



THE NEW YORK BOTANICAL GARDEN



Springer

A Survey of College Courses of Economic Botany

Author(s): Harriette V. Bartoo

Source: *Economic Botany*, Vol. 18, No. 4 (Oct. - Dec., 1964), pp. 291-310

Published by: Springer on behalf of New York Botanical Garden Press

Stable URL: <http://www.jstor.org/stable/4252540>

Accessed: 13/08/2010 09:49

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=nybg>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



New York Botanical Garden Press and Springer are collaborating with JSTOR to digitize, preserve and extend access to *Economic Botany*.

<http://www.jstor.org>

A Survey of College Courses of Economic Botany¹

HARRIETTE V. BARTOO²

Introduction

The term "economic" as seen in the headlines of the newspaper and magazine articles today (1) has such a popular appeal to the general public that it seems to be an appropriate time to examine more closely the courses entitled *Economic Botany* which have been in the biological curricula of American universities for over three-quarters of a century.

The problems involved in such a subject are universal in appeal and boundless in scope and importance. In the last few years, in fact, it has come to rival in popularity the biological aspects of the "population explosion." In view of the expanding program of modernization which is going on in many of the biological curricula of colleges and universities today, it is refreshing to find a major area of learning which is capable of adjusting its content to meet the challenge of some of the newer concepts and problems of life as easily as this one does. Education continues to be an important factor in feeding the world today (2, 3).

In its popular use, the term "economic" has been applied quite commonly today to world problems from food to finances and, in its application to the field of biology, it may refer to sundry areas of human interest from the salmon industry of Alaska to the spice market of Zanzibar. In its restrictive use as applied to Economic Botany, it may pertain to the seeming inexhaustible food

supply available in the ocean depths or to that which should be included in an astronaut's trip into outer space to assure his survival.

In 1948, Fosberg (4) outlined in the opening article of the journal *Economic Botany* topics which he considered as basic information essential to work on any species or plant group to be studied in the field of classical Economic Botany. And he remarked that, without the fundamental information provided by the study of Economic Botany, the more modern and specialized branches of biology cannot exist as fields of science.

This is certainly putting its importance on a high level, and while fifteen years have gone by since this article was written, much of the substance of it is still true today, although the stress has been more toward the chemistry and the ultramicroscopic nature of the plant products than was true in 1948.

The present study was prompted by an effort to obtain a list of those schools of the country which offer such a course. Since its inception, however, it has come to have the additional function of getting information about the past history of these courses and also that of forecasting, on the basis of this information, their future development.

The list of 135 schools and colleges of higher learning used as a basis for this study was derived from an examination of the more than 1150 college catalogues on file at the Dwight B. Waldo Library of Western Michigan University during the spring and fall semesters of 1962 and the spring of 1963. This method of selection is not infallible, first, because the catalogues of some schools may easily have been absent or overlooked at the time of compilation, since they were on open shelves, and others may have been using them at the time; and, secondly, because some school catalogues have been misplaced and are entirely lacking from the

¹ Preliminary report presented at the Fourth Annual Meeting, Society for Economic Botany, Madison, Wisconsin, April 20, 1963. Publication financed in part by grant from the Faculty Research Fund, Western Michigan University.

² Professor of Biology, Western Michigan University, Kalamazoo, Michigan.

Received for publication July 3, 1964.

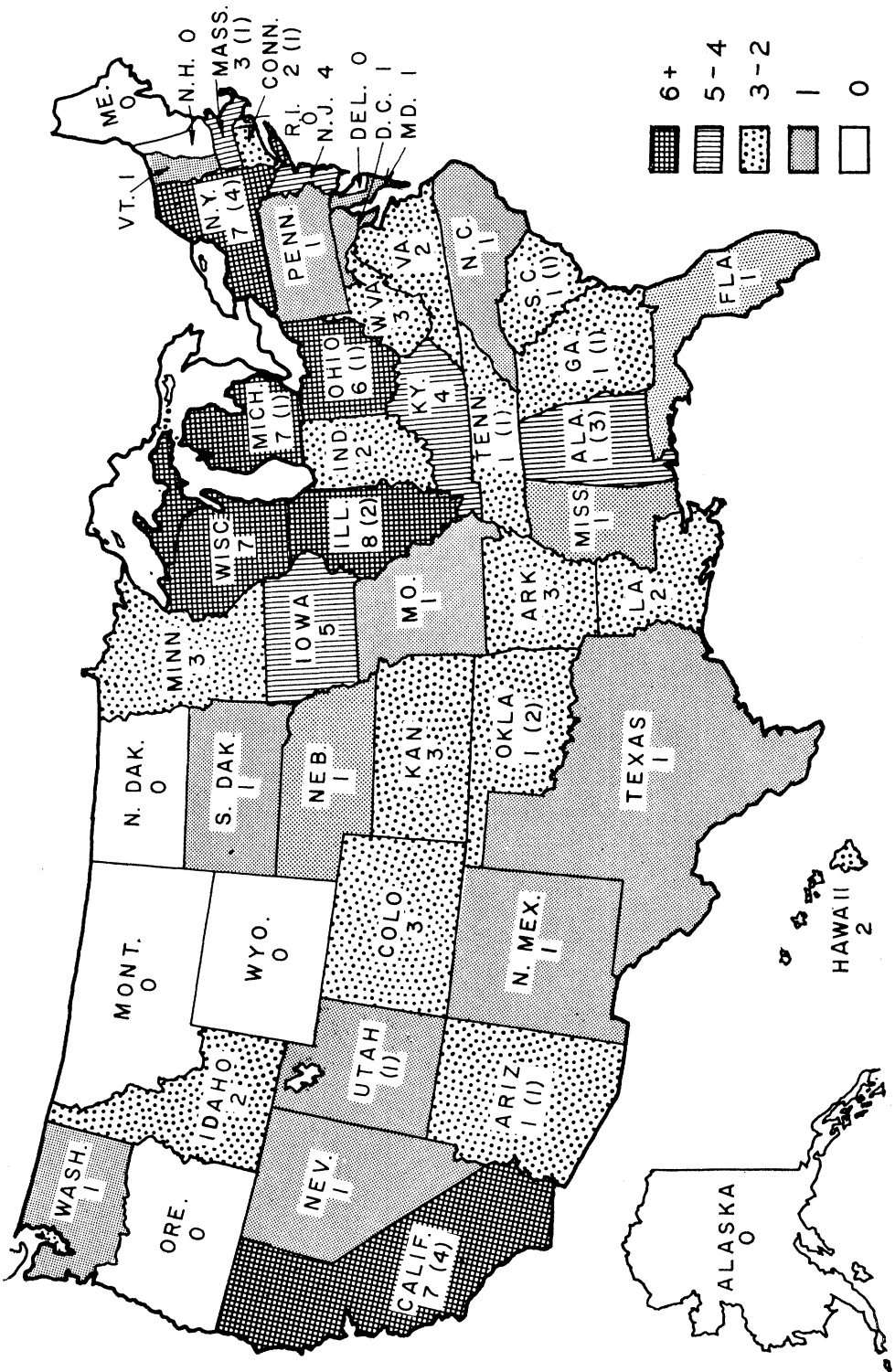


Fig. 1. Distribution by states of total number of courses in Economic Botany or related courses offered in colleges and universities of the United States, according to recent catalogues (numbers in parentheses indicate related courses).

collection. But the resulting list still indicates a fair sampling of a majority of the colleges and universities of higher learning in the United States, listing a course relating either directly or indirectly to Economic Botany in their curricula at the time of the survey.

