

ENGINEERING EXPERIMENT STATION
of the Georgia Institute of Technology
Atlanta, Georgia

FINAL REPORT

PROJECT NO. 177-170

SURVEY OF THE NEEDS OF INDUSTRY
FOR
RAW MATERIALS FROM NEW PLANTS
TO BE
GROWN IN THE UNITED STATES

By

H. H. SINEATH

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CONTRACT NO. A-1S-33685

DIVISION OF PLANT EXPLORATION AND INTRODUCTION
BUREAU OF PLANT INDUSTRY
UNITED STATES DEPARTMENT OF AGRICULTURE

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JUNE 15, 1953

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This Report Contains 12 Pages

I. INTRODUCTION

Through the Research and Marketing Act of 1946, the Bureau of Plant Industry activated in 1947 a national program for the introduction and investigation of new plants of potential value to United States agriculture. Plants which might be utilized by chemical and manufacturing industries were given special emphasis, since diversification of crops might place agriculture in this country in a better economic position. The Georgia Institute of Technology was requested to make a survey of the needs of industry for raw materials from plant sources by C. O. Erlanson, Head of the Division of Plant Exploration and Introduction. The purpose of the survey was to present a comprehensive picture of the raw material needs of industry which could be used as a guide in the search for plants of potential economic value. The survey was designed for two years' study. The first year's work was under Contract No. A-1S-33022; the primary objectives under the contract were:

1. A review of the literature to determine the recognized needs which have been published.
2. Direct contact with industry to get first-hand information of industrial raw material needs.
3. After needs had been established, to determine
 - a. How much was needed,
 - b. The price that could be expected for the material, and
 - c. The effect of price on the volume needed for use.

The program designed to accomplish the stated objectives was as follows:

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1. A literature survey, compiling the needs which had been published.
2. Contacts through industrial associations.
 - a. Correspondence with, and visits to, executive secretaries of groups of such as American Drug Manufacturers Association, Plastic Materials Manufacturers Association, etc., relative to needs.
 - b. Attendance of meetings of cooperating groups to contact leaders.
 - c. Listing of best companies for detailed contacts from recommendations from a and b.
3. Contacts with research institutes, universities doing industrial research, and government laboratories.
 - a. Correspondence.
 - b. Visits to discuss needs that have been recognized.
4. Organization of general information obtained in 2 and 3 in order to select obviously promising leads with chances of early results.
5. Visits to outstanding companies in each industry, with special attention to leads from 4.
 - a. Talks with technical men concerning recognized needs.
 - b. Talks with sales development groups concerning possible new products from new plants.
6. Summary of findings in a report, including recommendations for additional work.

Based on the findings of this program the second year's work under Contract No. A-15-33685 was outlined to include:

1. An extension of the literature survey covering past and current publications.

2. The publication of at least two informational summaries, preferably in bulletin form, based on current literature concerning industrial raw material needs.

3. Market surveys on at least three individual items selected for more detailed study.

This report is intended as a general summary of the work done on this two-year program. Detailed information is not given, but references are made to previous reports submitted under Contract No. A-1S-33022 and A-1S-33685.

II. PROCEDURE AND RESULTS

During the first year of the program a review of the literature was conducted to determine recognized or published needs for raw materials from plant sources. A secondary object was to locate published information indicating new crops that might have economic value.

Periodicals were selected from a compiled list of publications that were likely to contain pertinent information, and a general scanning survey was made which covered the period from January, 1946, through December, 1951. Numerous needs and various potential sources for raw materials were revealed.

A detailed discussion of this work was presented in Phase Report No. 2, dated January 18, 1952, under Contract No. A-1S-33022.

The scanning survey was extended during the second year to include the periods 1930-45 and 1952. The list of publications covered in the previous year was modified when necessary in order to give a

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comprehensive coverage of the literature. Additional needs and new raw material sources were disclosed and several new technological developments were reported; these results are presented in detail in Phase Report No. 1, dated December 18, 1952, under Contract No. A-1S-33685.

As an outgrowth of the current literature survey covering the year 1952, two bulletins were published concerning recent developments in plant-derived industrial raw materials. These reports are official publications of the Engineering Experiment Station, Georgia Institute of Technology, and are listed as Bulletins No. 13 and No. 15. These Bulletins were distributed to representatives of industrial concerns, research institutes, governmental organizations, and interested individuals; copies of these publications are included in the Appendix of Phase Report No. 2, dated March 1, 1953, under Contract No. A-1S-33685.

