made probable by these discoveries, gives promise for growing castor as an industrial crop on large acreages in the United States.

New process for soybeans in commercial use

During the past year, two soybean processors have installed commercial-size flash desolventizer units based on the original designs and pilot-plant development of the Department. These desolventizers were developed to remove solvent from extracted soybean meal without damaging the protein by excessive heating. Meal quality, as determined by water solubility of the protein, can be controlled over a wide range by simple adjustment of operating conditions. Use of this process permits the economic production of undenatured extracted soy flours and will promote the further development of high-quality soybean protein food products. The equipment required for the flash desolventizer is of simple construction and flexible design so that it can be added to existing plant facilities at low cost without major building revisions. It is unique in that it contains no moving parts in the desolventizing zone.

New chemicals from soybean oil show industrial promise

Ozonization of soybean oil or its fatty acids has yielded a variety of new chemical derivatives that have attracted widespread industrial interest. One type of derivative, called "MAZ" is an ester of a reactive aldehyde and shows much promise as a cross-linking agent for synthetic polymers and as an intermediate for novel types of acetal resins. Another type of derivative, called "aldehyde oil," retains the glyceride structure of the original oil and can be prepared in several forms having different degrees of reactivity toward other chemicals. Uses in plastics, resins, plasticizers, paper, and textile chemicals are being explored. Process economics appear to be very favorable for these new chemicals which have raw material costs of 12 to 23 cents per pound. Potential market areas for MAZ and aldehyde oils now consume 3 billion pounds of organic chemical products annually. These new chemicals are now being commercially evaluated.

"Hidden oxidation" a major factor in quality of soybean oil

The most important problem of the soybean oil industry is development of objectionable flavor during storage of the oil or upon exposure to heat when used as a cooking oil. Most of the volatile flavor components of these oxidative decomposition products are removed during the deodorizing stage of the refining. However, utilization research found that about 90 percent of the total decomposition products remain in the refined oil. Studies have shown that these residual products undergo further changes with time to reduce the flavor and oxidative stability of oil which may appear to be of high quality immediately after refining. These effects from unremoved oxidative products have been called "hidden oxidation." A method for detecting hidden oxidation has been developed by the

Department, and industry is now testing it. This test reveals the history of the oil and provides information on its future stability for use as salad oil.

Fast-drying linseed oil emulsion paint developed

Stable linseed oil-water emulsion paints have been prepared that dry-to-touch, develop excellent water resistance, and can be recoated within 15 to 30 minutes after application. The paints can be thinned with water, and water can be used for brush cleanup. Samples evaluated by six cooperating industrial companies compared favorably with commercially available synthetic resin emulsion paints in brushing, wet-edge, hiding, drying, and other essential properties. They were superior to many of the commercial synthetic resin paints in leveling, blister resistance, and adherence to chalkyweather surfaces. Outside weathering and long-term storage tests, and additional formulation studies to obtain the best combination of properties are being undertaken preparatory to commercial production of these paints.

New emulsifiers made from linseed oil

Nonionic emulsifiers of several types have been prepared from linseed oil by chemical derivatization of linseed fatty acids or linseed fatty alcohols. These new emulsifiers have properties uniquely different from conventional products now in use. When used to formulate linseed oil emulsion paints, the new emulsifiers appear to exert a specific stabilizing effect when the paints contain zinc oxide as one of the pigments. When such paints are formulated with conventional emulsifiers, they almost always increase gradually in viscosity until they become too thick to be used. With the new linseed oil derived emulsifiers, formulations are easily achieved having viscosities that have remained stable for more than 2 years. Emulsion paints made with these new products are being evaluated by six industrial companies.

Edible gels and foams made from soybean protein

Edible gels and foams have been made from refined soybean protein that have been good potential for both food and industrial uses. The gels, which are the first heat-reversible gels made from a vegetable protein, become liquid when heated and thicken when cooled. Foams made from solutions of the refined protein are unusually stable—several times more so than other foam products tested for comparison. They offer wide potential in many types of food products—giving them added desired texture and flavor properties.

Dehydrofreezing of fruits and vegetables gains broad acceptance

Dehydrofreezing is a new method of food preservation developed by Department scientists, whereby foods are partially dehydrated and then frozen. The process is now in commercial use. Several million pounds of dehydrofrozen apples are being produced each year for use in commercial bakeries. Dehydrofrozen peas, carrots, and potatoes are being manufactured in rapidly increasing tonnages and are becoming important export items. Three million pounds of dehydrofrozen pimientoes were produced last year for use in cheese products. A large food concern has just completed a successful market test of dehydrofrozen baby foods, including fruits, vegetables, soups, meat dinners, and puddings.

In the new process, dehydration is limited to removal of about half of the water present to avoid the irreversible quality damage that occurs during late stages of complete drying. The reduction in product weight and volume achieved by partial dehydration results in large savings in costs of freezing, packaging, handling, and shipping. Fresh flavor, texture, and color are retained by keeping the product frozen. Less drip on thawing and easier moisture control during remanufacture are among the advantages of dehydrofrozen over conventional frozen foods. The fresh-product quality, the convenience, and the economy of reconstituted dehydrofrozen foods assures expanding acceptance of dehydrofreezing as a method of food preservation.

A better dry bean product

Objective scientific research has not only established the cause and effect relationship between dry bean ingestion and flatulence, but has also yielded a reproducible method for demonstrating this relationship. A variety of bean products, including canned pork-and-beans, oven-baked beans, canned dry limas and canned green limas, have been examined and have all been found to cause the same response. It has also been demonstrated that contrary to popular belief, the causative agent is not the high fiber content of beans, nor the resistance of the cell walls to digestion in the upper intestine. The substances in beans which cause flatulence have not yet been identified, but the development of a

reliable, quantitative method for studying the phenomenon has removed the major barrier to this research, and should speed the identification of the substances responsible. This will lead to modified processing procedures to eliminate undesirable effects.

The present farm value of dry beans is about $110 million annually. Development of dry bean products devoid of flatulence-producing properties could double or treble the demand for this inexpensive but highly nutritious food.

New antimycotic agents discovered

Chemical preservatives, called sorbates, are now being used successfully on a commercial scale as antimycotic agents on retail packs of high-moisture dried prunes and figs. The utility of these compounds for this purpose was discovered by utilization scientists. Sorbates are also being used on bulk packs of these fruits for domestic and foreign shipment. The residual antimycotic effect is the most important attribute of this treatment, and represents an important advantage over the agents that were used for many years. The farm value of prunes and figs has been in excess of $50 million for the past several years and the value of the processed products is substantially greater than this. Six of the largest packers of these dried fruits now use sorbates on the major part of their packs. This is benefiting the growers by extending the domestic and foreign markets for these products.

Breakthrough in bacterial spore research

The great resistance of bacterial spores to heat makes it necessary to apply severe processing schedules in the canning of nonacid foods. This results in quality losses, and makes impossible the canning of certain commodities. Basic research on the nature of the heat resistance of spores has been impeded for decades by the difficulty in obtaining substantial quantities of clean spores, free of vegetative cell debris and medium particulates. This problem has now been solved by development of a two-phase solvent extraction system that makes possible the recovery of clean spores of *Clostridium botulinum* from dead cultures with a very low (1 percent) spore population. In other species, it has proved effective in removing very small amounts of subcellular debris. This accomplishment is a major breakthrough in microbiological research and has implications far beyond the solution of agricultural problems.

Fundamental research on food stabilizers

Basic research, being conducted in the United Kingdom under a grant through Public Law 480, is providing important information on the relationship between molecular structure and antioxidant activity. Among the antioxidants studied have been complex chemical compounds called polyphenols. These compounds have yielded some particularly valuable information on structural features necessary for antioxidant action. This information will prove of value in the design of practical antioxidants which combine the ideal structural features with commercial availability. The importance of this basic research is recognized since expansion of markets for many food products is limited by rancidity that develops in these products on storage. This rancidity, caused by oxidative deterioration of fats, can be inhibited or prevented by addition of trace amounts of suitable antioxidants. These fundamental studies are invaluable guidelines for developing antioxidants that are adequately effective and acceptably safe for use in foods.

Dehydrated mashed potatoes make further gains

A new direct process for the manufacture of dehydrated mashed potatoes in the form of granules yields an instantly reconstitutable product of uniform high quality. Cooked potatoes are dried and granulated in a series of operations which eliminates any recycling of partially dried product. New procedures and specially designed equipment make it possible to separate the delicate potato cells and dry them with a minimum of mechanical damage. Invented by utilization scientists, the process is undergoing intensive industry evaluation, and may well lead to greatly increased production, presently exceeding 150 million pounds annually of dehydrated mashed potatoes (flakes and granules).

Cherry brining

During the past several years, growers have suffered sizable losses due to the sporadic and unpredictable deteriorative softening of cherries during brining. The direct loss to the grower resulted from the withholding of crop payments until the brined cherries were examined several months after brining. Research

on this problem has yielded reproducible sampling procedures, and a simple objective method for measuring texture of the brined cherries. The mechanisms of softening have been identified by basic enzyme studies. Pectinolytic degradation has been shown to play a major role in softening. In addition, breakdown of the tissue cellulose and hemicelluloses occurs, presumably by a chemical process since cellulytic enzymes are not involved. This basic information, confirmed by model system studies, provides the information needed by the industry to develop modified brining procedures which will prevent softening. Potential losses to growers of as much as $5 million per year can thus be prevented.

Flavor components of onions identified

Improved products from a large variety of fruits and vegetables may be possible as a result of basic research on the flavor components of onions. Isolation and identification of the volatile flavor components of sliced onions furnished clues which led to the identification of precursor materials from which flavor components are derived. This in turn led to the isolation of an enzyme from onion capable of producing onion-like flavors from these precursors. Studies of these enzymatic reactions showed that chemical determination of the amount of a substance called pyruvic acid present in the onion can be used as an objective measurement of pungency. High pungency is desired in onion varieties used for processing. As a result of this research, the plant breeder can judge more accurately and more quickly whether varieties are suitable for processing. These findings suggest areas of research on other fruits and vegetables aimed at determining flavor precursors, and isolating flavor enzymes and determining their stability during processing. Greatly improved processed products will thus result.

Fruit juice concentrates improve frozen dessert flavors

Fruit juice concentrates with their accompanying concentrated aromas (essences) are a Department development. Their use has until recently been confined to making jelly of improved flavor. In cooperation with a land-grant college, concentrates and essences from seven important fruits and berries were evaluated as flavoring agents in ice cream, sherberts, ices, ice milks, and variegated ice cream. The optimum level of flavoring materials, the basic mix composition, as well as sugar and acid contents were determined. Most of the fruit concentrates and essences were found, by consumer test panels, to be a valuable and economically practical means of improving the flavor of fruit ice cream and related products, either when used as a fruit supplement or when used as the only source of fruit flavor. These findings including recommended formulations and cost data are being made available to commercial ice cream manufacturers and should increase the consumption of both dairy and fruit products.

New "instantized" dehydrated foods

Conventionally dehydrated vegetables, for example three-eighths of an inch carrot and potato dice, require from 20 to 30 minutes boiling to be ready for eating. A new process under pilot plant development shortens this time to 5 minutes. It also enables more rapid dehydration of large pieces formerly requiring inordinately long times to dehydrate and to reconstitute. The new process gives the dried piece a porous structure, which assures rapid reconstitution with boiling water to give texture and flavor comparable to the freshly cooked piece. The process has thus far been successfully applied to potatoes, carrots, beets, and corn, and should be applicable to other vegetables as well as fruits. The dehydrated soup industry has manifested considerable interest in the new process as it will permit the use of large vegetable pieces instead of the small fragments now necessary in a soup requiring about 10 minutes to prepare.

Precooked, dehydrated sweetpotato flakes

A flavor-stable precooked, dehydrated sweetpotato flake product, previously developed by Department scientists on a small pilot-plant scale in cooperation with the Quartermaster Food and Container Institute for the Armed Forces, is now being produced on a semicommercial scale. As part of national emergency planning, an industrial preparedness study has been completed for the Quartermaster Corps (under contract), and plant designs and costs for proposed commercial operations have been distributed to industry. Industry interest is high for this new product that can be reconstituted in 60 seconds and has the color and taste of freshly cooked mashed sweetpotatoes. One commercial firm is reportedly undertaking limited commercial production of the flakes this season to ascertain the commercial potential of the product. Commercial exploitation of the product will further the economy of the sweetpotato industry by affording

a profitable outlet for a substantial proportion of the crop, as much as 6 to 8 million bushels annually, which is substandard for the fresh market and not adequately absorbed by the demand for canned and frozen products.

DEPARTMENT OF AGRICULTURE,
Washington, D.C., February 6, 1962.

Hon. RICHARD B. RUSSELL,
Chairman, Subcommittee on Agricultural Appropriations,
U.S. Senate, Washington, D.C.

DEAR SENATOR RUSSELL: The conference report on the Department of Agriculture and related agencies appropriation bill, 1962, included the following item (p. 4): "$25,000 to study the feasibility of special engineering research on mechanical aids in the harvesting of citrus crops and report the findings to the Committees on Appropriations of the two Houses."

There is submitted herewith the Department's initial report on "Mechanizing the Harvest of Citrus Crops." It presents the need for and the feasibility of research on the citrus harvesting problem and outlines the current research underway.

The need to initiate Federal research on this problem is recognized by resolutions from the citrus industry of citrus-producing States, as well as by the Citrus and Subtropical Fruit Research and Marketing Advisory Committee which met in November 1961.

The Agricultural Engineering Research Division of the Agricultural Research Service is continuing to carry out the authorized studies, and additional information on these studies will be available at the time of the hearings before your committee on the 1963 budget estimates.

Sincerely yours,

JOSEPH M. ROBERTSON,
Administrative Assistant Secretary.

MECHANIZING THE HARVEST OF CITRUS CROPS—RESEARCH NEEDS AND FEASIBILITY

A Report Prepared by the Agricultural Research Service, U.S. Department of Agriculture, January 1962

REQUEST FOR REPORT

The conference report on the Department of Agriculture appropriation bill for fiscal year 1962, page 4, includes the following directive: "$25,000 to study the feasibility of special engineering research on mechanical aids in the harvesting of citrus crops and report the findings to the Committees on Appropriations of the two Houses."

Because the request came after the 1960–61 citrus harvesting season was over and because of making this report before the 1961–62 season is well underway, it is not possible to include the observations of a complete harvesting season. Supplementary information on the study will be available at the time of the congressional hearings. ——

PRELIMINARY STUDIES

To carry out the study requested by Congress, an engineer has been detailed to Florida from November 15, 1961, to March 15, 1962. Another engineer, stationed in Davis, Calif., on deciduous fruit, will be detailed to study citrus for 1 month this winter. During the harvesting season (January and February) visits will be made to the principal harvesting areas of Florida, California, Arizona, and Texas to study the various problems. Contacts will be made with State experiment stations and growers or industry people engaged in citrus harvesting machinery development. The purpose of this work is to—

(1) Survey past and current research.

(2) Survey current facilities available for research.

(3) Investigate conditions under which harvesting must be conducted in the several important production areas and determine which machine design factors are needed for these areas on which research would be necessary.

(4) Assign priorities to methods of harvest to be investigated on the basis of previous work and end-product utility.

(5) Determine the interest and role in the problem among other disciplines, such as horticulture and plant physiology, in order to exploit ideas which might simplify the work to be accomplished.

CITRUS PRODUCTION IS HIGH AND IS INCREASING

Production figures are given below:

TABLE I.—*Citrus production in 1,000 box units*

	Florida	California	Texas	Arizona	Others	Totals
1940	55,980	69,997	16,300	3,178	254	145,709
1950	105,580	60,940	10,200	4,550	300	181,570
1958	126,200	59,720	6,500	2,820	220	195,460
1961 (estimated)	138,930	[1] 41,200	10,200	5,250	325	195,905

[1] Low due to unfavorable weather (too hot and dry).

NOTE.—1940, 1950, 1958 actual production, and 1961 estimates (as of Jan. 1, 1962) are from the Statistical Reporting Service.

In 1958 the farm value of the citrus crop was over $525 million, more than the combined value of the apple, pear, peach, and most of the other deciduous fruits. The production of citrus in 1959 was 8,065,000 tons, far exceeding the combined production (tons) of apples, peaches, pears, cherries, plums, prunes, apricots, figs, olives, strawberries, cranberries, nectarines, and avocados. Between 55 and 60 percent of the fruit trees in the United States are citrus.