Criteria for Selection of Schools

Three criteria were used in selecting the schools used in the survey. 1) Title of Course: Such titles as *Economic Botany*, *Economic Plants*, *Plants For Man* or *Plants Used by Man* fell automatically into the list to be surveyed as dealing entirely with the subject of Economic Botany. 2) Catalogue description of the course: Such courses as *Plants and Man* and *Economic Biology* were carefully scrutinized for indication as to content. 3) The return of a questionnaire (see p.) usually giving complete information as to whether or not Economic Botany was involved in its content and to what extent it was involved, the text, or references used in the course, provided definitive data allowing the inclusion of the course under the category "completely" Economic Botany or only as a "related" course. Often this distinction was made directly by the person returning the questionnaire.

On the basis of these three criteria, a course was included under one of two categories: a) dealing *entirely* with Economic Botany in content; or b) dealing *partly* with subject matter of plants of economic importance and in which Economic Botany played only a minor role sharing with other biological topics, as in courses listed as Economic Biology. Courses in this category are indicated by the use of a (parenthesis) in the listing.

The geographic distribution of these schools is shown on the map in Fig. 1, with the states of California, Illinois, Michigan, New York, Ohio, Wisconsin and Iowa having the largest numbers of courses and representing together almost half the total number of courses being offered. Seven states—Alaska, Maine, Montana, New Hampshire, North Dakota, Oregon and Wyoming—show no evidence of such courses on their record.

Technical schools giving courses primarily in pharmacy, pharmaceuticals, paper technology, wood pulp products, agriculture or

veterinary medicine³ are not included, although it is recognized that many of them offer courses of botanical content relating to their particular fields and certainly they are to be recognized as schools whose contribution to Economic Botany is highly valuable. Not many such catalogues were available in the file with which we were working. This circumstance, together with the fact that they represent very highly specialized courses not available to the general run of college students, led to their omission.

Questionnaire Returns

A prepared questionnaire was sent to each of the 135 schools on the list in the spring of the year 1963 asking for definite information with regard to the coursework they were offering.

The questions asked and the replies given are briefly tabulated here with summarizing comments of my own in each case.

1. How many class meetings are there a week? —lectures? —laboratories? —or field trips? How much credit is given for the class?

Classes meet generally for 2 or 3 lecture sessions per week during the school year (5 daily periods during the summer school sessions). The following variations were listed by those answering the question:

5 meet 4 times per week
 52 meet 3 times per week
 30 meet 2 times per week
 4 meet 1 time per week (2½-to 3-hr period)

Lectures are supplemented by laboratory work or demonstration periods in more than half of these courses, whereas only about a third used field trips to nearby museums or industrial organizations whose primary concern are with manufacturing of plant products of one sort or another.

³ According to Pattersen's "Directory of Educational Institutions" for 1962, there are 77 Schools of Pharmacy, 27 Schools of Forestry, 88 Schools of Agriculture and 17 in Veterinary Medicine which, if added to the number of schools used in our survey, would increase the number of schools to something over 300 which deal in some measure with courses involving plants or plant material of economic use to man or animals in daily living.

COURSES LISTED IN RECENT CATALOGUES BY SCHOOLS
WHOSE QUESTIONNAIRE RETURNS WERE USED IN THIS SURVEY

(Courses in parenthesis are treated as *related* course, i.e., those which deal only *in part* with Economic Botany)

0 indicates that the course has been discontinued according to questionnaire returns

0 + status changed as indicated in questionnaire returns

<i>Alabama</i>	1—Econ. Bot; 3(related) (2438 Taxonomy of Cult. Plants—3 hrs) (352 Economic Biology—3 hrs) Plants and man—2 hrs (311 Poisonous Plants, Agr. Weeds— 3 hrs)	17 catalogues examined Alabama A & M College Florence State College University of Alabama Tuskegee Institute
<i>Arizona</i>	1—Econ. Bot; 1(related) (F341 Wood Anatomy and Ident.—3 hrs) Bo301 Economic Botany—3 hrs	6 catalogues examined Arizona State College, Flagstaff Arizona State University, Tempe
<i>Arkansas</i>	3—Econ. Bot; 403 Economic Botany—3 hrs 330G Economic Botany—3 hrs 2903 Economic Botany—3 hrs	12 catalogues examined Arizona State College, State College Henderson State College, Arkadelphia University of Arkansas, Fayetteville
<i>California</i>	8—Econ. Bot; 3(related) (201 Evolution of Cult. Plants—3 hrs) 0 (165 Economic Bacteriology—4 hrs) (185 Biology and Human Affairs —3 hrs) 0 + 141 Botany of Econ. Plants—3 hrs 0 16 Economic Botany—3 hrs 123 Economic Plants—3 hrs 366 Economic Plants—3 hrs 0 + 129 Economic Botany—4 hrs 106 Botany of Economic Plants—3 hrs 104 Plants and Man—3 hrs 0 Economic Botany	80 catalogues examined Claremont College, Claremont Fresno State College, Fresno Long Beach State Coll., Long Beach Mills College, Oakland, 13 College of the Pacific, Stockton San Francisco State College San Fernando Valley State College, Northridge University of Redlands, Redlands Long Beach State College Univ. of California, Santa Barbara Univ. of S. California, Los Angeles
<i>Colorado</i>	3—Econ. Bot. 220—Economic Botany—2 hrs B16 Economic Botany—3 hrs 208ab Economic Botany—3 hrs	15 catalogues examined Colorado State College, Greeley Colo. State University, Ft. Collins Adams State Coll. of Colo., Alamosa
<i>Connecticut</i>	2—Econ. Bot; 1(related) (539 Economic Biology—3 hrs) 210 Plants and Man—3 hrs 0 101 Economic Botany—2 hrs	20 catalogues examined So. Conn. State College, New Haven University of Connecticut, Storrs Yale Graduate School, New Haven
<i>Florida</i>	1—Econ. Bot. 250 Economic Botany—3 hrs	9 catalogues examined University of Florida, Gainesville
<i>Georgia</i>	1—Econ. Bot; 1(related) *390 Economic Botany (110— (111 Plant Biology and Man)	29 catalogues examined Georgia State College, Atlanta University of Georgia, Athens
<i>Hawaii</i>	2—Econ. Bot. 105—Economic Plants of Hawaii—2 hrs 110—Plants and Man—2 hrs	3 catalogues examined University of Hawaii, Honolulu University of Hawaii, Honolulu
<i>Idaho</i>	2—Econ. Botany 78 Economic Botany—2 hrs G-415— 416 Economic Plants—3 hrs	2 catalogues examined University of Idaho, Moscow Idaho State College, Pocatello
<i>Illinois</i>	8—Econ. Bot; 2(related) 426 Economic Botany—2 or 3 hrs 232 Economic Botany—4 qtr hrs 321 Economic Botany—2 or 3 hrs	60 catalogues examined Carthage College, Carthage Eastern Illinois Univ., Charleston McKendree College, Lebanon