Although not an objective of the program (but in accordance with the policy of the Engineering Experiment Station) an informational summary of the work carried out under Contract A-1S-33022 was published in the March, 1952, issue of the Research Engineer.

The preliminary survey of industry was initiated during the first year by directing correspondence to 253 national industrial associations, university research organizations, research institutes, and governmental laboratories. The answers received from this correspondence (a 60 per cent return) led to personal interviews with representatives of various organizations. From these contacts, both written and personal, 67 needs for raw material and 47 industrial organizations as possible sources of information were suggested. This information is presented in detail in Phase Report No. 1, dated July 16, 1951 (Contract No. A-1S-33022).

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After reviewing the information presented in Phase Report No. 1, the 47 companies recommended for contact were classified in one of the following groups according to the raw material they use:

1. Oils
2. Fibers
3. Drugs and Pharmaceuticals
4. Waxes, Gums, and Resins
5. Miscellaneous Materials

Also classified in these groups were 711 additional companies which were selected on the basis of their use of raw materials which have been reported as needs. Individual letters were written to all 758 of these companies; answers were received from 454. Personal interviews were conducted with representatives of 37 companies. From both written and personal contacts, 189 raw material needs were suggested. Forty-nine of these needs were considered significant and were discussed in Phase Report No. 3, dated January 22, 1952 (Contract No. A-1S-33022). Volume and price statistics were compiled when available, and estimates were given of the volume needed and the price per unit that could be expected.

In addition to these needs, 23 potential raw material sources were suggested and 13 companies offered their services as evaluation agencies for new material disclosed in their general field of interest.

The work under Contract No. A-1S-33022 was summarized in a Final Report dated March 1, 1952. Included were conclusions and recommendations based on the information obtained from the survey during the period February 12, 1951-February 12, 1952.

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After considering the conclusions and recommendations from the Final Report under Contract No. A-1S-33022, three plants were selected for more detailed study. Extensive literature reviews and market surveys were made on bamboos, candelilla, and Simmondsia. The programs were arranged to obtain as much information as possible concerning the history and growth characteristics of each of the plants, and the past, present, and future market potentials of the established and possible future products derived from them.

In the literature surveys on these plants extensive use was made of standard indexes and other secondary sources to locate the pertinent publications; the resulting bibliographies are believed to be the most comprehensive compiled to date on these subjects.

The market surveys were initiated by correspondence with organizations which were known or which could be assumed to have an interest in the selected plants or products from them; included in this list were representatives of experiment stations, government laboratories, research institutes, industrial associations, and industrial concerns. Individuals who were interested in the plants or their products were contacted, also, when their names were encountered either through correspondence or the literature. Additional correspondence was required in some cases, and personal interviews were arranged in instances where it appeared that they would be desirable.

The details of the literature and market surveys on the bamboos, candelilla, and Simmondsia are presented in Phase Report No. 3, dated June 5, 1953, under Contract No. A-1S-33685. In general, information on past uses and possible future market potentials and crop production

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are presented for each plant. Also included are discussions of possible future experimental programs for the plants, as well as suggestions for future informational programs. It is believed that the material contained in Phase Report No. 3 (Contract No. A-LS-33685) on the bamboos, candelilla, and Simmondsia represents the most extensive coverage of information on these subjects to date. The data it contains should serve as a valuable guide and detailed reference for future investigators interested in the development of these plants.

During the course of the work under Contract No. A-LS-33685 recommendations have been made concerning future experimental studies on the bamboos. Specifically, fiber length, pulping, and physical properties studies have been suggested. These recommendations were considered by the United States Department of Agriculture for proposed contracts to be conducted at the Herty Foundation, Savannah, Georgia, and Clemson College, South Carolina.