The citrus crop has been increasing rapidly (table I) while combined production of deciduous fruit has remained at about the same level. The increase in citrus production will continue, for many new plantings have been and are being made in all areas. Over 45 percent of the citrus trees in Florida are under 9 years old. In California and Arizona plantings of new citrus are at an all-time high and it is estimated by Sunkist growers new plantings for the next 5 years will average approximately 14,000 acres annually. Crop increases of 30 to 60 percent by 1970 and 60 to 75 percent by 1975 have been predicted by many authorities. Not only will the economic values of citrus increase but its size and value relationships to the deciduous crops will also be greater.

HARVESTING COSTS ARE HIGH

During each of the last 5 years, between $40 and $45 million was paid to the pickers for harvesting the citrus crop. It is expected that pickers will probably be paid from 2 to 4 cents more per box in 1961 than in 1960, resulting in a harvesting cost of almost $50 million.

HARVESTING LABOR IS HARD TO RECRUIT

A large number of workers is needed over a 6- to 7-month period in Florida and California and over a 3- to 4-month period in Texas and Arizona. Figures furnished by the Department of Labor show that a total of 40,034 workers was employed in the picking of citrus in the four States during the peak of the 1960-61 season. A high percentage of the workers do not come from the production area but from Mexico, Jamaica, Bahama Islands, and other areas. It is estimated that in Florida 25 to 30 percent of the crop is picked by people brought in from the off-shore islands, 30 to 35 percent by local help, and the rest by workers brought in from surrounding areas.

The quality of these workers goes down each year. It is becoming increasingly difficult to recruit and manage them and last year picking labor was in short supply. Competition for this type of labor is increasing. For example, the acreage in sugar cane in Florida is projected to increase from 45,000 to 200,000 acres in the next 2 years. Cane and vegetables in Florida are hand-harvested by the same type of labor which picks citrus and growers compete for the dwindling supply.

If present efficiency of harvest is not improved, 60 to 75 percent more workers will be needed to harvest the citrus crop 5 or 6 years from now. Finding the labor is becoming the most serious problem facing the industry in view of pressures to eliminate the off-shore and Mexican labor programs, and possible application of minimum wage and work laws to this type of activity.

EFFICIENCY OF HARVEST NEEDS TO BE INCREASED

The $40 to $50 million being spent each year for harvesting citrus needs to be decreased or at least kept from increasing if citrus is going to continue to be profitable as a source of farmer income without increasing cost to the consumer. Even a 10-percent increase in efficiency would result in a $4 to $5 million savings per year to growers.

Regardless of cost, it may be necessary to reduce the number of workers required to harvest the crop. Unless productivity of the picker is increased, it may be impossible to recruit enough help to harvest present sized crops, and with the increased production this problem is sure to become increasingly serious.

LITTLE RESEARCH NOW UNDERWAY

State agriculture experiment stations.—A survey of State experiment stations (made for "Food and Agriculture—A Program of Research") showed that 2.4 professional man-years were being spent on citrus harvesting research. This included about 1 engineering man-year in Florida, 1 economist man-year in California, and 0.4 engineering man-year in the western area. The State experiment stations plan no increase in manpower in the southern area and only a 0.9 man-year increase in the western region, making a total of 3.3 man-years by 1966. Although some excellent research is being done, a much greater effort is needed.

The same survey showed that State experiment stations had 10.3 professional man-years on deciduous fruit harvesting research and planned to have 24.2 man-years on this research by 1966. Considering the size and value of citrus fruit compared with deciduous fruit, a total of 2.4 man-years seems inadequate for the former.

Federal research.—The only citrus harvesting research underway is the present study of feasibility being made in connection with this report. At the same time the Federal program consists of 7.1 man-years on deciduous fruit research. This latter program has been very effective but the industry feels that it is far short of what is desirable.

Industry research.—It is estimated that between 3 and 5 man-years are now being spent on citrus harvesting. However, all of this work is of a machine development nature and not on basic principles of fruit removal. In fact, as far as is known, the bulk of this work is on one principle—the use of spindles. The company doing this research has already inquired about the possibility of USDA cooperation with them on the problem.

MECHANIZING THE HARVEST IS FEASIBLE

Past experience.—Past experience has shown that whenever a concerted effort has been made on mechanizing the harvest of a crop, including tree fruits, increases in efficiency have been made. For example, equipment and methods were developed which make it possible for four men to harvest 70 prune trees an hour. Not only is the cost of mechanical harvesting of prunes 50 to 60 percent less than the cost of handpicking, but one man does the work of four hand pickers. For pie cherries, equipment and methods have been developed so that 5 workers with machines harvest the same amount of fruit that 40 workers would harvest by hand. Similar examples can be given for blueberries and other fruit. The estimated savings to the deciduous fruit industry resulting from harvesting research costing approximately $60,000 a year amount to over $2 million annually. Potential savings amount to many times this figure.

Therefore, there is good reason to believe the efficiency of citrus harvesting can be improved. The few engineers now working on the problem are making headway. A coordinated, expanded, and balanced program should result in more progress at a quicker rate.

POSSIBILITIES FOR INCREASING HARVESTING EFFICIENCY

Aids to hand picking.—Previous studies have shown that a worker spends about 70 percent of his time removing citrus and 30 percent going up and down ladders, etc. If he could separate fruit 100 percent of the time he would increase his efficiency about 40 percent (30/70). Research in deciduous fruit shows that the picking bag, which weighs 40 to 50 pounds when full, could be removed from the worker's shoulders he would pick 30 to 40 percent faster, for he would not tire so rapidly and could move about easily. Also, research on deciduous fruit showed that if a worker could separate fruit from the tree and immediately drop it instead of placing it in a picking bag he could work 20 to 25 percent faster.

Equipment of this type has been and still is under development for deciduous fruits. USDA engineers have designed and constructed 3 different types of mechanical aids and have worked with at least 10 other types. Equipment of this type could be adopted or new equipment designed for citrus provided time and manpower are available to do the research. Roy Smith, UCLA economist in his report, "Memorandum on Tree Working Machinery," 1960, page 10, reports, "An increase in the rate of pick of 125 percent can be anticipated for oranges on good size trees."

There are also possibilities of developing aids to help the worker remove individual fruits. Very little has been done along these lines. As far as citrus is concerned, the only aid that has come to our attention is a type held at the worker's hand at ground level. The fruit is touched by the end of the tube, a knife revolves, and cuts the fruit off, it falls through the tube to the ground. Several similar devices have been tried for apple harvesting. Such aids may have possibilities of increasing worker efficiency from 10 to 40 percent.

If methods and equipment can be developed for separating a number of fruits at one time instead of individually, harvest rates of two to four times that of hand picking can be achieved.

Tree shakers.—Tree shakers have been used to a limited extent in citrus harvesting research. However, the tests so far have been with equipment using strokes of 1 to 1½ inches. Fruit removal of 50 to 70 percent was achieved. It is probable that the proper combination of frequency and strokes (4 inches or more) will remove over 90 percent of the fruit. However, tree damage may be severe and damage to the fruit will have to be evaluated. It may be necessary to develop new varieties or tree shape so that the fruit can more easily be shaken from the tree. A considerable amount of research is needed on the use of this principle. USDA personnel have developed several types of tree shakers for deciduous fruit and equipment is now being used commercially enabling 3 to 5 workers to harvest prunes at rates of 70 trees per hour and tart cherries at 20 trees per hour.

Spindles, etc.—One large farm equipment manufacturer has developed an experimental machine using spindles which move into the tree and twist the fruit from the limbs. Some research on spindles has also been done at Lake Alfred, Fla., at the experiment station. Results again show this method may have some promise. Recoveries as high as 80 percent were obtained. However, only the fruit on the outer surfaces of the tree can be removed. Damage to the trees, fruit injury, recovery of the fruit removed—all have to be evaluated. In order that this principle be used to the fullest extent, ways must be found to force all the fruit to be produced on the outer surfaces of the tree, and the shape, and possible structure of the tree changed. Much more work on spindle design and methods of using this equipment is needed.

Air, water methods of removal.—Citrus fruit removal by high velocity air, pulsating air, or water jets has not been tried. However, it is a known fact that hurricanes which have passed through citrus areas have removed 20 to 25 percent of the fruit. The use of air and water should be investigated. If fruit can be removed in this way, leaf and tree damage will then have to be evaluated.

INDUSTRY WANTS CITRUS HARVESTING RESEARCH

The Industry Harvesting Committee of Florida adopted a resolution on November 19, 1960, which stated that the problems of harvesting citrus crops in Florida, California, Texas, and Arizona will require the combined efforts of the U.S. Department of Agriculture, the citrus experiment stations of all citrus producing States, citrus equipment suppliers, citrus growers, handlers, and processors. The committee considered the needed research too large an assignment for any one agency or group to carry to successful conclusion. It petitioned Congress to provide $150,000 for the U.S. Department of Agriculture for a program to develop mechanical harvesting aids and/or systems adaptable both to fresh and processing citrus fruit. Similar resolutions have been adopted by the industry in Texas, California, and Arizona.

At its meeting held November 6–8, 1961, the Citrus and Subtropical Fruit Research and Marketing Advisory Committee recommended mechanization of harvesting and handling of citrus as a high priority research need of the industry, stating that this need is urgent due to the scarcity of and rapidly increasing cost of harvesting labor. The committee reiterated its previous requests to the Department that additional funds and personnel be made available for mechanical harvesting and handling research. It pointed out that producer committees have already been set up in Florida and California to cooperate in, and to expedite

research on, mechanization of harvesting and handling, and suggested that the Department solicit the aid of State experiment stations and private groups interested in mechanization research.

DEPARTMENT OF AGRICULTURE,
Washington, D.C., February 15, 1962.

Hon. RICHARD B. RUSSELL,
Chairman, Subcommittee on Agricultural Appropriations,
U.S. Senate, Washington, D.C.

DEAR SENATOR RUSSELL: The Senate Appropriations Committee in its report on the Agricultural and Farm Credit Administration appropriation bill, 1962, made the following request (pp. 5 and 6):

"The Secretary of Agriculture is requested to submit reports on two items which were considered by the committee. * * * The other item is with regard to the National Barley and Malt Laboratory at Madison, Wis. The committee requests that this facility be surveyed as to operating space and general requirements and that a comparison be made as to the number of square feet per person compared with other similar research laboratories. The committee would also like to have the Department examine into the feasibility and advisability of realining the testing work between the existing facility and other available laboratories in such a manner as to permit some of it to be done at laboratories already existing in the States which produce malting barley."

There is attached a report in response to this request. Representatives of the Agricultural Research Service will be glad to discuss it in further detail, if you so desire, during their hearings before your committee on the 1963 budget estimates.

Sincerely yours,

JOSEPH M. ROBERTSON,
Administrative Assistant Secretary.

REPORT ON THE NATIONAL BARLEY AND MALT LABORATORY, MADISON, WIS.

Agricultural Research Service, U.S. Department of Agriculture, January 1962

OPERATING SPACE PER PERSON COMPARED WITH SIMILAR RESEARCH LABORATORIES

Most laboratories are somewhat unique with regard to size, number of people employed, type of research conducted, and other pertinent factors but it is believed that a valid comparison may be made among the Barley and Malt Laboratory, the Hard Red Winter Wheat Laboratory, and the Eastern Utilization Research and Development Laboratory. The Hard Red Winter Wheat Laboratory, which is a Federal program housed in Kansas State University facilities, conducts research on Hard Red Winter Wheat that has much in common with the program on barley at the Madison, Wis., Laboratory. Both are engaged in processing and testing large numbers of samples from plant breeders to determine quality attributes and both are engaged in basic research to identify and characterize quality attributes and to develop improved methods of measuring them. The Eastern Utilization Research and Development Laboratory is much larger and its program more diversified but the general nature of work conducted and type of laboratories and facilities required seem to be comparable in the broad sense. The following table presents a comparison of the three laboratories:

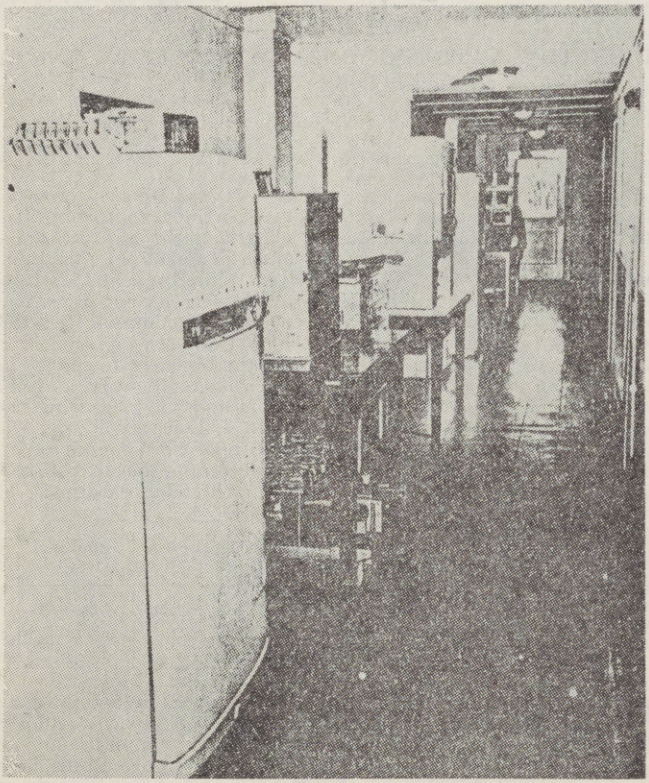
	Square feet of space	Number of people	Square feet per person
Barley and Malt Laboratory	7,216	19	380
Hard Red Winter Wheat Quality Laboratory	3,717	8	465
Eastern Utilization Research and Development Laboratory	132,000	300	440

A comparison among laboratories may be made also by attempting to arrive at figures reflecting the average amount of actual work space regularly used by each worker. Such figures usually exclude space for common use and supporting activities such as corridors, offices, shops, library, conference rooms, storage, constant temperature and cold rooms, and special-purpose rooms for general use of laboratory personnel as needed. These special-purpose rooms would include quarters for such work as X-ray diffraction, electron microscopy, spectrophotom-

etry, use of radioactive isotopes, chromatographic analysis, fluorometry, fermentation, electrophoresis, ultracentrifuges, routine chemical analytical services, growing quantities of micro-organisms, and other activities that require specialized equipment or conditions that it is not practical or feasible to provide in the immediate work areas assigned to individuals. An article entitled "Planning a Laboratory," in "Cereal Science Today," volume 6, September 1961, suggests 200 to 264 square feet for the area assigned to individual workers. A series of papers in "Industrial and Engineering Chemistry," volume 38, April 1947, gives areas per person ranging from 144 to 352 square feet with about 243 square feet being typical of the space allotted to the individual for his direct research.

There are difficulties in arriving at a comparable figure for the Barley and Malt Laboratory but it appears to be slightly less than 200 square feet per person. Superficially this might seem to fall into the lower part of the ranges cited above but such a comparison does not reflect the lack of special-purpose rooms in the Laboratory. Especially critical is the need for space suitable for chromatographic analyses, an instrument room, a room for isolation, identification, and culturing pure strains of organisms on the scale required for biochemical studies of important metabolic products, a special room designed for the use of radioactive isotopes in tracer research, and cold storage space to handle malt evaluations.

The increase in samples for malt analyses for breeders has doubled during the past 4 years creating increasing pressure for encroachment of this service activity into the already limited space available for basic research. The accompanying photograph shows the crowded condition of the main corridor resulting from locating the items of essential equipment for which there is not space in the research laboratory. The crowded condition of research space with the current program seriously limits the possibility of increased emphasis being given to research on barley to supply fundamental information needed in quality evaluation and genetics of barley quality.



First floor hall: Equipment excess to space in research laboratory.

REALINEMENT OF TESTING WORK BETWEEN THE EXISTING FACILITY AND OTHER AVAILABLE LABORATORIES

Consideration of possible realinement can best be done in relation to the stages involved in testing. Quality evaluation in the development of new varieties is usually carried out in the following steps:

(1) Prediction tests by analysis of barley, on 50-gram samples. Useful in saving most promising selections from large numbers of early generation selections.

(2) Micromalting—preliminary malting and analysis on 50- to 100-gram samples. Requires more time but gives additional useful information.

(3) Pilot malting and analysis—malting and analysis on 250- to 300-gram samples from preliminary experimental tests. Industry laboratories collaborate at this stage on a limited number of most promising selections.

(4) Pilot malting, analysis and microbrewing on 500-gram samples of the most promising selections from advanced experimental tests. Requires much more time for two processes but gives additional valuable data.

(5) Pilot malting and pilot brewing—This final stage of evaluation before commercial testing requires from 15 to 30 pounds but permits very reliable evaluations. At this stage from 6 to 8 industry laboratories collaborate in the testing program.