*did not reply

COURSES—(Continued)

	431—Economic Botany—4 qtr hrs	Western Illinois University, Macomb
0	116 Economic Botany—3 hrs	University of Illinois, Urbana
0 +	(114 Economic Biology—4 sem. hrs)	Illinois State Normal Univ., Normal
0 +	336 Economic Botany—2 hrs	Northern Illinois University, Dekalb
	350 Plants in Relation to Man—4 hrs	Southern Illinois Univ., Carbondale
	323 Food Plant Products—3 hrs	Wheaton College, Wheaton
	(202 Economic Biology)	Principia College, Elsau
<i>Indiana</i>	2—Econ. Bot.	32 catalogues examined
	B368 Economic Botany—3 hrs	Indiana University, Bloomington
	333 Economic Botany—4 hrs	Marion College, Marion
<i>Iowa</i>	5—Econ. Bot.	26 catalogues examined
	36 Economic Botany—2 hrs	Briar Cliff College, Sioux City
	304 Botany of Economic Plants—3 hrs alternates with Food Plants	Iowa State University, Ames
	305 Botany of Economic Plants—3 hrs everything else	Iowa State University, Ames
	322 Economic Botany—4 hrs	Upper Iowa University, Fayette
0	364 Economic Botany—3 hrs	Westmar College, Le Mars
<i>Kansas</i>	3—Econ. Bot.	24 catalogues examined
	208 Economic Botany—3 hrs	Ottawa University, Ottawa
0 +	5 Economic Botany—2 hrs	University of Kansas, Lawrence
0	302 Economic Botany—3 hrs	Washburn University, Topeka
<i>Kentucky</i>	4—Econ. Bot.	20 catalogues examined
	433 Economic Plants—3 hrs	Eastern Kentucky State, Richmond
0	456 Economic Botany—2 hrs	Nazareth College, Louisville
	351 Economic Botany—3 hrs	University of Louisville, Louisville
	205 Economic Botany—3 hrs	Western Ky. State College, Bowling Green
<i>Louisiana</i>	2—Econ. Bot.	16 catalogues examined
	640 Economic Botany—3 hrs	Louisiana Polytechnic Inst., Ruston
	306 Economic Botany—3 hrs	Univ. of S.W. Louisiana, Lafayette
<i>Maryland</i>	1—Econ. Bot.	12 catalogues examined
	329 Economic Botany—3 hrs	The State Teachers College at Towson, Maryland, Baltimore 4
<i>Massachusetts</i>	3—Econ. Bot.; 1 (related)	40 catalogues examined
0	22a Economic Botany—3 hrs	Smith College, Northampton
0	207 Plant Resources—3 hrs	Wellesley College, Wellesley
	104 Plants and Human Affairs— $\frac{1}{2}$ course	Harvard University, Cambridge
	(206 Origin and Evolution of Cultivated Plants— $\frac{1}{2}$ course)	Harvard University, Cambridge
<i>Michigan</i>	7—Econ. Bot.; 1 (related)	30 catalogues examined
	215 Economic Botany—3 hrs	Eastern Michigan, Ypsilanti
	540 Plant Products in Industry—2 hrs	Eastern Michigan, Ypsilanti
	(103 Plants and Man Today—4 hrs)	University of Michigan, Ann Arbor
	336 Economic Botany—3 hrs	Mich. State Univ., East Lansing
	207 Economic Botany—3 hrs	Albion College, Albion
	225 Economic Botany—3 hrs	Mich. College of Mining & Tech., Houghton
	523 Economic Botany—3 hrs	Western Mich. Univ., Kalamazoo
	394 Economic Botany—3 hrs	Central Mich. Univ., Mt. Pleasant
<i>Minnesota</i>	3—Econ. Bot.	22 catalogues examined
	171 Plants and Man—3 hrs	Bethel College, St. Paul
	201 Economic Botany—4 qtr hrs	Mankato State College, Mankato
	12W Plants Useful to Man—4 qtr hrs	Univ. of Minnesota, Minneapolis
<i>Mississippi</i>	1—Econ. Bot.	15 catalogues examined
	214 Economic Botany—4 qtr hrs	Univ. of S. Mississippi, Hattiesburg
<i>Missouri</i>	1—Econ. Bot.	32 catalogues examined
	BI-220 Economic Botany—3 hrs	Harris Teachers College, St. Louis
<i>Nebraska</i>	1—Econ. Bot.	14 catalogues examined
0 +	176 Economic Botany—2 or 3 hrs	Duchesne Coll. of the Sacred Heart, Omaha

COURSES—(Continued)

<i>Nevada</i>	1—Econ. Bot. 207 Economic Botany—2 hrs	1 catalogue examined University of Nevada, Las Vegas
<i>New Jersey</i>	4—Econ. Bot. 130:207 Economic Botany—3 hrs 413 Economic Botany—2 hrs 510 Anatomy of Econ. Plants—3 hrs 207 Economic Botany—3 hrs	24 catalogues examined Douglas College, Rutgers, The State University, New Brunswick Montclair State College, Montclair Rutgers, The State University, New Brunswick Rutgers, The State University, Newark
<i>New Mexico</i>	1—Econ. Bot. 177 Economic Botany—3 hrs	9 catalogues examined The Univ. of N. Mex., Albuquerque
<i>New York</i>	7—Econ. Bot.; 4(related) 304 Economic Botany— Biol. 43 Economic Botany—2 hrs B1.21 Economic Botany—2 hrs Bot. 7 Plant Resources—3 hrs Se 682 Economic Botany—3 hrs 112G Economic Botany—3 hrs (1002y Evolution and Utilization of Plants—3 hrs) Plants and Man—1 hr (412 Economic Biology—2 or 3 hrs) (1701 Economic Biology—3 hrs) * (Biol 200 Economic Biology)	96 catalogues examined Colgate University, Hamilton State Univ. of N. Y. Harper College Binghamton State Univ. of N. Y. College of Educ., Albany Barnard College, Columbia Univ. State Univ. of N. Y. College of Educ., Oneonta, N. Y. Syracuse Univ. of Liberal Arts School of General Studies, Columbia University, N. Y. 27 Hunter Coll. of Arts and Sciences of the City of N. Y. State Coll. Univ. of New York, Coll. of Educ. at Plattsburg, N. Y. State Univ. of N. Y., College of Education, Geneseo State Univ. of N. Y. College of Educ., Brockport
<i>North Carolina</i>	1—Econ. Bot. 44 Economic Botany—3 hrs	30 catalogues examined U. of North Carolina, Chapel Hill
<i>Ohio</i>	6—Econ. Bot.; 1(related) 0 B211 Economic Botany—3 hrs 377 Economic Botany—3 qtr hrs 0 231 Economic Botany—3 hrs 619 Economic Botany—5 hrs 404 Economic Botany—3 hrs 209 Plants and World Affairs—3 hrs (Economic Biology—2 hrs)	48 catalogues examined Bluffton College, Bluffton Kent State University, Kent Miami University, Oxford Ohio State University, Columbus Our Lady of Cincinnati, Edgemoor Walnut Hills, Cincinnati Marietta College, Marietta Bowling Green Univ., Bowling Green
<i>Oklahoma</i>	1—Econ. Bot.; 2(related) 0 244 Economic Botany—4 hrs (453 Economic Biology—3 hrs) 0 + (453 Economic Biology—)	14 catalogues examined University of Tulsa, Tulsa Northeastern State Coll., Tahlequah Northwestern State College, Alva
<i>Pennsylvania</i>	1—Econ. Bot. 233 Economic Botany—3 hrs	80 catalogues examined Bucknell University, Lewisburg
<i>South Carolina</i>	1—Econ. Bot.; 1(related) Bot. 402 Economic Botany—3 hrs (309 Economic Biology—3 hrs)	15 catalogues examined Clemson College, Clemson Furman University, Greenville
<i>South Dakota</i>	1—Econ. Bot. 0 302-502 Economic Botany—3 hrs	12 catalogues examined Black Hills Teachers Coll., Spearfish
<i>Tennessee</i>	1—Econ. Bot.; 1(related) 221 Economic Botany (514 Economic Biology—3 hrs)	30 catalogues examined Vanderbilt University, Nashville Middle Tenn. State College Murfreesboro
<i>Texas</i>	1—Econ. Bot. 473 Economic Botany—3 hrs	50 catalogues examined Sam Houston State Teachers College, Huntsville, Texas