III. CONCLUSIONS AND RECOMMENDATIONS

After reviewing the results of the two-year program as outlined previously, it is believed that the methods employed were satisfactory for obtaining the desired information. Personal contacts were particularly valuable since individuals gave detailed information verbally that they declined to disclose by correspondence. In general, the organizations and individuals contacted were cooperative, but difficulties were encountered in a few instances in that representatives of some organizations were limited by company policy in the amount of information that they could make available to the researchers. This situation usually occurs when one attempts to obtain confidential figures, the release of which could conceivably cause economic repercussions for the company involved. Various market survey techniques were employed when applicable to circumvent the situations, and it is believed that the reported data represent a comprehensive coverage of the information available on the various subjects studied. The methods employed for the survey should be useful as a guide in subsequent studies of this type.

The literature survey reported in Phase Reports Nos. 1 and 2, under Contract Nos. A-1S-33685 and A-1S-33022, respectively, represents an extensive coverage of the literature on industrial raw materials of plant origin covering the period 1930-52. It is believed that further examination of the literature previous to 1930 would reveal little significant information.

Based on the comments received, the bulletins published on the current literature (1952) were well-received and are considered as

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useful summaries of recent developments in their respective fields. Future examinations of current literature, with periodic publication of appropriate summaries, should be of considerable value, especially in view of the present strained international conditions.

In the Final Report (dated March, 1952) under Contract No. A-1S-33022 a list of raw material items was given for which the preliminary survey had revealed enough information to permit considering them for more detailed study. These items are:

Chia or perilla oils,
Sesame oil,
Simmondsia oil,
Bamboo,
Khellin,
Candelilla wax, and
Pyrethrum.

As previously noted, industrial surveys of bamboo, candelilla, and Simmondsia have been conducted; these surveys are included in Phase Report No. 3 (Contract No. A-1S-33685). Similar surveys on the other raw material items in the list above should be of value in view of the industrial need for such items and the possible use of the plants from which they are derived for crop diversification in the United States.

One situation encountered in the industrial surveys on bamboo, candelilla, and Simmondsia is that industry has been unaware of the potentialities of these plants and their products. This fact suggests that informational programs should be expanded. Therefore, the publication of results obtained from the industrial surveys conducted is

planned. These publications will be technical bulletins from the Engineering Experiment Station of the Georgia Institute of Technology and will be distributed to representatives of industrial concerns and other interested organizations. It might be advisable to publish parts of this information in some form of popular media.

The results of the industrial surveys on bamboo, candelilla, and Simmondsia have indicated that they have potentials as domestic crops for supplying certain needs of industry. However, before these sources can be developed, some additional information concerning the economics and technology of their production and utilization must be determined. These factors should be determinable through suitable experimental programs, and the potentials appear to be of sufficient magnitude to warrant such investigations.

The studies recommended for these plants are outlined as follows:

1. Studies should be conducted on experimental plantings of candelilla to determine
 - a. The proper species and the optimum growing conditions for producing plants of commercial value.
 - b. Production cost, including planting, cultivation, and irrigation.
 - c. Yields per acre.
 - d. Proper harvesting methods, including development studies of harvesting machinery.
2. Methods of processing, handling, and marketing procedures of candelilla and its products should be studied in an attempt to
 - a. Improve quality.
 - b. Decrease costs.
 - c. Improve percentage recovery.

3. Investigations should be undertaken with experimental plantings of Simmondsia of sufficient size to determine

- a. The optimum growing conditions and methods for producing Simmondsia seed.
- b. Production costs, including planting, care, and irrigation.
- c. Yields per acre and methods for improving yields.
- d. Harvesting methods, including development studies of harvesting machinery.

4. Studies on processing and handling Simmondsia should include

- a. Methods and economics of storage and shipment.
- b. Optimum process for oil extraction.
- c. Investigation on hydrogenation of Simmondsia oil.
- d. Investigations of other chemical derivatives and byproducts from Simmondsia.

5. The physical properties of various species of bamboo should be studied to disclose the optimum curing and processing methods for each end use. This research should include fiber length determinations.

6. Different species of bamboo should be planted in quantities large enough to permit the determination of

- a. The optimum methods of production, including techniques for efficient plantings, and techniques and machinery for harvesting and shipping.
- b. The optimum methods of pulping bamboo for various uses.

After such programs have been completed, correlation of the data obtained should indicate the feasibility of producing these plants as

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crops for industrial use. If their production and industrial use were found to be economically feasible, these plants would then be useful in crop diversification and could provide a means for increasing the productivity of large areas of land in the United States.