Three of the States, North Dakota, Minnesota, and Montana, producing malting barley have laboratories in which tests for quality are made on samples from their own breeding programs. North Dakota and Minnesota are equipped to carry out the first three steps outlined above while Montana has facilities for the first step only.

The feasibility of expansion of testing at these three locations has been recently reviewed. The Cereal Technology Department at Fargo has been conducting effective barley quality evaluation work for a number of years, with emphasis on the testing of large numbers of early generation selections from the North Dakota breeding program only. More advanced selections are submitted to the Barley and Malt Laboratory for evaluation by malting and finally microbrewing and pilot brewing. Expansion would require testing of early generation samples for other States or equipping and providing space for later stages of testing on samples from the North Dakota program. The Federal Hard Red Spring Wheat quality work is currently being moved from Beltsville, Md., into the Cereal Technology Department at Fargo and it is anticipated that all available space will be fully occupied.

Barley quality testing at St. Paul is in the Department of Agricultural Biochemistry. This is one of the older buildings on the campus and badly crowded. Expansion of the work without an increase in space seems impractical. The current staff of this laboratory is preoccupied with other research problems and has not been able to emphasize barley evaluation work even to the extent of adequately servicing the local breeding program with early generation tests. Expansion of testing at this location would require additional space and personnel to conduct the work.

The barley quality testing work at Bozeman, Mont., is limited to barley prediction analysis. The laboratories, which also conduct wheat quality work, are crowded into basement space and physical facilities for expansion, even to include malting equipment, appears to be impossible. A request to the industry by this laboratory for funds to obtain malting equipment was refused on the basis of space and uncertainty about the adequacy of the staff.

It appears, therefore, that available space would limit expansion of the type of barley evaluation work now being done in existing State laboratories. Expansion of their programs to include other steps in barley and malt evaluation would require additional equipment, space, and staff.

The problem of evaluating the increased number of breeders' samples was carefully considered by industry recently when it received requests from some of the experiment stations for financial support. After considering the desirability of establishing a western regional quality evaluation laboratory, as well as the possibility of expanding existing State laboratories, industry representatives decided to support early generation prediction tests in some of the States but turned down proposals for expansion of facilities to permit more advanced steps in evaluation. They concluded that the more advanced testing should be done in the Barley and Malt Laboratory at Madison as being more economical and offering greater assurance of reliable evaluation. Industry, through the Malting Barley Improvement Association, followed this plan and made funds available to cover the cost of additional equipment and personnel in the Laboratory at

Madison. This decision helped meet the immediate need for evaluating the plant breeders' samples but aggravated the already crowded conditions in the Laboratory.

Certain other factors should be considered in relation to centralized versus decentralized testing.

A larger establishment permits more efficient handling of large numbers of samples with uniform results. Several smaller laboratories require establishing and maintaining the reliability of the test data by collaborative effort and review. A centralized laboratory can use expensive and pilot plant equipment more efficiently throughout the year on various phases of its program. Liaison with industry groups is simpler with larger establishments and they are more likely to have confidence in and accept the findings and recommendations.

Smaller establishments have the advantage of somewhat closer cooperation with the plant breeders but this is really effective only if quality program personnel are sufficiently familiar with the biochemistry of the processes for which malt is used to advise accurately on selection.

The relationship of fundamental biochemical research on barley to the evaluation program is of paramount importance. Present evaluation methods are largely empirical because there is not sufficient basic information on barley quality. There should be more emphasis placed on research on barley to supply fundamental facts which can be applied to quality evaluation and to the genetics of barley quality. Research, even more than quality testing, can be accomplished much more efficiently in a centralized laboratory. The cost of modern research equipment is such as to preclude its purchase except where it can be used on a number of projects. Groups of workers with similar interests will stimulate new ideas and methods and usually result in more rapid and reliable research findings. The close association between research and the quality testing program, such as exists at the Barley and Malt Laboratory, tends to speed up developments in both phases of the work.

The lack of space at present is limiting research more than the quality testing. However, unless research effort is increased, the quality testing which is dependent upon it will be lessened in value. This is particularly true at present, when marked technological changes in the malting and brewing industries are being developed. The breeding and production of barley varieties suited to possibly changed requirements is essential.

Review of the overall barley improvement program indicates that the quality evaluation phases can keep pace with expanded breeding programs only if additional space, equipment, and personnel are provided. The need includes provision for basic research on quality as well as for processing samples for breeders. Consideration of all factors involved including limitations of existing laboratories leads us to conclude that expansion of the laboratory at Madison will best serve the needs of barley producers and consumers.

DEPARTMENT OF AGRICULTURE,
Washington, D.C., February 27, 1962.

HON. RICHARD B. RUSSELL,
Chairman, Subcommittee on Department of Agriculture and Related Agencies, Committee on Appropriations, U.S. Senate.

DEAR SENATOR RUSSELL: I am pleased to forward herewith a report on "The Feasibility and Practicability of a Timber Price Reporting Service."

This is in accordance with amendment No. 13 of the statement of the managers on the part of the House on the conference report on H.R. 7444, the Appropriation Act for the Department of Agriculture, 1962 (Rept. No. 726, 87th Cong., 1st sess., House of Representatives).

Sincerely yours,

JOSEPH M. ROBERTSON,
Administrative Assistant Secretary.

A REPORT ON THE PRACTICABILITY AND FEASIBILITY OF A TIMBER PRICE REPORTING SERVICE

Statistical Reporting Service in cooperation with the U.S. Forest Service, U.S. Department of Agriculture, February 1962

PREFACE

This report has been prepared pursuant to amendment No. 13 of the section "Statement of the Managers on the Part of the House" of the conference report on H.R. 7444, the Appropriation Act for the Department of Agriculture, 1962 (Rept. No. 726, 87th Cong., 1st sess., House of Representatives); in particular, to that part of amendment No. 13 which reads: "Salaries and expenses: * * * The increase over the House bill includes $15,000 for a special study and report on the practicability and feasibility of a timber price reporting service, including firm estimates on the costs involved and the proper method of financing the project; i.e., whether or not it should be financed from funds available to the Forest Service. * * *"

Reports on forest product prices currently being issued by Government agencies in several States have been assembled, their characteristics analyzed, and their general methods of preparation reviewed.

Representatives of the Statistical Reporting Service and of the Forest Service have interviewed officials in most States where forest products are important and have conferred with representatives of the forest products industry including several sawmill operators who purchase both stumpage and logs.

This report has been prepared through the cooperation of staff members of the Statistical Reporting Service and of the Forest Service, in order that the talent and experience of both organizations might be brought to bear upon the subject.

It presents to the Congress information and conclusions regarding the feasibility and practicability of a timber products price reporting system, together with cost estimates.

SUMMARY

It is feasible and practicable to conduct a useful timber price reporting service giving a range of prices for standing timber and cut products relating to market or production areas.

Participation by the Federal Government in timber price reporting would strengthen the reports being issued by 18 States. These reports now show wide variation in scope, content, frequency, and quality. Federal participation also would promote uniformity and coordination of reporting, facilitate interstate and interregional comparisons, and promote more effective and more uniform pricing practices generally.

An annual cost of $300,000 is estimated as necessary to provide reports on a semiannual basis covering 37 States in which forest products are considered sufficiently important to justify the service. The Statistical Reporting Service is the logical agency within the U.S. Department of Agriculture to conduct a timber price reporting service.

Feasibility of a Timber Price Reporting Service

INTRODUCTION

Price reporting bills introduced in Congress

Bills were introduced in the 84th Congress, 1st session (e.g., S. 2105) which would direct the Secretary of Agriculture to: (1) Establish a price reporting service for basic forest products such as standing timber, sawlogs, and pulpwood; cooperation with State and private agencies is authorized; (2) conduct and stimulate research aimed at developing standards of quality, collecting marketing information, and increasing the efficiency of marketing forest products; (3) make a study of price trends and relationships for basic forest products and within 2 years report to Congress his recommendations as to an appropriate formula for the establishment of parity prices for such products. None of these bills was enacted. The provision for a study of price trends and relationships was included in the Agricultural Act of 1956 (sec. 402, Public Law 540, 84th Cong.). This study was completed and issued as House Document No. 195, 85th Congress (*13*).[1]

[1] Italic numbers in parentheses refer to literature cited at the end of this report.

In the 84th Congress, 2d session, and 85th Congress more bills were introduced (e.g., S. 840) similar to those of the 84th Congress, 1st session, except that they did not include a section directing the Secretary of Agriculture to make a study of price trends and relationships for basic forest products and to submit recommendations as to an appropriate formula for the establishment of parity prices for such products. None of these bills has been enacted. The Department of Agriculture believed these bills to be unnecessary because it already has general legislative authority to carry out the provisions of the bills.[2]

In the 86th Congress, the Select Committee on Small Business of the U.S. Senate, in its report on "The Small Independent Firm's Role in the Forest Products Industry" recommended, among other things:

"* * * that the Secretary of Agriculture correlate the present State price-reporting programs, establish a Forest Products Price Reporting Branch to his Crop Reporting Board and begin to publish, at his earliest opportunity, price and market information on forest products."

Meaning of "a timber price reporting service"

Since there has been no official definition of a timber price reporting service, it is quite natural that different interpretations have developed. (For the purpose of this report, the term "timber" includes stumpage (standing timber) and logs and other cut products.)

To some, a timber price reporting service apparently implies the publication only of regional or national estimates of prices. However, publication of such regional or national averages alone would not serve the needs of forest landowners, nor are sufficient data available concerning quantities sold for use in weighting State or local product prices into regional or national averages. Even though a price reporting service were federally sponsored, price data should pertain basically to individual States, to significant marketing areas within a given State, or to marketing areas crossing State lines.

Others apparently have interpreted a price reporting service as a device for determining or indicating the prices that buyers shall pay producers. However, no price reporting service can determine what prices should be paid in any specific transaction but can only provide a measure of what prices have been paid during some specific period in the past. Such knowledge may be used as a guide in making sales or in making administrative decisions, but it cannot properly be considered as a means of specifically determining or establishing prices for particular properties or products.

In practice, if the Federal Government should participate actively in timber price reporting, its reports would doubtless have a strong resemblance to several of the reports currently being prepared by State agencies.

The objective would be to collect, compile, and publish representative data concerning prices paid for timber and forest products in such detail as practicable with reasonable frequency so as to provide to both buyers and sellers a factual background as a guide to their planning and marketing. It is to be noted that there is a vital distinction between price reports and price quotations. The former are necessarily somewhat general, summarizing prices reflecting transactions that have taken place; the latter are necessarily specific, relating to particular offers specifying products, locations, and times.

Timber price reporting, if undertaken by the Statistical Reporting Service, would be administered through the State offices commonly known as the Cooperative Federal-State Crop Reporting Service. These offices are operated by the Statistical Reporting Service of the U.S. Department of Agriculture in cooperation with State agencies, usually the State departments of agriculture or the State university or college of agriculture, depending upon the particular State.

TIMBER PRICE INFORMATION CURRENTLY AVAILABLE

Price reports issued by State agencies

Persistent needs for published prices of timber products have led officials in a number of States to prepare and publish timber price reports. Although State agricultural extension services have been the most active participants in this field, a number of other agencies have cooperated in the undertaking and, in some cases, have taken the lead in collection and publication of timber products prices. Among these agencies are State departments of conservation, agriculture, and natural resources; State universities or land-grant colleges, and (in

[2] Letter from True D. Morse, Acting Secretary, to the Honorable Harold D. Cooley, chairman, House Committee on Agriculture, Apr. 4, 1957.

cooperation with these agencies in some cases) the offices of the Federal-State Cooperative Crop and Livestock Reporting Service.

To a considerable extent the data have been collected, analyzed, and prepared for publication as an adjunct to other primary duties and responsibilities. As a consequence, direct out-of-pocket costs have been held to a minimum and in many cases cannot be specifically determined. This is particularly true of those cases in which much or all of the data are collected by extension or service foresters as part of their routine service activities. In other cases the data are collected largely by means of mailed questionnaires with a limited number of personal calls to price reporters for the purpose of soliciting and maintaining cooperation. In some cases the burden of maintaining these reports has fallen almost entirely on one or two individuals who are heavily loaded with other responsibilities. This has curtailed or eliminated this price reporting activity in some cases.

Forest products price reports are currently being issued by 18 States (see exhibit 1 in the appendix). In addition, Pennsylvania issues a series of reports limited to Christmas trees. Several more States have, on occasion, compiled price data for inclusion in forest products marketing bulletins. There is no standardized system of reporting, each State compiling whatever detail is considered useful and obtainable with resources available. Although a report on log prices is issued weekly by one State, the other reports are issued quarterly, semiannually, or annually. In every case the reports are issued by a State agency which has prepared the report independently, or in cooperation with other State agencies or with the Statistical Reporting Service of the U.S. Department of Agriculture.

Variation in contents of State price reports

In general, most reports contain average prices or a range of prices, based on buyers' quotations rather than on actual sales data, for standing timber and sawlogs delivered at the mill, by species and geographic area. Prices for other timber products such as pulpwood, veneer logs, mine timbers, cooperage stock, poles, and piling, etc., are listed in some detail by several States but only sketchily by others.

Timber quality is one of the most important price determinants, yet none of the reports contain standing timber price information by quality grades and a majority of the reports do not list saw log prices by grade.

Various log rules can be used in estimating the wood volume contained in a tree or log, but different log rules result in different volume estimates according to the diameter of the log. When prices are quoted on a per thousand board foot basis, it is important to specify which log rule applies. Yet half of the reports do not do so.

Many other factors, such as degree of local competition, accessibility, total volume of sale, scaling practices, logging and road conditions, and log-hauling distance may also influence prices for standing timber or timber products. The reports do not cover these factors except, in some instances, to indicate in a general way that they may affect the quoted prices.

The fact that the price reports fall short of providing specific prices is indicative of the difficulties involved. It does not, however, make the problem insoluble, or the existing reports useless. The various States appear to recognize the limitations imposed by the existing market structure and, within resources available, issue reports they consider to be most meaningful under current conditions. Moreover, prices are based on quotations rather than transaction evidence.

Several States are issuing price reports closely keyed to the existing market organization and find considerable demand for the information contained therein. The Wisconsin Forest Products Price Review, for example (see exhibit 2 in appendix), "* * * is designed to offer practical information on the current timber market." It is compiled semiannually with the cooperation of the wood-using industries and uses available product identification measures to advantage. The report lists standing timber and delivered product price ranges by species for sawtimber, pulpwood, box and excelsior bolts, railroad ties, posts, poles, and piling, as well as some rough lumber prices. Veneer and saw log prices are further reported by quality grades and prices are shown for both rough and peeled pulpwood. A uniform log rule is used for sawtimber and measurement specifications and dimensions for other products are shown and prices given.

This report is based on reports from 40 to 50 major mills and around 200 smaller plants or mills. The data are collected primarily by Wisconsin State Department of Conservation foresters who are experienced and knowledgeable in the matter of both prices and marketing practices. The office of the Extension Forester participates in the price surveys and compiles the report.

The Wisconsin price report is based on 30 years' experience and represents a realistic approach to the problems encountered under current marketing practices. Useful market information that cannot be included in the price tabulations is mentioned in the text. Precautions are given on limitations of the data—for example, the report states "* * * It should be understood that timber prices are determined by a combination of factors including local market demand, distance to mills, timber accessibility, marketable volume, and timber size and quality. For this reason a quoted price range may have a wide spread between the high and low offers. These ranges can be used as guides by local timber owners and buyers n arriving at a fair price agreement."

Thus, the Wisconsin report serves not only as an example of what can be done now in the timber price reporting field, but also reveals there still are price-determining factors to be accounted for before specific pricing can be realized.

State price reports evaluated by interview

An evaluation of the usefulness of current State price reports and the data they contain was obtained through interviews with various representatives of the forest products industry and of public agencies with responsibilities to forest-land owners. The majority opinion was that such reports can serve a useful purpose so long as they purport to represent not specific prices but rather general background price information.

State extension foresters interviewed were strongly in favor of price reporting to inform timber sellers and others on forest product market conditions. Over half the current State price reports were initiated by extension people to meet a demand they experienced from frequent contacts with forest-land owners. It is recognized that there is room for improvement in many of these reports and the State extension foresters would favor a program to accomplish this.

There was mixed opinion among those interviewed at State forestry departments on the type and content of current price reports, but most believed that forest-land owners, particularly those with small tracts, needed additional price information. At present 46 States are providing technical assistance, including the marketing of harvested products, to owners of private forests and to small sawmill operators and other processors of primary forest products. This assistance is given by farm or service foresters familiar with market and price conditions within their local area. Some service foresters felt that they already had an adequate knowledge of prices to satisfy landowners' requests and that most landowners could not properly interpret and use current timber price report information. Other service foresters who now collect prices from mill operators stated that these regular contacts were beneficial both to them and to the mill operators. Moreover, they believed that periodic timber price reporting would help bring about a more stable and uniform market.