*did not reply

COURSES—(Continued)

<i>Utah</i>	0—Econ. Bot; 1 (related) (104 Evolution of Cultivated Plants— 3 qtr hrs)	10 catalogues examined Utah State University, Logan
<i>Vermont</i>	1—Econ. Bot. 101 Economic Botany—3 hrs	12 catalogues examined University of Vermont, Burlington
<i>Virginia</i>	2—Econ. Bot. 0 + 105 Economic Botany—3 hrs 210 Economic Botany—3 hrs	22 catalogues examined Univ. of Virginia, Charlottesville The College of William and Mary in Virginia, Williamsburg
<i>Washington</i>	1—Econ. Bot. 250 Economic Botany—3 hrs	14 catalogues examined Central Washington Coll., Ellensburg
<i>West Virginia</i>	3—Econ. Bot. 405 Economic Botany—2-3 hrs 305 Economic Botany—3 hrs 218 Economic Botany—3 hrs	13 catalogues examined Concord College, Athens, W. Va. Marshall Univ., Huntington, W. Va. West Va. University, Morgantown
<i>Wisconsin</i>	7—Econ. Bot. 162 Economic Botany—2 hrs 96 Economic Botany—3 hrs 0 211 Economic Botany—2 hrs 24 Plants for Man—2 hrs 145 Economic Botany—3 hrs 126 Economic Botany—3 hrs 117 Structure of Economic Plants— 3 hrs	32 catalogues examined Wisconsin State College, Platteville St. Norbert College, West de Pere Milwaukee Downer Coll., Milwaukee University of Wisconsin, Milwaukee Wisconsin State College, Superior Wisconsin State College, Eau Claire Graduate School of University of Wisconsin, Madison
<i>Wash., D. C.</i>	1—Econ. Bot. 0 526 Economic Botany—3 hrs	15 catalogues examined The Catholic University of America

The states of Alaska, Delaware, Maine, Montana, New Hampshire, North Dakota, Oregon, Rhode Island, Wyoming have no courses listed; 69 catalogues were examined in these 9 states.

2. Enrollment is open to Freshmen —; Sophomores —; Juniors —; Seniors —; Graduate Students —; to all classes of students regardless of standing —.

Out of 101 schools answering the question:

- 11 admit Freshmen (a tendency to discourage entering Freshmen from taking it)
- 44 admit Sophomores
- 75 admit Juniors
- 74 admit Senior Students
- 38 admit Graduate Students (5 of these admit *only* graduate students)

This would indicate that the majority admit students from Sophomore level through the Graduate level with most of the enrollment drawn from the Junior and Senior years of college. Those schools in which the course was open only to Graduate students were:

- Southern Connecticut State College, New Haven, Connecticut
- The Graduate School at Rutgers, New Brunswick, New Jersey
- State University of New York, College of Education, Oneonta, New York

State College University of New York, College of Education at Plattsburg, New York

Middle Tennessee State College, Murfreesboro, Tennessee

3. What prerequisites, if any, are enforced? —. Is it a required course or an elective? —. Does it count toward a major? —. If so, in what department? —.

21 schools require at least 6 hours work in Gen. Biology before enrolling in Economic Botany.

42 schools require at least 1 course in Botany previous to enrollment.

24 specify no prerequisite for enrollment in the course.

85 schools give it as an *elective* course.

7 schools require it for majors in the department of Biology, Botany or Biology—Agriculture major.

82 schools count it toward a major in Botany, Forestry, Biology—Agriculture or Home Economics.

Several mentioned it as a suggested course elective for majors in Business, Geography,

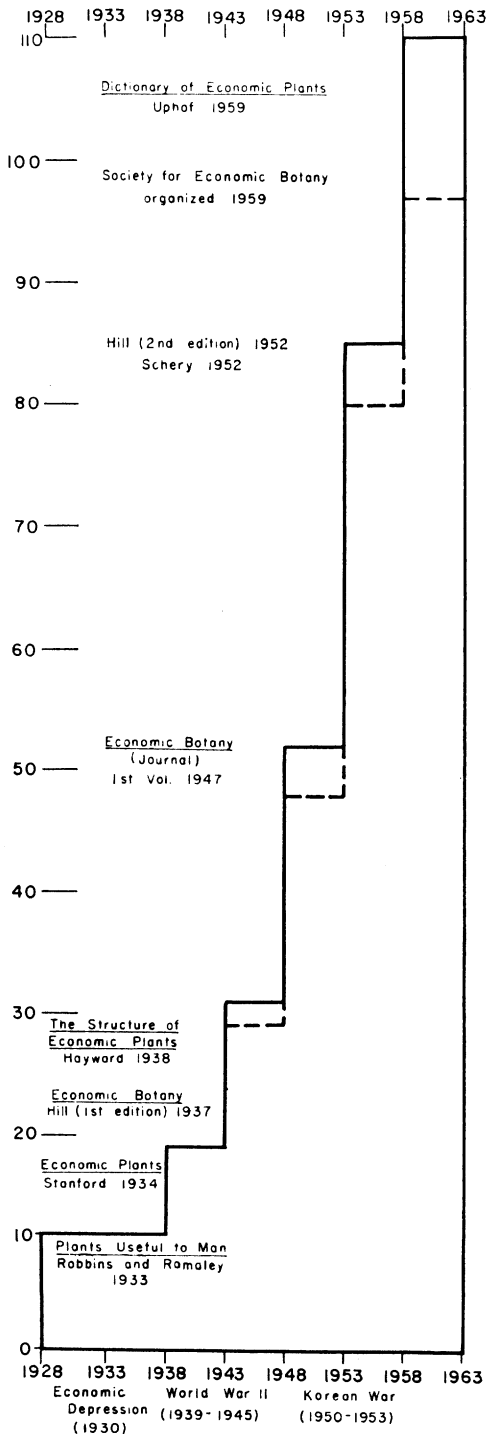


Fig. 2. Growth in number of courses over the last 35 years as shown by the questionnaire results in answer to question #5. Dotted lines indicate losses due to changes or "drop-out." Results show a steady growth over the years.

Conservation, Social Sciences, or Education (particularly Elementary teachers). In Hawaii, the course was required for majors in *Recreation*.

4. How many times a year is it offered? Each semester—; once a year—; or in rotation with other courses?— (If so, at what intervals?—.)

- 9 schools offer the course each semester.
- 39 schools offer the course once a year.
- 33 schools offer the course in rotation, every other year.
- 6 schools offer the course in rotation once every 2-3 years.
- 8 schools offer the course on demand at no regular time.

5. How long has the course been offered in your curriculum?— (Approximate the length of time, if exact date of first time offering is unknown.) So far as we know, Harvard is the oldest course on record.

This question was asked in order to find out a little of the history of Economic Botany as well as to see if there were any tendency for offerings to be periodically stimulated by meetings or publications of the Society for Economic Botany or membership in that body. An interesting correlation is seen in Fig. 2 which will be discussed later.

- 17 schools have had the course for 5 years or less.
- 34 schools have had the course for 5-10 years.
- 20 schools have had the course for 10-15 years.
- 9 schools have had the course for 20 years.
- 6 schools have had the course for 21-25 years.
- 9 schools have had the course for 30 years or more.

In this last category, two schools should receive special mention for their long continuous and stimulating record made over the years. Harvard, which stands at the top of the list, with a development of courses at both the undergraduate and graduate level, with laboratory research and research reading facilities not only for its own students but for the general public as well, has had the course on record since 1876, a period of 88 years. Close behind it, Iowa State University, at Ames has devoted two full semes-

ters to it in their curriculum, covering in one semester plants used for food; and in the second, the other plants used by man. The course has been taught since about 1900, a period of 64 years. Four schools show a continuous operation of a course in Economic Botany for the last 30 years:

Sam Houston State Teachers College at Huntsville, Texas 28-30 years.

Eastern Illinois University at Charleston, Ill. over 30 years.

University of Tulsa, Tulsa, Oklahoma over 30 years.

Douglas College, The Rutgers University, New Brunswick, N.J. over 30 years.

Two pioneer schools, College of the Pacific, California and Wellesley College, Massachusetts are not currently operating the course as shown in Table 1 of this paper.

The course entitled "Evolution and Utilization of Plants" at the ninth school in this category, Columbia University, New York, has been in existence since about 1890, which is over 70 years. It is classed as a (related course) by its staff (5). Since it is of a general botanical nature, and deals with many other subjects than Economic Plants, emphasis given to the economic aspects might conceivably vary according to the interests of the individual instructor involved in teaching it.

6. How many sections are there each time it is offered?— How many students to a section?— (Approximate an answer, if exact figures are not available, marking your answer as such.)

Most offered a single section, with from 3-10 students in the smaller ones and up to 130 in the largest one. University of Minnesota has 2 sections with 25 students per section. Rutgers University at *Newark, N. J.* has 4 sections with 50 each, making 200 students.

10 or less—19 schools

12-15 students per section—18 schools

15-30 students per section—17 schools

25-30 students per section—24 schools

35-40 students per section— 6 schools

40-50 students per section— 5 schools

60 students per section— 2 schools

130 students per section— 1 school

The average size of sections was about 20 students with an estimated total enrollment in all the country of about 2325 students

studying Economic Botany for a single semester sometime during the school year.

7. Is there a required text, manual or outline used in the course? List by title and author (with publisher and cost if printed locally.)

Twenty schools used no text or laboratory manual. Those schools giving the course in *Economic Biology* are chief among these since there is no adequate text extant which deals with both the zoological and botanical phases. In organization, they seem to suffer as a consequence. There is much need for such a text. Several of them are presently using mimeographed outlines with a bibliography for readings, but they are dependent largely upon the lectures of the individual instructor. In several instances, the instructor was a zoologist who himself offered the suggestion that the course should be revised and two separate courses given, one dealing with plants and a second with animals. To my knowledge, there is no text covering the zoological area alone in publication today and certainly none comparable to Hill (6) or Schery (7), the two most widely used texts in the college field of Economic Botany today.

On the questionnaire returns Hill (6) was used by 36 schools, Schery (7) by 38; 20 used no regular text. Both of these were used by a number of schools for reference where neither was used as an actual text for classroom use. An English publication by Hutchinson and Melville, "The Story of Plants and Their Uses To Man" (8), was used by several, including the University of Minnesota and the University of New York at Albany, where the text was selected because of its appeal to students going into Elementary Education. It is beautifully illustrated in color and is written in a form which would find ready use in stimulating interest among those connected with science education at the elementary level.

Still another text by E. E. Stanford (9) was mentioned, although it is now only to be found on the reference shelves of the older institutions. As a pioneer in the teaching of Economic Botany in the Pacific Coast area, this text was once more widely used and has many illustrations of plant uses not seen in the modern textbook. The author is presently teaching at Pikeville College in Ken-

tucky, and it is hoped that he may revise some of the diagrams and tables which are outdated and that a revised edition be put on the market.

Several teachers who filled out questionnaires mentioned that they were in the process of writing texts; it would be of great value if these can soon be completed and placed on the market. Such publications would go far in stimulating interest along this line in the newly organized curricula which many schools are in the process of setting up. Such a text could well include more chemistry, plant physiology, morphology, historical or ethnic and economic aspects as well as the traditional taxonomy, geography approach with the details of processing which have been included in the past.

In the advanced field, Hayward's book on "The Structure of Economic Plants" (10) is used by a graduate class at Rutgers, New Brunswick, N. J. Bailey's "Manual for Cultivated Plants" (11) is still a good standard classic for those interested in the taxonomy of economic plants. There are also several very highly specialized books on Ethnobotany in use at the graduate level (12, 13).

Two outstanding manuals are in use which can be highly recommended as a guide for laboratory work for those courses having the facility and size to warrant laboratory classes.

D. B. Lawrence (1952) *Plants Useful to Man* (Bot 12w Study Outline) 90 p. (multiplicity) U. of Minnesota, Minneapolis, Minn.

Richard Evans Schultes & A. F. Hill (1960) *Plants and Human Affairs*. Laboratory Manual for Biology 104, Harvard University, 64 p. Botanical Museum of Harvard University, Cambridge, Massachusetts.

Both of these contain bibliographic reference material which will be found useful in classes in Economic Botany, even though there may not be time allowed in the schedule for complete use of the laboratory exercises contained therein. An excellent and complete outline and bibliography for the course in Economic Biology (including both the botanical and zoological aspects) have been worked out for the course at Plattsburg, New York, by the instructor (14).