Most of the industry people interviewed said they had little need for the State price reports since they already knew what prices could be paid for stumpage or cut products in their procurement areas; also, that timber sellers could always get a price by contacting mill operators or other buyers. The difficulty of reporting specific prices was mentioned frequently and there was apprehension that price ranges or averages would be misleading where considerable price variation existed due to quality differences and other factors. The interviews disclosed little real opposition to the reports, and some buyers indicated that such reports might help by educating landowners as to the value of their timber and serve as a basis for further negotiation between buyer and seller.

State reports evaluated by survey of those receiving such reports

In addition to the interviews, a mail survey was made in which a questionnaire (see exhibit 3 in the appendix) was sent to about 9,200 recipients of price reports issued by 17 States. The survey was made in cooperation with the State agencies. Six identical questions were carried in all States [3] with the explanatory letter at the top varying slightly depending upon sponsorship of the report and of the survey. Some 2,600 questionnaires were returned in time to be used and sufficiently completed to provide a basis for appraising the type of users served by existing price reports and the degree to which such reports meet the needs of recipients.

[3] Oregon added a question concerning the need for a weekly report, and Minnesota added 2 questions to get further detail for local analysis.

Among those returning the questionnaires there was a fairly uniform representation of the major fields of interest in prices of timber products. Question 1 read:

"Are you primarily interested in prices of timber products (stumpage, logs, and bolts) from the standpoint of:

(*a*) An owner or seller of timber or timber products ☐
(*b*) A buyer of timber or timber products ☐
(*c*) An adviser of timber owners ☐
(*d*) Other (specify) ____"

A tabulation of the replies is shown below:

Classification:	*Percent*
Owner or seller	31
Buyer	29
Adviser	33
Other	7

The product or products in which there is primary interest in most cases varied according to individual circumstances. For example, a sawmill operator is primarily interested in stumpage and sawlog prices of the species he is cutting; a pole and piling operator wants information on these products; and the major concern of a walnut-log buyer is veneer log prices. In general, all major, and some minor, species and products in each State would have to be reported if the majority of interests expressed are to be satisfied.

A majority of owners, buyers, advisers, and others indicated that the State price report does furnish them with information not readily available from other sources. Question 3 reads as follows:

"Does the report furnish any information not readily available to you from other sources?" ____ Yes ☐ No ☐

If "no," on what other sources do you depend for such information?

The replies are summarized below:

Classification	Yes (percent)	No (percent)	Not answered (percent)
Owner or seller	87	5	8
Buyer	78	14	8
Adviser	89	7	4
Other	77	9	14

Those who responded "no" stated that direct contact with timber buyers, mill operators, loggers, or foresters was the most common source on which they depended for such information.

Many suggestions were made for additional useful timber marketing information not now shown in the price reports. The nature of the suggestions varied by States according to the type of price report being issued and completeness of coverage. The most common requests, however, were for lists of buyers, prices for products and species not now reported, and analyses of market demand and outlook. Other suggestions included reporting of stumpage prices, more current and specific prices generally, rough lumber prices, and costs of harvesting and hauling timber products. A large number of respondents stated that the present report is quite satisfactory.

A majority of respondents indicated that in their experience the price quotations published in the report reasonably represented prices actually being received by producers. Question 5 read as follows:

"In your experience do the price quotations published in the report reasonably represent prices actually being received by producers? Yes ☐ No ☐

If "no," please give examples ____

The response obtained is shown in the following tabulation:

Classification	Yes (percent)	No (percent)	Not answered (percent)
Owner or seller	69	7	24
Buyer	74	12	14
Adviser	77	6	17
Other	46	4	50

The large proportion who did not answer this question seems to mean that many respondents did not feel qualified to reply yes or no. This applies particularly to the "other" classification which includes such people as teachers, administrators, and researchers who do not maintain regular trade contacts. Many owners or sellers make infrequent timber sales and would also have rather limited experience with current prices. A significant fact is that so many buyers, who can be considered knowledgeable on price matters, believed the price information to be representative.

Among those who checked "no" there was some tendency, as indicated by comments on the questionnaires, with regard to a given State report, toward agreement that reported prices were either higher or lower than actual sales with which they were familiar. However, for the reports considered in total there was about the same number who believed the reported prices were higher than actually received compared with those who reported them to be lower.

Comments that price ranges were too broad to be of much use indicate a need both for more specific pricing and for an understanding that current price reports are only rough guides with final sale price being dependent on buyer and seller negotiations.

A few letters were received in response to the questionnaires expressing opposition to establishing a Federal timber price reporting service, on the grounds that it is not necessary, would increase taxes, or extend "Federal bureaucracy."

Price information available from other sources

Although price quotations for cut products delivered to a loading point or plant site can be obtained at any time by contacting the particular mill dealing in products the timber owner wishes to sell, quotations from a particular mill provide no clue as to how these quotations compare with the general market. Some mills offer only verbal information; many mills, particularly the larger, more permanent type installations, issue price lists periodically. Exhibit 4 in the appendix illustrates such a list for a mill purchasing veneer logs. Since a majority of timber owners sell stumpage rather than cut products, price delivered at the plant does not supply the price information needed by most landowners.

Price lists for stumpage are not available because of the many variables such as accessibility, topography, tree size and quality, sale volume, or cut per acre, which must be determined individually for the particular property. However, a timber owner with sufficient volume to sell can usually get a price offer from any interested mill operator, logging contractor, or other buyer. Many of the problems associated with buying and selling timber arise at this marketing point. Timber sellers generally do not know how to make an accurate determination of timber value and, unless they seek experienced and impartial advice or can arrange to get bids from several independent buyers, are not in a position to bargain effectively.

An effective timber price reporting service would provide one of the guides necessary to help place sellers of forest products on a more nearly equal bargaining basis with buyers.

Public and private foresters are another source of timber price information. Farm foresters employed by the States are well acquainted with going prices in their area and will provide general information upon request; they are usually not familiar with prices being paid outside their area, particularly for products such as veneer logs. In some States farm foresters will appraise a timber tract to determine an approximate market value. In others they can only give the timber owner a price range. Industrial foresters are primarily concerned with prices for the products purchased by their company. However, they will often give approximate prices on other products to a timber owner. Consulting foresters probably offer timber owners the most complete service available on forestry matters. It is their business to be fully informed on markets and prices and for a stated fee will represent and protect the interests of a timber owner in sale negotiations.

NEED FOR TIMBER PRICE REPORTING SERVICE

Reporting service supported by forest landowner advisers and others

Expressions of need for State price reports arose largely from extension and service foresters, research workers, and others who are dealing directly with and are advising farmers and other owners of forest lands. These people have felt the need for published price data that would serve as an approximate guide to trends and levels of timber and product prices. Even though it is recognized that such price data do not provide data sufficiently current nor precise for trading they do provide a convenient reference source of information not otherwise available in published form. These reports have probably had their greatest value as a means of raising the general level of knowledge of forest landowners, public officials, and students regarding the approximate value of a wide range of timber products.

Extension and service foresters say that one of the first steps toward the improvement of forestry practices on farms and other small forest holdings is to make the owner aware of the fact that he holds a resource that can be made more valuable with proper management. Periodic timber products price reports serve as one means of bringing this to the attention of the forest landowner. Opponents of such reports, on the other hand, contend that such price information tends to stimulate overcutting for the same reason that it focuses the forest landowner's attention on the value of his timber. Clearly, a continual process of education is needed to compose these conflicting forces, to the extent that they exist.

In addition to the forest landowners and those assisting and advising them there are other groups who find it convenient and useful to have published price reports which serve as guides to timber values for use in real estate appraisal for loan purposes, land condemnation for highways and utilities, and tax administration. Such persons must frequently make judgment values regarding many widely separated properties and these reports furnish rough guides to timber values that otherwise would not be as conveniently available.

Increased price and market knowledge needed by landowners

Various studies have shown that many nonindustrial woodland owners, both farm and other private, are handicapped in timber sales negotiations by a lack of adequate marketing knowledge. In the Northeast (*9*) for example, a survey of 2,953 farm woodland owners found that two-thirds of the timber sales were made by owners without presale knowledge (1) of markets; (2) of the amount of timber available for sale; or, (3) that timber could be cut into various products and sold by quality grade.

A statewide survey of more than 250 buyers of primary timber products in Kentucky (*10*) concluded that:

"Timber owners need to be better informed on timber markets and marketing methods," and that "periodic timber market and price reports can provide farmers and other owners of small forest properties with current information on timber values and market locations and can aid them in more efficiently and profitably marketing forest products."

A study in South Carolina (*5*), which analyzed 382 usable sale records of tracts that had been marked for cutting by service foresters of the South Carolina Commission of Forestry, stated:

"The need to inform small timber growers of current stumpage prices and to accumulate a series of average stumpage prices could be satisfied by a price reporting service. No such service now exists in South Carolina or in any other Southeastern State."

After completing a mail survey of 1,159 private owners of forest tracts under 5,000 acres in western Oregon, Adams (*1*) stated:

"Farmers generally lack knowledge of the amount and quality of the merchantable timber in their holdings. They have little basis for bargaining with the purchaser, either as to price or other arrangements such as cutting practices, cleanup responsibility, or protection of the residual stand. After the sale has been completed, they often cannot be sure how much timber was actually removed, whether they actually received payment for every load, or whether they received a fair price."

The fact that the survey found that 90 percent of owners replying stated they were satisfied with their timber sales would indicate a high degree of complacency by owners toward protecting their interests in sales transactions.

A study of small forest owners in California (*4*) similarly found that "these owners knew little about their timber holdings, seldom had experience in timber sales, and played a passive role in the marketing process."

This passive attitude on the part of timber sellers and their lack of realization of the complex nature of timber sales was considered the main weakness in marketing practices. The study stated further that:

"In the absence of competitive bidding, negotiation with the buyer was probably the seller's most effective means of obtaining fair market price for his timber. Price determination by negotiation, accounting for one-third of all sales, involved bargaining between buyer and seller. To arrive at fair market price, both buyer and seller should be in full possession of all facts pertinent to the sale. Thus the actual price finally agreed upon may hinge on how little or how much the woodland owner knows about the product and market."

Improvements in timber marketing will depend in part at least upon timber owners' increased knowledge and interest in forestry practices, particularly with regard to quantity determination, product specifications, and harvesting costs. Development of more uniform marketing methods for many forest products also is needed. Such improvements and developments are needed if individual landowners are to make most intelligent use of reported prices.

In discussing the question of data needed in the field of forest economics (*12*) Stoddard stated:

"To obtain a more adequate picture of primary timber production activities many types of data now collected for agriculture would suffice. * * *

"Current prices of forest products should be collected and disseminated with market reports in the same manner as other farm products in order to keep forest owners and timber producers informed of developments in supply and demand. It is recognized that stumpage prices are more difficult to obtain and present. Further study may be required before actual data can be disseminated. * * *"

Industry viewpoint toward need for price reports

Although there are exceptions, timber buyers and their organization representatives are indifferent or hostile to timber price reports. This attitude stems from the belief that such reports at best do no good, may do harm, and in all cases result in an unnecessary drain on tax funds. This buyer response in the main reflects their opinions of the usefulness of these reports for their own purchasing operations and to a lesser extent an evaluation of how they might be useful to sellers or to others who may have a need for such reports. Quite obviously such reports furnish limited information to the buyers since buyers are largely the source of the data in the first instance. Some buyers find the reports to be of some general interest for comparative purposes but their own buying experience provides them the only reliable guide to local purchase conditions. Occasionally the published reports may be used by buyers in providing to the seller an unbiased report of local prices.

On the other hand some buyers stated that the uninformed seller has demanded "top of the range" prices for timber of low quality that did not warrant top prices. Buyers also argue that such price reports may mislead timber owners into believing that a market exists at the prices reported when in fact there may be no such local market or the market has changed since data for the last report were collected. They also emphasize the inability of such reports to serve as a specific measure of price for a specific transaction. Except for the case of a few closely specified cut products, not even the stanchest supporter of price reporting would hold out the promise of such a possibility. Nevertheless, there is a rather wide application of price reports as a guide, either for specific actions or in reaching a decision with regard to specific offers to purchase.

Buyers generally show little enthusiasm but also little fear of State-sponsored timber price reports, as distinguished from nearly unanimous apprehension concerning the Federal Government's entering the field of timber price reporting. This apprehension apparently stems from the belief that price reporting is the opening wedge to price controls. It is also argued that the Federal Government has nothing to contribute to such reports that cannot be met adequately by State government agencies if and when local demand exists for such service.

In 1956 the Forest Industries Council, policy-coordinating organization of the pulp and paper, plywood, and lumber industries, made a survey of forest products marketing and price reporting services in the United States (*6*). The council position on price reporting is contained in the following quotation:

"The survey demonstrates that a sound program for establishing and improving marketing and price reporting services for forest products in each State may develop the following features as needed:

"(1) A director or list of buyers of forest products.

"(2) A periodic review of market demand and supply, price trends, and major price changes by areas within the State.

"(3) Published material which explains good harvesting and marketing practices for woodland owners and tree farmers.

"(4) Personal advice of industry foresters, consulting foresters, farm foresters, or other public agencies.

"(5) Price reporting by a State agency if considered necessary at the State level by a marketing committee with representatives of both buyers and sellers of forest products. This feature is not necessary or even helpful to forest owners if the first four features are successful in reaching owners and operators of forest land.

"The survey finds no justification for the Federal Government to enter into price reporting of forest products or stumpage, since it is evident that State and local governments, private organizations, and forest industries are discharging their responsibilities of making current prices or market data on forest products available to those who need it. The Federal Government already has the authority to cooperate where desirable with State and private agencies and is already doing so. Expansion of Federal activities in this field is not necessary.

"At the present time, there is so much competition for wood in every form that the seller of forest products can readily get current information on stumpage prices in his area, and in fact, can and should get several bids for his timber. There is no need for Federal price reporting as this is obviously an effort to bring in parity determination and price fixing in the forest products industries. Cooperation between State forestry departments, State extension forestry departments, and buyers and sellers of forest products will do more to improve the quality and quantity of marketing services for forest owners and operators than any proposal of Federal legislation and control in this field can ever hope to achieve."

This position was generally adhered to by industry representatives during hearings before the U.S. Senate Select Committee on Small Business in November 1958 and January 1959 (*14*). It was also expressed in a letter from Mr. W. S. Bromley, executive secretary, American Pulpwood Association, to B. R. Stauber, Chief, Agricultural Price Statistics Branch, Agricultural Estimates Division, Statistical Reporting Service. (See exhibit 5 in the appendix).

Pattern of ownership and product use indicates priorities

The total area of commercial forest land in the United States and coastal Alaska is approximately 489 million acres. Of this area 130 million acres, or nearly 27 percent, is publicly owned; about 62 million acres, or nearly 13 percent, is owned by forest industries; 165 million acres, or nearly 34 percent is on farms, and 131 million acres, or about 27 percent, is under other private, nonindustrial ownership. Of the 358 million acres of commercial forest land in private ownership, 121 million acres are held in 3.9 million ownerships of less than 100 acres in size, and 219 million acres are held in 4.5 million ownerships, of less than 500 acres in size. (See exhibit 6 in the appendix.)

Data on number of owners, timber volumes, and product output by States or regions provide a general outline for determining where and in what detail timber price reporting services could most effectively serve the greatest potential need. It is recognized that local interest is an additional consideration affecting decisions concerning undertaking price reporting in some States and for some timber products.

The 4.5 million private owners of commercial forest land, primarily nonindustrial, represent the major group in need of a timber price reporting service. These owners are more concentrated in the East where, except for some Northeastern States, each State has more than 100,000 such owners. (See fig. 1, and exhibit 7 in the appendix.) They are generally fewer in number from the Plains States westward, particularly in the central and southern Rocky Mountain area. The distribution pattern of these owners provides a very useful, although not a conclusive, guideline for determining where timber price reports could serve the needs of the greatest number of timber sellers.

The timber volume held by all private owners (*7*) shows the relative importance among the various States of the forest resource base (fig. 2). The distribution pattern generally follows that observed for number of owners, with the eastern States, particularly those in the South, ranking high. In the Pacific Coast States the volume of timber in private ownership is a less reliable guide to the potential usefulness of a timber price reporting service because of extensive industrial holdings. Nevertheless, in all Pacific Coast States reports on prices of forest products are being issued.