Mention must be made of the newer and more highly specialized fields of Ethnobotany (15) and Evolution and Taxonomy of Cultivated Plants which is occupying the attention of those interested in broadening the field of Economic Botany, especially at the graduate level. In this field, Prof. Paul C. Mangelsdorf and his staff at Harvard, Dr. Schultes, Dr. Margaret A. Towle, Dr. Walton C. Galinat and Dr. Albert F. Hill have contributed much to the current literature, along with the work of Dr. Volney Jones of University of Michigan at Ann Arbor and Alfred H. Whiting at the Museum of Northern Arizona at Flagstaff. Many others are adding to this ever widening circle of knowledge about plants as used by peoples of other cultures and from earlier stages of civilization.

8. Do your students use the publication "Economic Botany" in their work?—Other publications or journals which they are requested to use?— (Use opposite side if you would like to list them.)

More than half of those answering this question use and encourage their students to make use of the journal *Economic Botany*. Some 30 do not use it at all or use it very little. A greater effort should be made to get the journal into the libraries of all schools offering courses in botany, and to encourage the teachers of botany courses at all levels to interest their students in reading and using the articles contained therein for reports and projects in the class room. The articles are well written and often in terms understandable to students with little technical knowledge in the subject. Students in related fields such as chemistry, geography, agriculture or anthropology should also find them well worth reading.

Additional publications varying from government documents to current "paper back" modern science series were listed among the publications being used in addition to or in lieu of a textbook in the course.

9. Are they encouraged to engage in research during the course?—, or do they often engage in further research in the field of Economic Botany going on to do graduate work in the field as the result of this beginning?

46 schools did nothing in the way of research assignments in the classroom.

32 schools answered that they encourage re-

search along with the class but largely in terms of research reading.

15 of these said that the research was related to individual term papers, special projects or reports required as a part of the class assignment.

3 required research for graduate credit but no statement made as to type or areas of research.

10. What comments have you to offer, personally, either as a teacher or as an administrator, with regard to the course? Use the statements below or add to them, indicating your position. Teacher— Administrator—

- a. It is a new area in our department.—
- b. It was given some in the past but is no longer.—
- c. It is a very popular course, greatly enjoyed by most students. —
- d. It has been used as a general education course for non-majors. —
- e. It has been judged too technical for the average student. —
- f. It has been difficult to find instructors to handle the subject. —

Other comments:

- a. 5 indicated that the field of Economic Botany was new to their department; some are only initiating it this school year.
- b. 5 indicated that it was given in the past but would no longer be offered regularly after this year.
- c. 40 indicated that it was a very popular course, greatly enjoyed by most students. Several, in fact, indicated that enrollment had to be limited because of the popularity and that some took it for purely cultural value without credit.
- d. 46 said it was used as a general education course for non-majors. This was quite generally under a competent and interested instructor.
3. 5 judged it too technical for the average student, but these were noticeably taught by instructors who admitted they knew little or nothing about the subject other than the text and that greater value could have been gained by having a teacher who was better acquainted with the subject matter, or one who was more interested in it.
- f. 12 stated that it had been difficult to find instructors to handle the subject, three, in fact, had discontinued giving the course because of the retirement of the instructor who had given the course for many years and their inability to obtain another who could carry on the work.

Discussion

In these questionnaire replies, we see a rather clear picture of the past as well as the present status of Economic Botany. But it would be unfair to leave it without giving some attention to the changes which have been made, in some cases amounting to a complete "dropout" of the course, although it was still being listed in the current catalogues.⁴ Such changes were studied in detail and, from the data given in either the questionnaire returns or in personal letters sent from instructor or administrators, the information shown in Table 1 was derived.

Of the 24 schools in which such changes have been made, nine showed some hope of future continuation of the course in one form or another. This leaves 15 which have discontinued giving the course. At first glance, this may seem to be a high percentage out of 135. But, upon closer examination, it will be seen that these changes have been scattered over at least 15 years, and that it therefore does not represent a sudden "drop out" of the course.

Two main causes seem to be in evidence: that of curriculum revision, which was mentioned by five schools; and that of faculty or staffing difficulties which was given by six schools as their cause for action.

Changes show growth. To get a proper perspective, we must refer back to the information derived from answers to question #5, and note that a total of 71 schools were teaching Economic Botany for the first time during this same 15-year period. The apparent loss of 15 schools, when measured against this addition of 71 during the same period, indicates a decided gain so far as total numbers are concerned, not to mention the enthusiastic zeal which many of these new professors brought into their classroom teaching of the subject. Or, to put it another way, two-thirds of the presently listed courses had their introduction into the college or university during this 15-year period. Of these, 40 indicated that it was a very

⁴ There seemed to be some reluctance in removing a course from the catalogue because of the "red tape" often involved, so that in some instances it was still listed, although it had not been taught for a period of years.

TABLE 1: CHANGES IN COURSES FROM CATALOGUE LISTING AS SHOWN IN QUESTIONNAIRE RETURNS

	Course Title	School	Action Taken	Cause for Action
0	Economic Bacteriology	Fresno State College	discontinued	"impractical, too much material to cover"
0 +	Botany of Economic Plants	Mills College	relegated to a problems course for advanced students	"curriculum contraction"
0	Economic Botany	College of Pacific	taught for 30 years, discontinued; some consideration for future offering	"retirement of instructor"
0 +	Economic Botany	U of Redlands	may be dropped	"given at infrequent intervals"
0	Economic Botany	U or S. Cal. Los Angeles	discontinued	"interest slight when offered"
0	Economic Botany	Yale Graduate School	no longer offered	"a casualty of the current trend of modernization"
0 +	Economic Biology	Ill. State Normal Univ.	no longer given	"a course, <i>Economic Botany</i> is under consideration"
0 +	Economic Botany	Northern Ill. Univ.	has not been taught for six years	"inadequate facilities and materials replaced by <i>Applied Botany</i> "
0	Economic Botany	Urbana, Ill.	to be "dropped"	retirement of instructor and low registration
0	Economic Botany	Westmar Coll. Le Mars, Iowa	discontinued	"curriculum revision"
0 +	Economic Botany	U of Kansas	dropped and replaced by 66 Ethnobotany	"demand does not justify continuation"
0	Economic Botany	Washburn U., Topeka	removed from catalogue for next year	no cause given
0	Economic Botany	Nazareth College Louisville	has not been given in about 12 years	retirement of faculty
0	Economic Botany	Smith College	taught 1930-42, has not been taught for 7-8 years	
0	Plant Resources	Wellesley College	first taught 1882—intermittently to about 8 years ago. Not given now although still offered in catalogue	curriculum revision
0 +	Economic Botany	Duchesne College of Sacred Heart, Omaha	may be dropped. Offered on demand	lack of time in scheduling, not lack of interest

0	B211	Economic Botany	Bluffton College, Ohio	dropped from curriculum	instructor deceased
0	619	Economic Botany	Ohio State Univ.	course discontinued	
0	453	Economic Biology	N. E. (Okla.) St. Coll.	has not been taught for number of years	prefer 2 separate courses; may organize Econ. Botany
0	+ 453	Economic Biology	N.W. St. Coll., Alva, Okla.	offered on sufficient demand. Has not been offered for 15 years	insufficient staff
0	302-502	Economic Botany	Black Hill Teachers Coll., Spearfish, S. D.	dropped, some material will be incorporated in Gen. Botany course	curriculum revision
0	105	Economic Botany	U. of Va. (Blandy Farm)	being discontinued '63-64 when someone is secured to teach it, it will probably return to E. B.	lack of sufficient faculty
0	211	Economic Botany	Milwaukee Downer Coll.	deleted in spring of '61; not taught in 10 yrs. prior	no reason to retain it.
0	526	Economic Botany	The Catholic Univ. of America Washington, D.C.	given only once	no cause for action given

24 have modified the course

9 show some hope of continuing (shown as 0+)

15 have discontinued the course within the last 15 years (shown as 0)

popular course, i.e., student interest was high; and 46 stated that "given as a lecture course or a general education course, it was given by a competent and interested instructor."