Forest stands produce a large diversity of timber products depending upon the species, size, and quality of the trees harvested. The local importance of these

products varies from region to region. (See exhibit 8 in the appendix.) However, saw logs, together with pulpwood, constitute a substantial majority of total output of timber products from roundwood in all but the Plains region. Timber products other than saw logs and pulpwood, such as veneer or cooperage logs and bolts, posts, poles, piling, etc., are of only secondary importance in all regions, although they may be of great importance to many individual owners (7). Fuelwood is excluded from total output as shown in exhibit 8, since it is not considered industrial wood and much of it is consumed directly in plants and homes. Many posts are also cut for home use without entering the market and the relative commercial importance of post output to other timber products, particularly in the Plains region, is probably less than these data indicate. Pulpwood and saw logs represent the bulk of total output today, but the proportional output of pulpwood has increased and that of saw logs decreased since 1952, especially in the Northeast, Lake States, South Atlantic, and Southeast regions.

FEASIBILITY OF COLLECTING USEFUL TIMBER PRICE DATA

Differing interpretation of the term "feasibility"

The feasibility of collecting and reporting useful timber price data is a subject that may be considered from several aspects. In the first place, the fact that there are 18 States in which timber price information has been collected and published for a number of years is, in itself, evidence that the activity is feasible, at least in these States.

But there are those who raise serious questions concerning the usefulness of at least certain features of these reports and, since "feasibility" implies success in the undertaking, the basis for these questions is germane. Such questions are directed more toward reporting prices for standing timber than for cut products, although many of the objections apply to the latter as well. For example, in a study of timber marketing in Mendocino County, Calif. (4), it was found that—

"Accurate and meaningful price reporting for standing timber does not appear to be feasible under the conditions prevailing in the county. The detailed and time-consuming field interviews of this study plus an analysis of recorded timber-sale contracts did not produce data adequate for the appraisal of price levels for individual properties or for the isolation of the effects of price determining factors. A fundamental difficulty in price reporting is the lack of precise and fully defined information as to the price received by the sellers. One-third of the standing-timber sales were on a lump-sum basis, which automatically makes the significance of any data on price per thousand highly questionable. In the two-thirds of the sales on a scaled-volume basis, variations in scaling practice—often unreported and frequently unknown—substantially reduce the reliability of price data. In a number of cases the sale was based not only on cash payment for the timber but also on supplemental services such as roadbuilding, the value of which cannot be readily determined. * * *

"The quoted price for standing timber, therefore, is not as clear an indicator of the success of a sale as is true in many other areas of economic activity. Price is only one of several factors determining the actual return to the seller. Accurate determination of the volume cut also has a great effect on the gross cash income from the sale, while the condition of the residual stand and damage to roads, fences, and other improvements may often be the dominant factor in determining the net benefits received. The sellers' complaints usually centered on cutting and logging practices, slash disposal, scaling practices, and failure to provide services rather than on price."

Thus, concern about the feasibility of timber price reporting is directed largely to the question of the applicability of price quotations or reported prices directly to particular types of timber, particular stands of timber, particular products, or particular parcels of land with which a given owner, seller, or buyer may be concerned.

Problems associated with reporting specific prices

Some of the major problems associated with specific pricing are concerned with stumpage prices, cut product prices, species and intended use of product, measurement standards, and quality specifications.

Stumpage prices.—Stumpage has certain attributes which make price reporting very difficult at this stage in the marketing process. There is no common marketing point, for example, among the numerous sale transactions. Price is firmly linked with timber stands on specific locations. Prices for different sales vary with many cost factors—i.e., the degree of accessibility, road construction needs,

ground cover, logging conditions, length of log haul, stand density, and many other factors associated with a particular tract—as well as with quality and value of the trees. Except where owners get assistance from a forester, very few private timber sales are made where even the most obvious price-determining factors are measured and recorded. Most buyers simply make a general estimate based on judgment and experience unless the sale is large enough to justify using appraisal techniques. Consequently, sales records are generally inadequate for compiling stumpage price reports except by very general categories.

After analyzing the feasibility of price reporting for standing timber in California, Zivnuska and Shideler (*15*) proposed as an objective "* * * the development and publishing of price data which are free of bias and sufficiently definite to be useful in making economic decisions concerning specific forest properties."

In terms of kind of data required, they specified two major criteria:

"(1) There must be a low variance of prices around the mean price reported for any given commodity. Unless this range of variation around the reported price is narrow, any attempt to apply the data in making decisions for specific properties may be badly misleading. This problem is particularly acute for standing timber. * * *

"(2) The reported prices must be based either on complete enumeration or on a sampling method which will provide relatively precise and unbiased estimates of average price. This appears self-evident, but the problems involved merit later discussion."

After examining quite critically the findings of several research studies they stated, among other things:

"No conclusive evidence has yet been given that measurable characteristics of the timber commodity itself can be used as a basis for obtaining the needed reduction in the great variability of timber prices which exists even for particular species, areas, and markets. The analysis presented here for the relatively simple case of national forest sales in California has failed to reveal any usable relationship between ponderosa pine prices and such factors as volume of timber, proportion of pine, density of cut, and length of log haul. In work on timber price reporting to date, problems of bias due to selectivity in reporting sources and difficulties of maintaining precision in estimates through adequate sample size have received only incidental consideration."

Although not all the factors associated with variable stumpage prices can be isolated as yet, some progress is being made. An analysis of stumpage prices for southern pine sawtimber sales on national forests in Mississippi, Louisiana, and Texas produced a regression equation accounting for 47 percent of the price variation (*8*). Factors significantly correlated with stumpage price were sale volume, cut per acre, hardwood ratio, tree volume, and wholesale lumber price for the month prior to that of the sale.

A more recent study (*2*) of southern pine sawtimber sales in South Carolina tested the relationship of 23 independent variables to stumpage price received. It was found that:

"Regression analysis showed that of the variables considered, only four were significant. These were: (1) Volume per tree, (2) distance to mill, (3) number of bids, and (4) geographic location. Together, these four variables explained 58 percent of the price variance. * * *

"This study provides a method for translating the general average price into the average price a specific tract would bring. It demonstrates that in spite of the great variability in the characteristics of pine sawtimber in South Carolina, well over half of the price variation among tracts can be explained with a few measurable variables.

"Of course, the analysis does not provide a complete explanation of price behavior. But in our daily lives, we accept many imprecise explanations because of their usefulness. And by reducing the number of factors represented in the complex process of setting a price on stumpage, we can express useful information about this process which otherwise would have to be accepted as random. As better ways are found for measuring potential price determinants, the explanation of stumpage prices may be further improved. In this way, we can provide better market information to timber sellers than has been available in the past."

Cut product prices.—Collecting and reporting cut product price appears less formidable than for stumpage prices. Logs and bolts cut and delivered to a loading point or mill yard can be separated and identified as individual products such as sawlogs, veneer logs, pulpwood, poles, or piling. The loading point or mill yard is a common marketing point for pricing free of such variables as

accessibility, road construction, and logging conditions, that confound stumpage price determination.

Some problems remain to be solved before cut product prices can be reported precisely. Foremost is the need for uniform application of quality grades and scaling methods. So long as buyers use differing standards of grading and measuring, price reports will continue to reflect the price range created by this situation. However, marketing practices in some localities and for some products, such as pulpwood, now are sufficiently uniform to allow price reporting within a relatively narrow range.

Bruce (*3*), reporting his experiences in making periodic price reports on cut products in the State of Washington, indicated that both mail questionnaires and personal interviews were used successfully, each under a particular set of circumstances, to collect data. He also reported—

"Another important aspect is the extent of industry support of market reporting. We have received numerous favorable comments from sawmills, landowners, loggers, and others associated with the forest industry. Probably the most concrete evidence, however, was the request from two forestry trade journals to publish the market report information regularly. These are the Timberman and Western Equipment and Timber News. Newspapers also have felt this type of information to be newsworthy. * * *

"The following problems have been faced in attempting to publish a periodic market report.

"(1) Obtaining an adequate sample at a minimal cost: What is the minimum number of a region's mills that must be contacted in order to assure an accurate estimate of the market price?

"(2) Obtaining accurate prices within the limitations of existing product standardization and scaling practices: Probably the most significant problems in market reporting today are associated with inadequacies of product definition. The methods used for measuring the quantity of delivered material, too, are an important source of price variation—yet, to date, the effect of certain scaling practices is undefinable in specific terms.

"(3) Reporting a meaningful price: Prices offered are subject to variation due to bargaining and scaling practices. Prices paid, however, do not specify the basis for agreement between buyer and seller if certain factors not related to product quality are considered in the transaction. Which is the most meaningful? Which can be most readily obtained?

"(4) Defining the number of reports necessary each year: Saw-log prices seldom change very much from month to month; hence, why not publish such prices less often than once a month? One reason is the attention and reminder value of frequent reports received by the forest-land owner. These two aspects must be weighed before letting cost of publishing be the main consideration. * * *

"It cannot be said that these problems have been 'solved,' if that would imply we have the best possible answer. These are areas deserving of additional attention, and perhaps it is here where the greatest opportunities lie."

Species and product use.—Most forest stands contain a mixture of species and possible timber products. For example, hardwood forests in the Central States may be composed of several oak species, hickory, ash, elm, maple, and walnut. Products which may be cut from some or all these species are sawlogs for lumber, veneer logs for face and container veneer, and logs or bolts for cooperage, handle stock, mine timbers, and ties. Southern pine stands which may contain only pine species can often be utilized for sawlogs, pulpwood bolts, poles, and piling; individual trees may serve several of these product uses.

Tree values can vary considerably by species and product. Buyers will make price offers based on the particular product they seek. A buyer interested in veneer may quote a price double that of a tie buyer; or a buyer with a good market outlet for small poles may offer more than a pulpwood buyer for the same tract of pine timber. Some buyers will make an offer only for a portion of the stand, such as veneer timber, while sawlog buyers, for example, may make an offer on the entire stand. The result of the diversity of species, products, and buyers' needs is that the categories by which prices can be quoted or actual sales can be classified cannot be narrowed sufficiently for direct application to the holdings of individual owners.

Measurement standards.—The estimated board-foot volume in a log or tree can vary according to the log rule used. For example, considering 12-inch logs, for each 1,000 board feet indicated by the International ¼-inch rule, the Scribner rule would indicate 830 board feet and the Doyle rule would indicate 670 board feet. This relation changes according to the diameter of the log, and for 28-inch

logs there is relatively little difference in the yield as shown by these three log rules. A timber seller who does not understand these variations in log rules cannot interpret reported prices. Acceptance by buyers of a standard log rule for use in all timber transactions would eliminate many of the difficulties. However, tradition has established the use of certain log rules and customs developed over the years are not easily changed.

The wood volume estimated for pricing purposes in a load of logs or stand of trees will vary by the scaling practices applied; and not all buyers apply the same practices. Thus measurement of log diameter may be inside bark, or including one bark thickness, or based on either a single measure or an average of two right-angle measures. Whenever a log or tree contains defective material, crook, or sweep, a largely subjective judgment is necessary to arrive at a net volume figure. Moreover, measuring practices may be strict when demand is down, and easy when it is higher. Since price varies no less than measurement, it is apparent that specific timber prices per unit volume cannot be determined consistently for reporting purposes as long as log rules and scaling practices differ.

Quality specifications.—A well-defined measure of quality is needed for application in both stumpage and cut product sales. Many grading systems are in use today but most are difficult to apply uniformly and few have been subjected to a critical test of their validity. In Kentucky (*10*), for example, each mill operator uses his own individual grading system. These systems are seldom outlined in printed form, but are rules of thumb that the operator applies as he purchases timber. In West Virginia (*11*), 9 out of 10 sawmills do not use written quality specifications when purchasing raw material.

Quality is taken into consideration to some extent nearly every time a sale is made and variation in quality accounts for much of the wide price range shown in current timber price reports. In most areas the lack of adequate specifications uniformly applied makes it impossible to correlate price paid with product quality. When these measures of quality can be identified and related to individual sales, it will be possible to narrow the range of reported prices for specific products.

Timber price reporting service is feasible

The question of feasibility of timber price reporting is not one of a clear-cut yes or no, but rather one of whether the kind of reporting that can be carried out is sufficiently useful to justify conducting it. Replies to the mail survey of State price report recipients indicate, on the whole, a belief that the reports currently being issued are serving a useful purpose.

A timber price reporting service to inform each forest-land owner exactly what price he should receive for his timber is obviously not possible. Such an objective—apparently held by some—rather overstates what it is reasonable to expect for any price reporting service. Timber price reports are not intended to serve as substitutes for a competently made timber cruise, a thorough solicitation of bids, and careful negotiation. To avoid misuse and to promote proper use of timber price reports requires a continual process of education.

However, the fact that reporting of such specific timber prices is not possible does not mean that periodic publication of general price information cannot serve useful purposes. In fact, the very circumstances that render precise price reporting difficult are the ones that impede the small forest-land owner in judging the value of his products. Accordingly, they are the circumstances that argue persuasively for the publication of the best information that can be collected.

Information on timber prices is just as important to forest-land owners as any other kind of marketing information pertaining to buyer location, product specifications, or selling practices, and should not be underestimated. Most timber price reports currently being issued are in an early stage of development and can do no more than reflect the prevailing market structure. Users should accept them as sources of general price information with full recognition that prices for particular stumpage or cut products depend upon more or less unique circumstances and can only be determined through bargaining. Such reports can help foresters keep up to date on approximate prices and price differences among timber products, can aid county agents and other nonforesters in dealing with price inquiries, and can contribute toward the development of a more systematic and orderly setting for marketing operations for the benefit of both buyers and sellers.

Our review leads us to conclude that it is feasible and practicable to conduct a useful timber price reporting service, although the range within which it is possible to report prices would in many cases exceed the limits considered desirable by some users. The circumstances which make it difficult or impossible to quote specific prices are precisely those which present problems to the small

forest owner and which create the need for providing information as accurately as is possible.

A PROGRAM FOR TIMBER PRICE REPORTING

A timber price reporting program should embrace not only the mechanics of collecting, compiling, and issuing reports but a strengthening of research to develop increasingly useful price information.

Federal price reporting efforts should begin by considering the need for, and the facilities necessary for improving the programs already being conducted. A Federal program could furnish technical statistical assistance in some States, the means for more complete utilization of basic sources of data, improved sampling methods, exploration of more complete product coverage, more detailed reporting by area, and continuing research into better pricing techniques and procedures.

Consideration should, in other words, first be given to strengthening the programs already in existence, rather than to superseding or replacing them. Emphasis would be upon helping all States move up to the level of the best reporting practice as heretofore conducted. Programs of price reporting should be extended to other States or areas where the need exists. Continual efforts would be made through research, interstate consultation, and conferences to improve the quality and usefulness of reports generally.

A Federal program also should seek to promote better integration of programs between States in situations where a natural marketing area is divided by State lines. Promotion of uniform reports for such areas in terms of commodities and timing seems to hold promise for increased usefulness to forest-land owners.

Factors to consider in preparing timber price reports

There are a number of important elements associated with timber price reporting, such as data sources, actual sales evidence versus quoted prices, price range and average, market areas, sampling universe, frequency of reporting, and general marketing information which must be considered in the collection, compilation, and issuance of useful timber price reports.

Sources for both stumpage and cut-product prices will necessarily consist primarily of buyers such as mill operators and logging contractors. These men make frequent purchases, are thoroughly familiar with timber products, and could readily supply price information for the products they buy. Stumpage price data would be less specific than that for cut products. Forest-land owners who market their timber with the assistance of State farm or service foresters are another possible source of stumpage prices. This source may be helpful in those States in which a sufficiently large number of sales are made to provide an adequate sample.

Transaction evidence of such factors as actual sale volume, quality, accesibility, and price received per unit volume would be more desirable than general price quotations as a base for report compilation. However, such information would be difficult to obtain for stumpage prices. Many sales are made on a lump-sum basis and unit prices by species or grade would be unavailable. Except for some sales made through professional foresters, most sales records do not contain the detail needed for collecting price data according to such variables. Transaction evidence for cut products is potentially available from industry sources. However, many small mills do not maintain records adequate for that purpose and there is some question as to whether mills which do maintain records would generally open their books to the person collecting the price data. Therefore, price quotations (with the inherent possibilities of some biases and inaccuracies) represent the only generally accessible source of basic data.

The question of reporting price ranges or averages points up the basic difficulties of compiling specific price information. Because of large variations in the physical composition of timber products and a lack of uniform application of existing standards of measurement, price quotations generally show considerable variability or range. The decision whether to use range or average or both would probably best be made for each product and reporting area.