It would be an endless task to enumerate all of these cases, but it is worthwhile to look more closely at some typical examples drawn from the correspondence accumulated from the questionnaire returns.

One of the most successful of such courses has been the one developed over the past 13 years at Rutgers, the State University at Newark, New Jersey (16). As described in a paper given at the meeting of the teaching section of the Botanical Society of America in August, 1963 at Amherst, Massachusetts, it is a lecture course in which plants and their products are studied in relation to their role in civilization and in contemporary, national and world problems. It emphasizes the influence of plants and plant cultivation in the economic, social and cultural history of man. It is the most heavily registered elective course in natural science of the non-laboratory courses offered to non-science majors. Four sections of 50 students each are being given during the current year, and there are still students clamoring to get into it.

An excerpt from a letter dated April 8, 1933 sent to the late Dr. Leslie A. Kenoyer from J. C. Arthur, Purdue University indicates an early beginning in marked contrast to the course in Economic Botany of today.

"The first differentiation of the subject was to offer a course in Economic Botany, which consisted chiefly of a dry review of the families of plants embracing cultivated plants. Of course, no laboratory work. Instruction was chiefly by lectures."

In the reply from Ft. Collins, Colorado, where the course has been in force for 10 years and is offered in alternate years in a single section with from 14 to 27 students, we have the following comment: "Originally intended for business majors, it attracts more advanced students than others, even some graduate students. I don't know why, because many of them do not need the additional botany credit" (17).

In Ottawa, Kansas, where it has been taught for only six years and is given every other year in a single section of from 30 to



Fig. 3. The Beal-Garfield Botanic Gardens at Michigan State University are open for group study. Labels assist students in learning valuable information with record to economic plants.

50 students, "it is usually recommended for Elementary school majors as a science elective, in which capable students are encouraged to do it as an "Honors" course which may include more specific and comprehensive study of some specific group of economic plants. It has proved to be a very popular course, greatly enjoyed by most students" (18).

Here at Western Michigan, where the course has been taught for about ten years and the classes in general have been small, never exceeding 20 students, it has been rated by the students as "one of the most interesting and practical courses taken" during their college career. Among these have been students from countries such as Japan, Nigeria, Denmark and Latvia who have particularly enjoyed the field trips into in-

dustries connected with the use of plant products. Such trips are more easily arranged for smaller groups. The course is also currently being offered through the extension division by correspondence with some rather interesting results.

At Michigan State, where a course has been offered for about 15 years, they have developed and use the Beal-Garfield Botanic Garden with a fine collection of economic plants arranged each year by a competent staff into plots showing various plant uses and their taxonomic classification. Lately, they have developed a planting to show the genetic origins of cultivated plants as well, which is very useful for study by classes of any size (Fig. 3).

Nor is the enthusiasm confined to those of recent introduction. From Hamilton, New

TABLE 2
INDUSTRIES IN THE KALAMAZOO AREA (WITHIN 25 MILES) WHOSE RAW
MATERIALS ARE LARGELY FROM PLANT SOURCES

-
1. Lumber industry and builder's supplies
 2. Plywood manufacturers, furniture and sleds
 3. Paper and cardboard cartons (only one buys logs directly from the farmer and carries the process from log to finished product)
 4. Panelyte (paper and resin make quite a different product)
 5. Musical instruments (various types of woods and stains are used, imported)
 6. Mattress factory (a small concern)
 7. Latex compounders (Latex as well as raw rubber imports are used in their product, largely used by auto manufacturers)
 8. Peppermint oil (formerly grown locally)
 9. Breakfast cereals
 10. Potato chip factory (a small concern)
 11. Grape juice bottling company (from farmer to finished product, even to distilled liquors)
 12. Tea, coffee and nut shop (imports and local)
 13. Largest fresh fruit produce market in the midwest
 14. Cigar manufacturer (a one-man industry)
 15. Flower and greenhouse growers and marketing, nurseries
 16. Seed production and sales to local farmers
 17. Pharmaceuticals
 18. Paint, varnish and artist supplies
 19. Maple sugar, beet sugar and honey (directly and indirectly from plants)
 20. Flavoring extraction plant and local herb farm and market (a one-man business but of great economic value to the community)
-

(Any community with college facilities can make a similar list).

York, where a course has been taught for 20 years, in a single section once each year with an enrollment of about 20 students, we have the comment, "It is so popular we have to turn away students because of staff limitation" (19).

These are only a few random selections from the returns which show that enthusiasm for Economic Botany is still going strong, despite the "modernization" trend which, in some of the colleges and universities, has caused it to become inactive.

Growth in numbers of courses is shown graphically in Fig. 2, where the number of years that the course has been taught was taken as the basis of comparison for the period of years since the economic depression of 1930. This shows also in chronological order some of the major publications which are in use in the teaching of Economic Botany and the date for the founding of The Society for Economic Botany. Each of the events of publication, as well as of the Society organization, seem to have served as a decided impetus toward the stimulation of the subject in the field of teaching.

Growth in number of courses and enthusi-

asm in teachers and students has been accompanied by expansion in still another dimension which is that of the specialization of subject matter and its modernization by adding material from new fields of biochemistry, cell genetics and even of problems relating to uses of plant products in the newly developed science of space biology. Exploration of the resources of the sea, although always of interest to the economic botanist, has taken on new depth of meaning; radio-carbon dating has furnished us a new tool with which to determine the age of various foods and fibers as well as woody products which were found in relics of civilization and cultures of long ago.

This change is reflected in a comparison of articles published in the journal of Economic Botany in the year 1947-48 with those of the present date which shows four distinct differences. First, there are many more pages devoted to the chemistry of the plant products, where once the authors were content with merely giving the description of the plant, its geographic range or taxonomic position. These are to be found in today's articles to be sure, but a second difference is

that the geographic ranges have extended into far-away places, into newly developed countries, where plant introduction is taking a prominent place in the economic life of the nation and of the world as a whole. The third change is that of interdisciplinary cooperation and exchange. In recent issues of the journal, almost every article contained a list of acknowledgments of aid, some in funds, some in information, some in transportation, some in laboratory techniques, or possibly even in actual supply of materials used in some distant source inaccessible otherwise to the writer. The fourth great change is the recognition given to industry as it plays its part, sometimes in the investigation of the development of the plant products, sometimes in the manufacture of a synthetic product which so closely imitates the original as to be unrecognizable from it when the two are placed side by side, and the part played by these manufactured products in the day-to-day economy of man in many walks of modern life.