Reporting of prices by market areas is analogous to reporting by species, product, or quality grades. Natural groupings occur where price differences are not large. For example, pulpwood prices may be fairly uniform over an entire State and saw-log prices may vary from one local market area to another but be relatively uniform within a market area. As with the determination of price ranges and averages, market areas for reporting purposes should be designated on the basis of prevailing local conditions.

Most States have a list of forest product buyers which can serve as a universe for sampling purposes. If no such list exists, an industry survey would need to

be made. After classifying buyers into respective product manufacturing groups such as sawmills, veneer mills, pulpmills, and cooperage plants, proper sampling techniques can be applied to give adequate coverage for price reporting purposes. Since buyers are the most accessible and knowledgeable source of price information, sampling of sellers would rarely be feasible. Moreover, the majority of sellers do not sell timber frequently and the universe of sellers would change substantially from year to year.

Since stumpage and cut products are being bought and sold every day there is always someone who needs current price information. However, prices for some products often change very little over periods as long as several months. In some areas contracts are made in the spring and fall and prices remain fixed during the interval. Therefore, although weekly or monthly reporting may present advantages in specific circumstances, it appears that semiannual, or at most quarterly, reports are more nearly in the range of general practicality.

There is need for general marketing information in addition to price information. Many forest-land owners are not familiar with timber marketing procedures, and, if they are to make intelligent use of reported prices, will require some explanation of what the prices mean and how they can be applied to their situation. Some information on current market activity for the various products, how to locate buyers, and where to obtain marketing assistance would also be useful. The information can be brief and some of it could be carried in every report.

Minimum requirements of a timber price report

A useful timber price report should include, as a minimum, consideration of the following essential points:

(1) *Product coverage.*—Stumpage and cut product prices for all major species and products should be reported. Expansion to include minor species and products would depend upon local importance and interest within each State.

(2) *Frequency of reports.*—In some States, where the need has been demonstrated, quarterly reports appear desirable. In other States semiannual reports appear the most reasonable compromise between needs of users and cost of program, although the way should always be open for increased frequency as the need is demonstrated.

(3) *Data collection.*—Collection of information from primary sources by personal contact is desirable to maintain control of the sample, continuity of reporting, and adequate detail concerning prices and related pertinent characteristics of products and of the market. However, under favorable circumstances mail questionnaires can be used as a supplemental collection method.

(4) *Interpretative and market information.*—Reports should include such interpretative and explanatory information as may be appropriate to promote effective use of the price data.

(5) *States of primary concern.*—In most States the volume of timber sales is large enough to indicate the desirability of a timber price report. The important exceptions are the Plains States (except east Texas) and the Rocky Mountain States (except northern Idaho and western Montana). The need for timber price reporting in these States is considerably less urgent than in the States of relatively greater production. Available material indicates that timber price reporting in 37 States, some of which may be combined for reporting purposes, would serve a majority of the forest owners and would include the important marketing areas.

In general it is considered neither practical nor a constructive use of Federal funds to extend a timber price reporting service into areas in which sales are relatively few or the value of sales is small. Data from the 1959 Census of Agriculture provide the most recently available timber products sales data for each State and county. These data provide a minimum indication of both relative and actual importance of timber products sales, inasmuch as sales from tracts defined as farms by the census comprise only part of small timber holdings. Lacking detailed local area data relating to all sales of timber products, the 1959 Census of Agriculture has been used as a guide to indicate those States in which price reporting would be practical. As a general rule, in reaching a suggested list of States in which timber price reporting service would be justifiable, States were omitted for which the 1959 census reported fewer than 100 farms selling timber products or sales of timber products of less than a million dollars. The only exception is Rhode Island which should probably be included in combination with adjoining areas of Connecticut or Massachusetts.

Although this classification was used for preliminary planning purposes and for evaluating the magnitude of a program this would not preclude including some

States with less than a million dollars in sales or fewer than 100 sellers if sufficient local interest in timber price reporting should become manifest. Likewise, there may be some States that exceed these minimum requirements in which local interest would not warrant price reporting. Considering value of sales, the number of sellers, the density of sales, and the forest resources of the area, the following States are those in which a timber price reporting service appears justified.

Alabama	Maine	Oregon
Arkansas	Maryland	Pennsylvania
California	Massachusetts	Rhode Island
Connecticut	Michigan	South Carolina
Delaware	Minnesota	Tennessee
Florida	Mississippi	Texas
Georgia	Missouri	Vermont
Idaho	Montana	Virginia
Illinois	New Hampshire	Washington
Indiana	New Jersey	West Virginia
Iowa	New York	Wisconsin
Kentucky	North Carolina	
Louisiana	Ohio	

6. *Cooperation of interested agencies.*—Cooperation between the statistical reporting agency, service foresters, extension foresters, and others who know local conditions is highly desirable.

The statistical agency would provide the leadership in operations, sampling techniques, collection of data, and publication. At all stages, however, service and extension foresters can provide counsel as to products important in an area and delineation of marketing areas. They can promote the cooperation of mills, sellers, and others in providing data to the statistical agency. In some areas it may be found expedient and practicable for service and extension foresters to make the necessary contacts to collect part of the data. The particular form which cooperation can take, and the specific arrangements pertaining thereto, all depend to a large extent upon local conditions.

In a number of States, Christmas trees are among the products included in the price reporting service. However, in most areas the Christmas tree operation has become highly intensified, with specialized needs as to information and timing. In Pennsylvania a series of reports was developed to meet these needs, with price data as only one element in the reporting service. For purposes of this report, Christmas tree pricing is not considered as part of a "timber price reporting service," although such a service might—under appropriate circumstances—include price data on Christmas trees as well as on other products. Major areas of production of Christmas trees would be represented if there were price reports for northern New England, New York, Pennsylvania, Ohio, the lake States, and several Far West States. Two price reports, one in October and one in November would provide reports during the months of major marketing activity.

Research needed to develop better price reporting techniques

The objective of a timber price reporting service is to collect, compile, and publish representative prices based on actual sales data for products identified and measured on a clearly specified basis. As noted earlier, many obstacles exist that prevent early fulfillment of this objective. A research program specifically designed to overcome these difficulties is needed, if the full benefits of a price reporting service are to be realized. In the meantime, such price reporting as is conducted must necessarily be subject to the limitations discussed elsewhere in this report.

The most pressing need is for a well-defined quality measure for application in both stumpage and cut product sales. Also, most forest land owners want stumpage price information, yet such prices can be complied only in terms of broad ranges. The reporting of more meaningful stumpage prices for all species, products, and combinations within a forest stand offered for sale will require an expansion of research in this area. Additional research to improve timber price reporting is also desirable in many other areas.

Irrespective of the question of establishing a timber price reporting service, provision should be made for a research program to clarify these and many other aspects related to sales of stumpage and cut products. Responsibility for this research rests with the U.S. Forest Service and forest research organizations within the respective States.

Federal participation offers opportunities for improved timber price reports

Historically there has been full cooperation on the part of both Federal and State agencies in program operation directed toward the needs of Federal, State, and local interests. It is in such a setting that Federal participation would strengthen the resources available for timber price reporting. This implies that the Federal agency would invite full advice and assistance from whatever Federal, State, or private organizations are available and willing to assist, and working in a constructive and cooperative relationship in States where programs are already underway. In all cases the reports would be designed primarily for the use of State and local interests. In addition the Federal interest would be directed toward developing and promoting improved survey and statistical standards, and as appropriate, developing such features of the reports as would facilitate easy and accurate comparison of data from State to State and measurement of trends and other significant price movements.

Essentially, participation by the Federal Government in a program along the lines discussed above would provide the opportunity for—

1. Strengthening of the resources available for timber product price reporting in the States in which programs are underway.
2. Accelerating the introduction of timber price reporting into additional States.
3. Promoting improved statistical techniques and procedures. These would include strengthening the sample data upon which the report is based and working toward price reporting in terms of uniform or specified measurements of volume and of grade.
4. Promoting uniformity and coordination of reporting over market areas including parts of two or more States.
5. Providing data to facilitate interstate and interregional comparisons.
6. Making progress through research toward increased effectiveness of timber price reports.
7. Contributing to the development of more uniform pricing and marketing practices through coordinating the pricing program with the work of service foresters, Extension foresters, and research workers, and through consultation with industry representatives.
8. Developing more effective and more uniform price reporting practices through periodic conferences of the various leaders of the price reporting program in several States. Such conferences would afford an opportunity to exchange information as to developments in all regions and thus promote the development of reports of maximum usefulness.

METHODS OF FINANCING

Financial support for a timber products price reporting service could be provided by the Federal Government, by State governments, or by buyers and sellers of timber products. At present there is no indication that forest product buyers and sellers will provide financial support for the type of price reporting herein discussed.

State administered funds provide the financial support for existing timber product price reporting activities. Matching funds made available under the Agricultural Marketing Act of 1946 are providing most of the financial support for timber product price reports currently being prepared in several States. In other cases the reports are prepared by the Extension Service or other State agency, using funds available for marketing assistance programs. In several States, as already noted, the Statistical Reporting Service of the USDA provides some nominal assistance, mostly in the way of facilities and technical statistical assistance. Inquiries made to State officials concerned with forest products marketing reveal an interest in this type of activity, but there is no indication of material expansion of forest product price reporting based on State appropriations for that purpose.

Federal appropriation to the Department of Agriculture for use on a continuing basis would provide the means for the central direction and coordination desirable for establishing and maintaining a "timber price reporting service."

Within the Department of Agriculture both the Forest Service and the Statistical Reporting Service have contributions to make in the field of timber products price reporting. There are others also engaged in extending marketing assistance to forest owners such as State service foresters, Extension foresters, and the Soil Conservation Service woodland conservationists. Manifestly, the problems of forest products marketing are numerous and varied, and involve State, local, and Federal agencies.

As the Department visualizes a "timber price reporting service" however, this would be essentially a fact gathering operation, directed toward collecting through a sound statistical program information concerning prices of the more important products sold by forest owners, and publishing such information from time to time as a means of assisting both buyers and sellers to be better informed concerning prices and values than might be the case in the absence of such a service. Within the U.S. Department of Agriculture such a function clearly falls in the province of the Statistical Reporting Service.

At this point attention is invited to that portion of the committee's directive reading:

"* * * and the proper method of financing the project; i.e., whether or not it should be financed from funds available to the Forest Service."

In view of the allocation of functions as outlined above, it is believed that if it is the desire of the Congress that a timber price reporting service be established in the Department of Agriculture, the necessary appropriations should be made to the Statistical Reporting Service, and that appropriations for such supporting programs of research or education as are desired should be made available to the Forest Service, Extension Service, or other agency.

The State offices of the Statistical Reporting Service, generally known as cooperative Federal-State crop reporting offices, are organized and operated in a manner designed to serve the needs of Federal, State, and local interests. In most States there is formal cooperation with one or more State agencies. In both technical and administrative problems there is continuing close cooperation between the agencies at various governmental levels as well as with industry groups. The Federal contribution to the program is geared basically to the information for a given State needed for a coordinated system of reports covering the United States and meeting needs at the national level. The State contribution to the program is geared to the additional or more detailed information (commodity or areawise) desired by the State that cannot be collected with the Federal resources.

A timber price reporting service could be administered by the Statistical Reporting Service in a somewhat analogous cooperative manner, working through these same offices. A basic minimum program would be conducted at the level provided by the Federal contribution. States wishing to do so could provide for more detailed or more frequent reports, and with more areal breakdown.

It is suggested that minimum elements of the federally financed portion of a program (which could be expanded as needed by State contributions) would consist of a system of reports including essentially the following:

1. Prices of stumpage by major species and principal marketing or producing areas within the State.
2. Prices of principal cut products by important species and marketing or producing areas within the State.
3. Interpretative and explanatory information—such as that related to marketing practices, evident trends, and notations concerning the current market—to assist users in making more effective use of the statistical material.
4. Data collection primarily by personal enumeration, with mail questionnaire supplementation.
5. Reports to be issued semiannually.
6. Reports based on transaction evidence to the extent possible with dependence where necessary placed upon more generalized information supplied by buyers and sellers concerning prices being paid (or received) during the reporting interval.

The annual cost of a price reporting service embodying these elements under present cost conditions covering the 37 States in which forest products are considered sufficiently important to justify the service, is estimated at $300,000. During the first 2 years a substantial part of expenditures would be for development activities, but is it expected that by the end of the second year a price reporting program could be activated in all States where forest products are of sufficient importance to justify a program.

This cost estimate does not include price reporting for Christmas trees. The estimated annual cost of a program for Christmas trees of two reports per year (one in October and one in November) in the important States is $27,000.

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EXHIBIT 1

STATE FOREST PRODUCTS PRICE REPORTS

California

University of California Agricultural Extension Service, California State Division of Forestry, and California Small Woodland Council, cooperating.

"Markets for Woodlands Products in California." (Annual. Quotes prices for young growth stumpage and products such as logs and bolts, poles and piling, fence posts, pulp chips, redwood burls, tanoak bark, cascara bark, and sword ferns.)

Idaho

University of Idaho Extension Forestry Office.

"Idaho Woodland Market Summary." (Annual. Quotes prices for stumpage and products such as logs and bolts, lumber, railway crossties and Christmas trees.)

Illinois

Illinois Department of Agriculture, U.S. Department of Agriculture, and Illinois Technical Forestry Association, cooperating.

"Timber Prices." (Semiannual. Quotes prices for stumpage and products such as saw logs, veneer logs, cooperage logs, and pulpwood.)

Indiana

Purdue University Agricultural Extension Service and U.S. Department of Agriculture, cooperating.

"Notes on Forestry and Wood Use." (Semiannual. Quotes prices for products such as saw logs, veneer logs, pulpwood, and piling.)

Kansas

Kansas State University Extension Service.

"Timber Marketing in Eastern Kansas." (Semiannual. Contains information on the different timber product markets in Kansas along with some stumpage and log price information.)

Kentucky

Kentucky Department of Conservation and University of Kentucky, cooperating.

"Kentucky's Growing Gold." (Quarterly. Quotes prices semiannually for stumpage and products such as saw logs, veneer logs, and pulpwood.)

Louisiana

Louisiana Department of Agriculture and Immigration and U.S. Department of Agriculture, cooperating.

"Louisiana Timber Products." (Quarterly. Quotes prices for stumpage and products such as saw logs, poles, and pulpwood.)

Minnesota

Iron Range Resources and Rehabilitation Commission.

"Minnesota Forest Products Marketing and Pricing Review." (Semiannually. Quotes prices for such products as saw logs, poles, and pulpwood. This report is limited to the iron range area of Minnesota.)

Missouri

Missouri Extension Service and School of Forestry, University of Missouri.

"Missouri Forestry and Forest Industries." (Quarterly. Timber prices are reported in May and November issues. Quotes prices for stumpage and cut products such as saw logs and veneer logs.)

Montana

Montana State College Cooperative Extension Service.

"Woodland Market Report." (Annual. Quotes stumpage prices for sawtimber and miscellaneous forest products.)

New Hampshire

New Hampshire University Cooperative Extension Service and State Forestry and Recreation Commission, cooperating.

"Forest Market Report." (Annual. Quotes prices for stumpage and products such as logs, and bolts, lumber, poles, piling, fuelwood, posts, and Christmas trees.)

New York

New York State Conservation Department, Division of Lands and Forests.

"Forest Practice Doings." (Semiannual. Contains general news for the various forest districts in New York along with some stumpage and log and bolt price information.)

Ohio

Ohio Department of Agriculture, U.S. Department of Agriculture, and Ohio Department of Natural Resources, Division of Forestry, cooperating.

"Ohio Timber Prices." (Quarterly. Quotes stumpage, log and bolt prices for selected species, products, and grades of products for three regions in the State.)

Oregon

Oregon State University Extension Service.

"Farm Forest Products Market Report." (Weekly. Quotes delivered saw log and veneer log prices by species and quality grades for several localities. Occasionally reports prices for such products as poles, piling, maple burls, sword fern, and short pulpwood.)

Vermont

Vermont Extension Service, University of Vermont.

"Forestry Work Tools." (Quarterly. Quotes prices of delivered logs and bolts for various species and products in several marketing areas.)

Washington

U.S. Department of Agriculture, State agricultural extension service, State department of natural resources, and Forestry Department of Washington State University, cooperating.

"Forest Products Price Report." (Quarterly. Quotes prices for delivered logs and other products in western Washington districts.)

Washington State University, Department of Forestry and Range Management.

"Farm Woodland Products Market Report." (Monthly. Quotes prices for stumpage and delivered logs in eastern and central Washington.)

West Virginia

West Virginia Department of Agriculture, U.S. Department of Agriculture, West Virginia Conservation Commission, and West Virginia University, cooperating.

"West Virginia Forest Products Market Information." (Quarterly. Quotes saw log and stumpage prices for specified hardwood species.)

Wisconsin

Wisconsin University Extension Forestry Office and Wisconsin Conservation Department, cooperating.

"Wisconsin Forest Products Review." (Semiannual. Quotes prices for stumpage, delivered logs and bolts, lumber, railway crossties, piling, poles, and posts.)

[Wisconsin Crop and Livestock Reporter]

EXHIBIT 2

WISCONSIN FOREST PRODUCTS PRICE REVIEW

JULY 1961.

This semiannual forest products price report was compiled by the extension forestry office of the college of agriculture with the cooperation of the Wisconsin Conservation Department and the Wisconsin woodusing industries.

The forest products price review is designed to offer practical information on the current timber market. Each marketable form of timber is listed according to a statewide price range. It should be understood that timber prices are determined by a combination of factors including local market demand, distance to mills, timber accessibility, marketable volume, and timber size and quality. For this reason a quoted price range may have a wide spread between the high and low offers. These ranges can be used as guides by local timber owners and buyers in arriving at a fair price agreement.

The price ranges may or may not reflect the variable industry practice of awarding a premium over the mill base price for long-haul contracts. In addition, pulpmills may offer the delivered mill price or up to $1.50 less per cord f.o.b., depending upon species and location, Sawlog trucking rates average $15 per thousand board feet within a 60-mile range of the mill.

CURRENT MARKET TRENDS

The forest products market picture is definitely off from a year ago. A noticeable slump is evident in most areas regardless of the product. Both producers and buyers report the demand situation is low—and one which will last until fall. Prices are expected to remain steady, but some lower offerings are likely. An upswing in the national economy will definitely bolster the Wisconsin timber

market picture. However, most producers and wood users seem prepared to sweat out a hot summer before this welcomed trend occurs.

Although stumpage prices appear firm, the low demand for wood has resulted in light bidding on most timber sale areas. As usual, high quality timber is most readily sold even during the period of a depressed market.

Veneer log buyers in the east and northeast expect a steady price and demand for the premium grades during the summer months. Elsewhere in Wisconsin, however, mills have stopped buying until midsummer or fall.

In general, sawmill operators expect the poor demand for most logs to continue through the summer months. The price structure for logs should hold steady. Isolated reports of a good hardwood market, especially for oak and maple, keep the statewide picture somewhat hopeful. Some mills and operators report that a much larger volume of logs is being offered at the present time than the market can readily absorb. Unsold logs remaining in the woods or the deck do not increase in value. Standing trees can increase in value while the local market is temporarily depressed. Timber owners and log producers would be well advised to contact their prospective markets before felling and bucking trees into logs. This suggestion will also be worth noting next fall and winter.

The pulpwood market is tight due to a poor demand. One mill reports an expected 10-percent lower production compared with a year ago. Excess inventories have resulted in fewer pulpwood contracts let. This is evident in the few bid sales sold this spring on public forest lands. Reports around the State indicate overcutting in the woods without contracts has resulted in an excessive supply of cut material in the woods. Most mills are buying only a limited amount of contracted wood to maintain a full, but reduced, inventory. There is a very restricted demand for pine and hemlock in central Wisconsin. Only peeled balsam fir and spruce can be marketed there. Lower prices can be expected for most pulpwood species with the prevailing market.

The boxbolt market is reported good to poor. Generally the prices are expected to hold firm. Some mills in the northwest and northeast optimistically expect a steady demand will continue, while others are experiencing a lowering trend.

Sawtimber prices

[Ranges per thousand board feet—Scribner]

Species	Stumpage (standing tree)	Veneer and sawlogs (delivered at mill)				
		Grade No. 1		Grade No. 2	Grade No. 3	Woods run
		Veneer mills	Sawmills			
Ash	$12	$65–$100	$50–$ 75	$20– $40	$15–$25	$30– $45
Aspen	20	40– 60	30– 60	20– 40	15– 30	25– 50
Basswood	$12– 50	70– 105	50– 95	30– 50	15– 30	30– 60
Beech		50– 90	30– 50	20– 25	10– 15	30
Birch, white	20– 40	75– 165	50– 90	20– 50	15– 25	30– 60
Birch, yellow	25– 60	150– 250	80– 125	40– 60	20– 25	45– 85
Butternut		60– 80	60– 100	30– 70	25	30– 50
Cedar, white						35– 45
Cherry, black	60	70	60– 100	30– 70	15– 25	30– 65
Cottonwood		50	30– 40	20	15	25– 40
Elm, rock	10– 25		40– 60	25– 35	15– 20	30– 40
Elm, soft	10– 25	35– 65	40– 60	25– 30	15– 20	25– 40
Hardwoods, mixed	15– 35					
Hardwoods, swamp	12– 30					
Hemlock	10– 35					35– 50
Maple, hard	15– 50	90– 150	70– 115	40– 70	15– 25	35– 65
Maple, soft	15– 50	55– 90	50– 90	30– 45	15– 25	35– 55
Oak, red	15– 40	75– 115	50– 80	30– 50	15– 25	30– 65
Oak, white	15– 40		50– 80	30– 50	15– 25	30– 65
Pine, jack						35– 40
Pine, red	25– 50		50– 75	30– 50	15– 30	45– 60
Pine, white	25– 50	90– 100	50– 75	30– 50	15– 30	45– 60
Spruce						40– 50
Walnut		175– 700	125– 175	75– 100	40– 50	75– 100

Pulpwood prices

[Per 4-foot by 4-foot by 100-inch cord]

Species	Stumpage per cord (standing tree)	Price delivered at mill	
		Rough	Peeled
Aspen	$1.50–$2.50	$11.00–$15.00	$19.00–$20.50
Balsam fir	3.00– 6.00	20.00– 23.50	27.50– 28.50
Basswood	2.00– 3.00	11.00	----------
Birch, white	1.50– 2.50	13.00– 15.00	21.00
Hardwoods, mixed	1.00– 2.50	12.00– 15.50	21.00
Hemlock	3.00– 5.00	18.50– 19.50	23.50
Oak	----------	15.00	16.50
Pine	4.00– 7.00	17.00– 19.00	22.50
Spruce	6.00–10.00	26.00– 28.50	33.50
Tamarack	----------	----------	24.00

NOTE.—F.o.b. car prices average $1 to $1.50 less per cord.

Box and excelsior bolt price

[Delivered to mill]

Species	Stumpage per cord (standing tree)	Price per rough cord		
		4 by 8 feet by 40 to 44 inches	4 by 8 feet by 50 to 57 inches	4 by 4 feet by 96 to 100 inches
Aspen	$1.50–$2.50	----------	$11.00–$13.00	$12.00–$18.00
Basswood	2.00– 3.00	$12.00–$13.00	13.00	15.00– 20.00
Birch, white	1.50– 2.50	16.00	14.00	14.00– 16.00
Mixed hardwoods	1.00– 2.50	----------	----------	14.00– 16.00
Oak, red	----------	----------	16.00	----------
Pine, jack	4.00– 7.00	----------	----------	20.00– 22.00
Pine, red and white	4.00– 7.00	----------	----------	20.00– 25.00

NOTE.—Charcoal wood (mixed hardwood): 4 feet x 8 feet x 50-inch cords, $8 per cord. White and bur oak cooperage: 24-inch heading stock, 30 to 50 cents per cord foot; 39-inch stave stock, 70 to 85 cents per cord foot.

Lumber prices

[At mill, per thousand board feet]

Prices for rough, No. 3A and better lumber produced by mill operators for local consumption or remanufacture by volume buyers. Many mills also report lumber sales based on grade rather than mill run. No appreciable differences between green and air dry lumber range as reported. Dressed dry lumber somewhat higher.

Species	*Green or air dry*
Aspen	$50–$70
Black cherry	50– 80
Elm	40– 65
Hardwoods, mixed	50– 80
Hemlock	70– 90
Maple, hard	75–125
Maple, soft	70–110
Oak, red	55–100
Pine, jack	55– 85
Pine, red (Norway)	65–100
Pine, white	70–125

No tie market is expected by mill operators before fall. This is the general picture for the entire Lake States area. Compared with a year ago, present production and demand is very poor. Tie logs are not being purchased at the present time. Many operators are sawing their present log supply into ties and lumber, and are expected to halt production until fall. Some tie mills have temporarily shifted to sawing popple.

The lumber market is rather variable. Hardwood markets have remained steady. This is particularly true for well-seasoned material such as hard maple and aspen. Oak is reported in good demand by some southern Wisconsin producers, but the reverse for certain operators in the Northwest. Lower grades are hard to sell, however, No. 1 Common is moving better than a year ago according to reports from the Southwest. Demand is expected to pick up by fall.

The cedar post market is steady. Reports indicate purchases have been suspended until next winter. Current prices are expected to hold firm. Not much change is expected for poles and piling.

Stave mill operations in southern Wisconsin also report a depressed market. Perhaps this market situation underscores the general trend which currently prevails for forest products as a result of the national economic slump. Some pickup is expected within the year. Present stumpage prices are off as much as one-third compared with a year ago.

FOREST PRODUCTS MARKETING

For the past 30 years the College of Agriculture, in cooperation with the Wisconsin Conservation Department and wood-using industries, has compiled forest products price reports to acquaint both timber buyer and seller with existing market trends. Frequent criticism has been cited about the wide price ranges existing in the statewide reports for many listed products or stumpage. During the first 10 years of the price report, the State was divided into four areas in an attempt to report more localized prices—northern Wisconsin, Wisconsin-Chippewa Valleys, Fox-Wolf Valleys, and southern Wisconsin. Very little variation existed among prices from the arbitrarily chosen regions, and subsequent reports were therefore based on single statewide ranges.

Data submitted for this report were analyzed according to the five State management areas of the Wisconsin Conservation Department. This was done to reevaluate the practice of reporting statewide price ranges in view of the constructive criticism raised. Again the areas were arbitrarily chosen and do not necessarily represent the best breakdown for marketing various forest products. The resultant price ranges for each individual area were found to show as wide a spread as the statewide ranges. In some cases, the quotations reflect a species concentration in a definite region, such as those for black walnut. This type of trend, however, does not provide an adequate basis for an area breakdown in price reporting.

Railroad tie prices

Species	Tie size	Dimensions	Mill prices received for sawed ties
Hardwoods (oak, hard maple, beech, birch, elm, and ash).	1	6 by 6 inches by 8 feet	$1.10–$1.35
	2	6 by 7 inches by 8 feet	1.45– 1.75
	3	6 by 8 inches by 8 feet	1.80– 2.20
	4	7 by 8 inches by 8 feet	2.45– 2.75
	5	7 by 9 inches by 8 feet	2.75– 3.00
	Serviceable rejects		.60

Railroad tie log prices [1]

[Delivered at mill]

Species	Stumpage price (per 8-foot 6-inch log in standing tree)	Long diameter (small 8-foot 6-inch log inside of bark)	Price per 8-foot 6-inch log
Hardwoods (oak, hard maple, beech, birch, elm, and ash)	$0.40–$0.70	8 to 9 inches	$0.75–$1.00
		10 to 11 inches	.90– 1.75
		12 to 13 inches	.90– 1.90
		14 to 15 inches	.90– 2.75
		16 to 18 inches	1.50– 3.25
		19 to 20 inches	1.80– 3.75
		21 to 22 inches	2.70– 4.00

[1] Price quotes were also based on Scribner log scale at $35 to $40 per thousand board feet.

White cedar post prices

[Delivered to yard]

Stumpage per piece in standing tree	Post size	Price per post	
		Unpeeled	Peeled
3 to 5 cents for 7-foot posts	2 inches by 7 feet	$0.09–$0.15	$0.14–$0.15
	3 inches by 7 feet	.12– .13	.17– .18
	4 inches by 7 feet	.20– .21	.25– .26
	5 inches by 7 feet	.23	.28
	6 inches by 7 feet	.26– .30	.31– .35
	7 inches by 7 feet	.30	.35
	2 inches by 8 feet	.11	.16
	3 inches by 8 feet	.13	.18
	4 inches by 8 feet	.23	.28
	5 inches by 8 feet	.28– .30	.36– .37
	6 inches by 8 feet	.30– .36	.38– .43
	4 inches by 10 feet	.37	.46
	5 inches by 10 feet	.44– .47	.54– .56
	6 inches by 10 feet	.45– .49	.55– .58
	4 inches by 12 feet	.50	.62
	5 inches by 12 feet	.55– .62	.67– .74
	4 inches by 14 feet	.55	.69
	5 inches by 14 feet	.60– .70	.74– .84

Pole prices

[Per pole at delivery point]

Pole length in feet	Jack pine	White cedar, top diameter (inches)		
		4	5	6
16	$1.00	$0.65	$0.85	$0.95
20	1.40	1.25	1.50	2.45
22	1.50			
25	1.60		2.75	3.20
30	3.00			
35	3.75			
40	6.00			
45	11.00			

NOTE.—White cedar poles 15 to 25 cents higher when peeled.

Piling prices

[Per piling at delivery point]

Length (feet):	*Pine and hardwoods*
20	$4.00
25	4.50
30	6.00
35	8.40
40	12.80
45	16.20
50	20.00

Until further study proves otherwise, timber prices are determined by a combination of factors including local market demand, distance to mills, timber accessibility, marketable volume, and timber size and quality. That a wide range of price offerings exists for stumpage or cut products—even within a relatively small region—emphasizes the fact that timber owners and operators should analyze the markets carefully before cutting trees.

Marketing service is available from Wisconsin Conservation Department district foresters who work in each county of the State. These foresters can be contacted directly or local county agencies, such as the county agricultural extension office, can refer landowners to these foresters if assistance is desired. No charge is made for the forestry service.

Wood-using industries of the State also provide helpful assistance. Many of these mills publish specification and price lists of their raw material needs. Cut products of various forms, sizes, and grades might be utilized depending upon

the product made. Timber owners and operators should be aware of the common mill practice of purchase through written contract.

Wood-using industry lists have been compiled and periodically revised for each county by the extension forestry office and the conservation department. A "primary" directory lists mills using cut products as raw material. A "secondary" directory lists mills using lumber or veneer for the fabrication of a finished product. These marketing aids are available from either the extension forestry office at the college of agriculture or from the Wisconsin Conservation Department, Madison 2.

T. A. PETERSON.

(Compiled in the extension forestry office, College of Agriculture, University of Wisconsin, district foresters of the Wisconsin Conservation Department, and the wood-using industries cooperating.)

EXHIBIT 3

[Budget Bureau No. 40-61146—Approval expires Mar. 31, 1962]

U.S. DEPARTMENT OF AGRICULTURE,
STATISTICAL REPORTING SERVICE,
Columbus, Ohio, November 16, 1961.

DEAR SIR: At the direction of the Congress of the United States the Department of Agriculture is preparing a statement to the Congress concerning the "practicability and feasibility of a timber price reporting service."

You have been receiving a copy of a report of this general type prepared in this State, a recent issue of which is enclosed. It would be very helpful and greatly appreciated if you will answer the questions below concerning the report you have been receiving.

Kindly return the completed questionnaire in the enclosed envelope which requires no stamp.

Sincerely yours,

J. R. KENDALL,
Agricultural Statistician in Charge.

1. Are you primarily interested in prices of timber products (stumpage, logs, and bolts) from the standpoint of:
(*a*) An owner or seller of timber or timber products ☐
(*b*) A buyer of timber or timber products ☐
(*c*) An adviser of timber owners ☐
(*d*) Other (specify) _____

2. Please indicate the product or products in which you are primarily interested:
(*a*) Stumpage _____
Species _____
(*b*) Cut products _____
(Name and species)

3. Does the report furnish any information not readily available to you from other sources? Yes ☐ No ☐
If "No," on what other sources do you depend for such information? _____

4. Please indicate what type of timber marketing information, if any, that is not now shown in the report would be useful to you.

5. In your experience do the price quotations published in the report reasonably represent prices actually being received by producers? Yes ☐ No ☐
If "no," please give examples _____

6. Other comments or suggestions _____

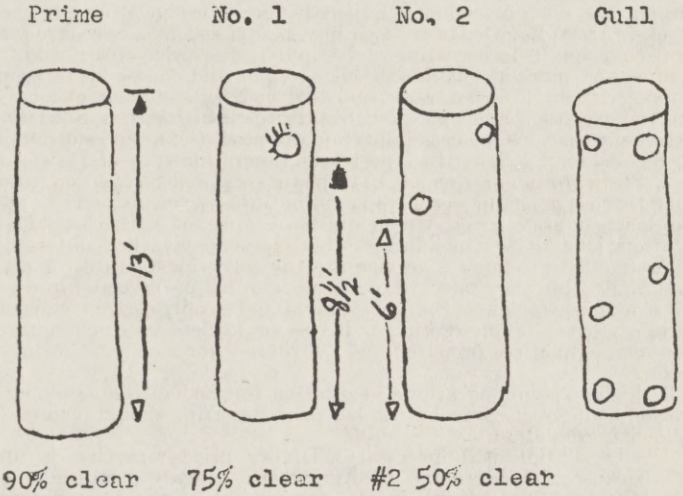
Name _____
City _____ State _____

EXHIBIT 4

NEWTON BOX & BASKET CO., NEWTON, ILL.

Log prices effective October 1, 1958

Species	Diameter	Prime logs	No. 1 logs	No. 2 logs
Cottonwood	16–20	$50	$40	$30
	20–32	60	50	40
Gum, maple, and birch	16–20	45	40	25
	20–32	55	50	35
Elm, hackberry, black gum, and sycamore	16–20	45	35	15
	20–32	50	40	25



Prime: Practically (90 percent) surface clear on three visible faces. (A face is any one-quarter of the surface of a log.) Must be 16 inches or more in diameter inside bark at the small end.

No. 1: At least three-fourths (75 percent) of the log length on the three visible faces must be surface clear in one section.

No. 2: At least one-half (50 percent) of the log length must be surface clear on the three visible faces.

Note.—

1. Please try to cut for 8½- and 13-foot logs.
2. Shakes and hollow logs are considered extra defects.
3. Catfaces are considered defects. Same as open-limb growth.
4. Worms not considered defects.
5. Under 16-inch diameter not considered veneer logs.
6. 32-inch diameter and up to be considered oversize and will be decreased in price.

EXHIBIT 5

AMERICAN PULPWOOD ASSOCIATION,
New York, N.Y., December 18, 1961.

Mr. B. R. STAUBER,
Chief, Agricultural Price Statistics Branch, Statistical Reporting Service, U.S. Department of Agriculture, Washington, D.C.

DEAR MR. STAUBER: We certainly appreciated the opportunity afforded Mr. Weir, Mr. Hammerle, and me to meet with you, Mr. Peterson of your office, and Mr. Josephson of the U.S. Forest Service, to discuss our industry's views with respect to a timber price reporting service, at your office on December 12. During our conversation, I promised to send you a statement outlining the position of the American Pulpwood Association on timber price reporting. It is as follows:

1. Price reporting in general: Information is presently available and reporting would add little if anything of value. Price and market information are not the sole possession of buyers of forest products but are the common stock in trade knowledge to both buyers and sellers. Sales are made under firm contracts before cutting and stipulate the price to be paid. Strongly competitive markets enable the seller to pick and choose his buyers. Speculators, without firm contracts, must of course take their chances but they are the exception and not the rule. Price reporting, unless qualified to the extreme variations in accessibility, quality and use, may result in loss of sales to the owner or overcutting and liquidation of forest assets.

2. State administration: If both buyers and sellers of forest products feel that a price reporting service is required, this service should be initiated at the local or State level. It should be established with the guidance of an advisory committee which includes both buyers and sellers of forest products. A prerequisite to such a service are the following features of a marketing program within the State: (a) a directory or list of buyers of forest products; (b) a periodic review of market demand and supply, price trends, and major price changes; (c) marketing bulletins or leaflets on good harvesting and marketing practices prepared and distributed for woodland owners and tree farmers.

3. Federal administration: Legislation for Federal Government administration or indirect control of timber price reporting should be opposed on the following grounds:

Legislation is unnecessary: Timber price reporting is unnecessary because the Secretary of Agriculture already has the authority to carry on this activity in the organic act of the Department of Agriculture of 1862, in the Research and Marketing Act of 1946, and in the McSweeney-McNary Forest Research Act of 1928. The Department of Agriculture issued stumpage and log prices annually from 1928 to 1948, when they were discounted for lack of any demonstrated need.

A duplication: A Federal price reporting system will only duplicate the many services already performed by State agencies, wood-using industries, and many other sources.

State or private responsibility: Prices of forest products, including forest stumpage, have local application only. Little interstate commerce is involved in the sale of primary forest products, and no interstate commerce is involved in stumpage sales. This in itself points to price reporting being a State or private responsibility.

Costly: It is estimated that enactment of this legislation will cost the Federal Government at least $500,000 a year, and at the same time be costly for farmers, woodland owners, and wood-using industries to complete the forms required while receiving no immediate or long-term benefits not now available.

Parity price calculations unwise: Calculation and use of parity prices for forest products, which may be one of the objectives of the proposal, will only tend eventually to create the same problems of overproduction, overcutting, and surpluses as they have for agricultural crops. Congress has already recognized that there is a difference between forest products which can be left standing on the stump a year or more longer, and farm products which must be harvested, sold or stored for future use when ripe.

While in your office we left with you copies of the booklet entitled "Marketing Information Available to Forest Owners." You will note that it has 230 references to sources of information on pricing and marketing services. We also left a copy of the reprint entitled "A Marketing Information Primer For Woodlot Owners." It gives the names and addresses of sources of information on marketing forest products in every State. These publications outline in detail more background material that leads us to the conclusions and policies we express to you on timber price reporting.

Again, let me say we appreciated the opportunity to confer with you on this subject.

Very truly yours,

W. S. BROMLEY, *Executive Secretary.*

EXHIBIT 6.—*Privately owned commercial forest land: Number of owners and acreage owned, by size of holding and section, United States and coastal Alaska, 1953*

Size of holding (acres)	Owners	Area	Proportion of commercial forest area	Average size of holding
	Number	*Thousand acres*	*Percent*	*Acres*
All sections:				
Less than 100 [1]	3,875,093	121,023	24.8	31
100–499	586,467	97,882	20.0	167
500–4,999	46,326	46,378	9.5	1,001
Total	4,507,886	265,283	54.3	59
5,000–49,999 [2]	2,330	34,669	7.1	14,879
50,000 and over [2]	283	58,317	11.9	206,067
Total	4,510,499	358,269	73.3	79
North:				
Less than 100 [1]	2,316,089	69,338	14.2	30
100–499	224,935	37,608	7.7	167
500–4,999	12,259	10,214	2.1	833
Total	2,553,283	117,160	24.0	46
5,000–49,999 [2]	563	8,279	1.7	14,705
50,000 and over [2]	75	16,176	3.3	215,680
Total	2,553,921	141,615	29.0	55
South:				
Less than 100 [1]	1,476,478	48,315	9.9	33
100–499	322,414	52,449	10.7	163
500–4,999	26,605	27,428	5.6	1,031
Total	1,825,497	128,192	26.2	70
5,000–49,999 [2]	1,367	20,140	4.1	14,733
50,000 and over [2]	156	28,277	5.8	181,263
Total	1,827,020	176,609	36.1	97
West and coastal Alaska:				
Less than 100 [1]	82,526	3,370	.7	41
100–499	39,118	7,825	1.6	200
500–4,999	7,462	8,736	1.8	1,171
Total [3]	129,106	19,931	4.1	154
5,000–49,999 [2]	409	6,400	1.3	15,648
50,000 and over [2]	62	13,714	2.8	221,194
Total	129,577	40,045	8.2	310

[1] Number of owners shown for holdings of 3–99 acres in the East and 10–99 acres in the West.
[2] Owners in a given size class on a sectional basis do not add to national totals because holdings of a given owner located in different regions were combined in determining number of owners on a national basis.
[3] Includes 286 owners in coastal Alaska.

Source: "Timber Resources for America's Future," U.S. Forest Service, Forest Resource Report No. 14, p. 293, January 1958.

EXHIBIT 7.—*Privately owned commercial forest land: number of owners and acreage owned, by type of owner and by States, 1953*

State	All private holdings		Farm		Forest industries		Other private	
	Thousand acres	Owners	Thousand acres	Owners	Thousand acres	Owners	Thousand acres	Owners
Alabama	19,790	169,821	8,114	131,057	3,138	1,522	8,538	37,242
Arizona	125	458	46	287	2	8	77	163
Arkansas	16,382	160,957	6,733	123,184	4,118	760	5,531	37,013
California	8,053	10,464	1,586	2,675	3,389	385	3,078	7,404
Colorado	1,613	4,333	994	2,168			619	2,165
Connecticut	1,818	45,719	526	11,096	3	108	1,289	34,515
Delaware	435	7,576	217	6,543	124	173	94	860
Florida	19,268	93,583	8,905	52,821	4,369	581	5,994	40,181
Georgia	22,287	196,665	15,854	172,314	4,246	1,434	2,187	22,917
Idaho	2,967	10,831	1,166	4,669	1,180	18	621	6,144
Illinois	3,712	131,101	3,050	116,467	10	633	652	14,001
Indiana	3,762	126,190	2,878	108,319	9	184	875	17,687
Iowa	2,463	34,738	2,321	31,078			142	3,660
Kansas	1,663	57,514	1,160	56,962			503	552
Kentucky	10,721	243,488	4,903	207,916	308	1,329	5,510	34,243
Louisiana	15,051	111,654	3,160	58,088	4,281	406	7,610	53,160
Maine	16,419	77,479	2,232	30,401	6,617	580	7,570	46,498
Maryland	2,683	39,544	1,169	29,695	57	4	1,457	9,845
Massachusetts	2,860	29,758	740	8,697	259	134	1,861	20,927
Michigan	12,462	174,422	3,877	126,642	1,447	208	7,138	47,572
Minnesota	7,940	140,562	4,881	101,298	578	375	2,481	38,889
Mississippi	14,722	133,394	6,958	100,712	2,602	594	5,162	32,088
Missouri	13,447	201,025	8,498	168,435	460	608	4,489	31,982
Montana	4,857	14,536	2,360	4,930	1,086	4	1,411	9,602
Nebraska	1,419	53,831	820	53,831			599	(1)
Nevada	77	180	11	40	13	11	53	129
New Hampshire	4,000	49,373	1,039	15,397	771	752	2,190	33,224
New Jersey	1,729	27,150	320	11,837	(2)	(2)	1,409	15,313
New Mexico	1,733	2,037	1,355	1,789	136	8	242	240
New York	11,107	254,942	3,473	167,731	1,172	1,196	6,462	86,015
North Carolina	17,393	267,056	13,590	222,110	2,584	1,959	1,219	42,987
North Dakota	255	8,500	182	8,500			73	(1)
Ohio	5,099	149,529	3,047	134,406	30	287	2,022	14,836
Oklahoma	5,548	82,033	2,240	52,154	944	15	2,364	29,864
Oregon	9,768	36,253	3,458	22,835	4,733	1,236	1,577	12,182
Pennsylvania	11,879	301,604	3,424	229,620	442	1,271	8,013	70,713
Rhode Island	404	12,330	79	2,846			325	9,484
South Carolina	10,975	116,215	7,530	103,438	1,696	732	1,749	12,045
South Dakota	596	17,963	523	17,786	6		67	177
Tennessee	11,129	185,133	6,126	160,174	1,088	302	3,915	24,657
Texas	11,536	119,707	3,125	81,389	3,123	2,629	5,288	35,689
Utah	392	748	343	551	5	6	44	191
Vermont	3,416	39,912	1,522	25,833	528	473	1,366	13,606
Virginia	13,768	211,187	8,848	149,316	1,334	1,271	3,586	60,600
Washington	9,806	47,667	1,886	22,574	4,147	743	3,773	24,350
West Virginia	8,878	133,571	3,197	97,906	270	282	5,411	35,383
Wisconsin	11,431	176,906	6,426	143,389	1,014	229	3,991	33,288
Wyoming	412	802	325	596	(2)	(2)	87	206
Coastal Alaska	19	286					19	286

[1] Number of owners not estimated because of insufficient sampling.
[2] Included with other private to avoid possible disclosure of individual ownership.

Source: "Timber Resources for America's Future," U.S. Forest Service, Forest Resource Rept. No. 14, pp. 508–509, January 1958.

EXHIBIT 8.—*Timber products as percentage of total output from roundwood, by region of origin, 1952* [1]

Region	Total output (excluding fuelwood)	Sawlogs	Pulpwood	Veneer logs and bolts	Cooperage logs and bolts	Posts	Poles	Piling	Hewn ties	Mine timbers	Other products [2]
	Mil. cu. ft.	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
New England	445	52	2	3	1	1	[3]	[3]			[3]
Middle Atlantic	418	62	20	2	[3]	4	[3]	1		8	2
Lake States	392	40	44	3	[3]	5	[3]	[3]		2	5
Central	270	66	3	3	6	11	[3]	[3]	[3]	7	3
South Atlantic	1,099	64	24	4	[3]	2	1	[3]	[3]	1	3
Southeast	1,867	56	31	3	2	2	2	[3]	2	[3]	1
West Gulf	896	58	25	3	1	3	3	1	4	[3]	2
Plains	34	25	2	3		69	[3]				1
Rocky Mountain	394	88	5	[3]		1	3	[3]		2	1
Pacific coast	3,265	81	9	7	[3]	[3]	[3]	[3]	[3]	[3]	2

[1] Output from roundwood is according to regions where the logs, bolts, and other round timbers cut from various products originated, and not necessarily where they were processed into lumber, veneer, pulp, or other manufactured products or used in round form as poles, piling, posts, etc.

[2] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and bolts for other such miscellaneous products.

[3] Less than 0.5 percent.

Source: U.S. Forest Service.

FIGURE 1

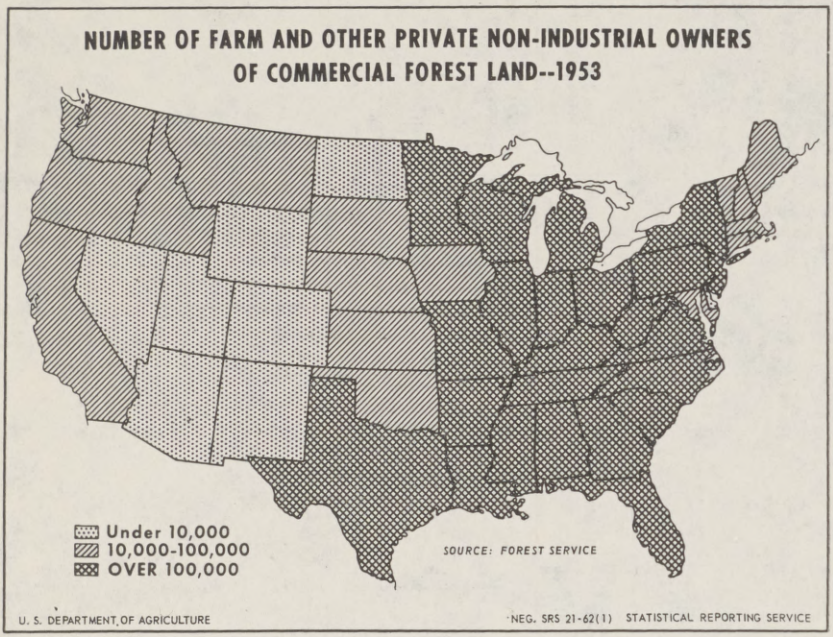
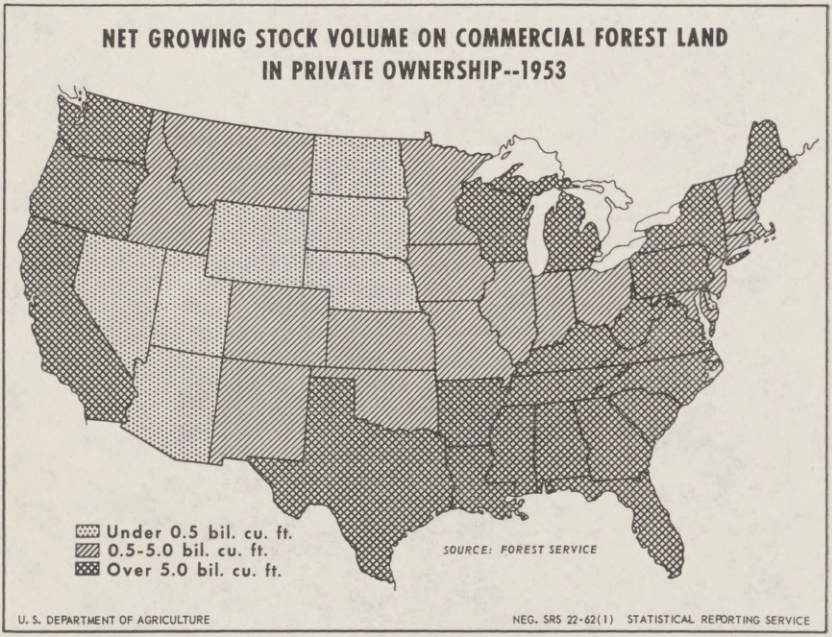


FIGURE 2



LIST OF WITNESSES

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