While these advances in specialization and depth of knowledge in the field have not as yet penetrated into the text books of today, the various media of publication give the college teachers of the course in Economic Botany a source of up-to-date information and knowledge for use in the lecture, in the laboratory demonstration to be in turn passed along for later use by his students in whatever walk of life they may follow.

Summary

Of the 135 schools listed in this survey, there are still over 110 schools and colleges in the United States giving courses covering the general area of Economic Botany at the undergraduate or graduate level in colleges of arts, sciences or letters. Such courses consist largely of lectures, meeting two or three times a week, and supplemented in many instances by at least an additional period of laboratory microscopic observation or demonstration of visual aids, museum tours or trips into the fields or factories where plant products are being grown or produced on a large scale.

In general, such a course also carries with it a certain amount of research reading in the library in connection with a required project or term paper which is presented to

the class at one of its meeting periods. In one course (that at Harvard), these papers represent about 1/3 of the grade, and, each year, a number are of such high calibre that they are published in learned journals.

Several texts have been quite generally used as a basis of study in such college courses, among which Hill's "Economic Botany" (6) and Schery's "Plants for Man" (7) are the most popular. Hutchinson and Melville's "The Story of Plants and Their Uses to Man" (8) is strongly recommended for use in classes involving teachers of elementary education. E. E. Stanford's "Economic Plants" (9) and "General and Economic Botany" have also been used, although both of these are in need of revision and are presently out of print. Credits of from two to three semester hours or up to four quarter hours have been given by various schools giving such a course. This is frequently counted toward a major in Biology or Agriculture-Biology combination, and may be applied as a general education course for those not majoring in these fields. It is strongly recommended for those going into educational fields in either Elementary or Secondary schools, and is highly desirable as an elective for those in the fields of Business, Geography, Anthropology or Social Studies.

The course is most often taken by students in the Junior and Senior years, but is open in general to students in any year of college, including the graduate school. Freshmen are discouraged from taking it, however, unless they are quite mature or have previously had at least the equivalent of six hours of General Biology or a single course in Botany. It has, in most instances, where properly taught by an enthusiastic and well-informed instructor, been very well received by the students, some of whom have been encouraged by the instructor to pursue their interest into the graduate level. It is hoped that more of this will take place in the future, as there is a need for such teachers at the college level, particularly in the smaller colleges, with a background and appreciation of the general aspects of Economic Botany along with the knowledge of the fundamentals of plant science at the undergraduate level.

There is a tendency at the graduate level to expand the courses in Economic Botany into areas of plant taxonomy, evolutionary development or the anatomy of cultivated plants, tying these in with archeology or ethnobotany. There should possibly also be an expansion in terms of biochemistry or plant physiology or ecology of Economic Plants with a view toward facilitating coordinated studies by the botanist in the herbarium, teamed with the plant explorer in the field and the plant chemist in the laboratory. Economic Botany presents, in this respect, a challenge for the new biology of the future, with international and interdisciplinary cooperation a key to success.

Some suggestions for the future of Economic Botany. In the light of the survey, the following suggestions are put forth for the consideration of college teachers or administrators who are interested in the improvement of the status of college courses in Economic Botany. These are not original with me but represent the pith of those sent in during the course of this study.

a. An education committee be formed to stimulate interest in teaching Economic Botany in colleges, and to maintain a record file of the progress of such courses over the coming 5-10-15 year period. Such a committee would keep in active communication with the schools offering Economic Botany at the undergraduate level, would encourage advanced research on the graduate level as well, and at the annual meeting of The Society for Economic Botany would try to bring together the results of the teaching staff and the research workers for mutual exchange of information which would be of benefit to each of the two groups. This would serve to create a working team of Teacher-Investigator-Research Botanist which should bring the latest developments into the classroom as well as to furnish research workers with new potentials in assistants capable of carrying on teaching and field research for the future.

b. Such a committee would maintain an active file of up-to-date books, magazine articles and research bulletins dealing with Economic Botany, to be circulated periodically among its members.

c. A course in Economic Botany be especially recommended as a resource course in science for both elementary and secondary, Economics, Business, Geography, and Education as well as a general Education course for non-majors in Biological Sciences.

d. Botanical gardens which display growing plants of economic importance should be encouraged, with an active list being kept so that they may be available for study tours by students from nearby colleges interested in seeing the actual plants discussed in the classroom.

e. There is a great need for a summer Conference or Institute for college teachers of Economic Botany under a National Science Foundation, Ford or Carnegie Grant, to present the modern approach to the subject of Economic Botany in the light of the enlarging interests in the field of Genetics, of Biochemistry, of Ethnobotany, of Archeology, as well as in the taxonomic backgrounds necessary to trace back the history of modern agricultural crop-plants to their earliest historical beginnings.

f. It is hoped that in the light of the translation of Hill's book into Arabic and of both Hill and Schery into Spanish there will be an interest in expanding our American facilities into an International body which will become active in the advancement of knowledge and use of facilities offered to college and university students outside the confines of our own country. Several excellent texts in foreign languages should also contribute to this end.

g. It should be recommended that members of the Peace Corps as well as other international Student Exchange programs, and that international students in the United States be encouraged to include one or more courses in Economic Botany in their program of preparation and that, upon their return, they be encouraged to continue their interest or research in such areas at the graduate level or beyond.

h. Through research, a check list of potential economic plant crops be worked out for publication, listing such plants by climate, temperature range, rainfall tolerance and physiographic adaptations, etc., and offering alternative crops which might be introduced into countries with limited economic plant resources.



Fig. 4. This National Science Institute held in Bogotá, Colombia, shows intense interest in Economic Botany on the part of our Latin American neighbors. Held under the sponsorship of the Alliance for Progress Program, summer 1963.

i. An international exchange of teachers or leaders in the field of Economic Botany from other countries would be of great value for the future. The series of meetings which were held during the summer of 1963 in Bogotá, Colombia and led by Dr. Schultes under the auspices of the Alliance for Progress and the Universidad Nacional is a step in the direction of international exchange of information and values for Economic Botany and it is to be hoped that this is only the beginning. It is certainly a step in the right direction, one to be highly encouraged

and applauded⁵ (Fig. 4).

With such an expanding future in mind, I venture to outline in Fig. 5 a suggested curriculum "flow sheet" diagram of courses which might be considered in the preparation of students of Economic Botany both at the undergraduate and graduate level, for those wishing to go farther than the general course usually offered in the college or university curriculum of today. There is nothing mandatory about either the sequence or the credit courses involved, but it is desirable that such a student have a well-rounded foundation understanding of the fundamental groundwork of botany provided by courses in morphology, taxonomy, physiology, genetics and ecology, etc., as well as to have a good background in chemistry or the physical sciences or of anthropology or economic geography in the social sciences if he wishes further to pursue his interest in Economic Botany into the more highly spe-

⁵ In a letter to me dated November 4, 1963, Dr. Schultes writes: "I went to Colombia prepared to teach 40 students and ended up with 129. There was tremendous enthusiasm for it and they want a repeat sometime. Eighty per cent of the course was composed of professors, agronomists, chemists, medical doctors, etc., and twenty percent were fifth-year students in the National University."

General Background which contributes
to
Modern Course in Economic Botany

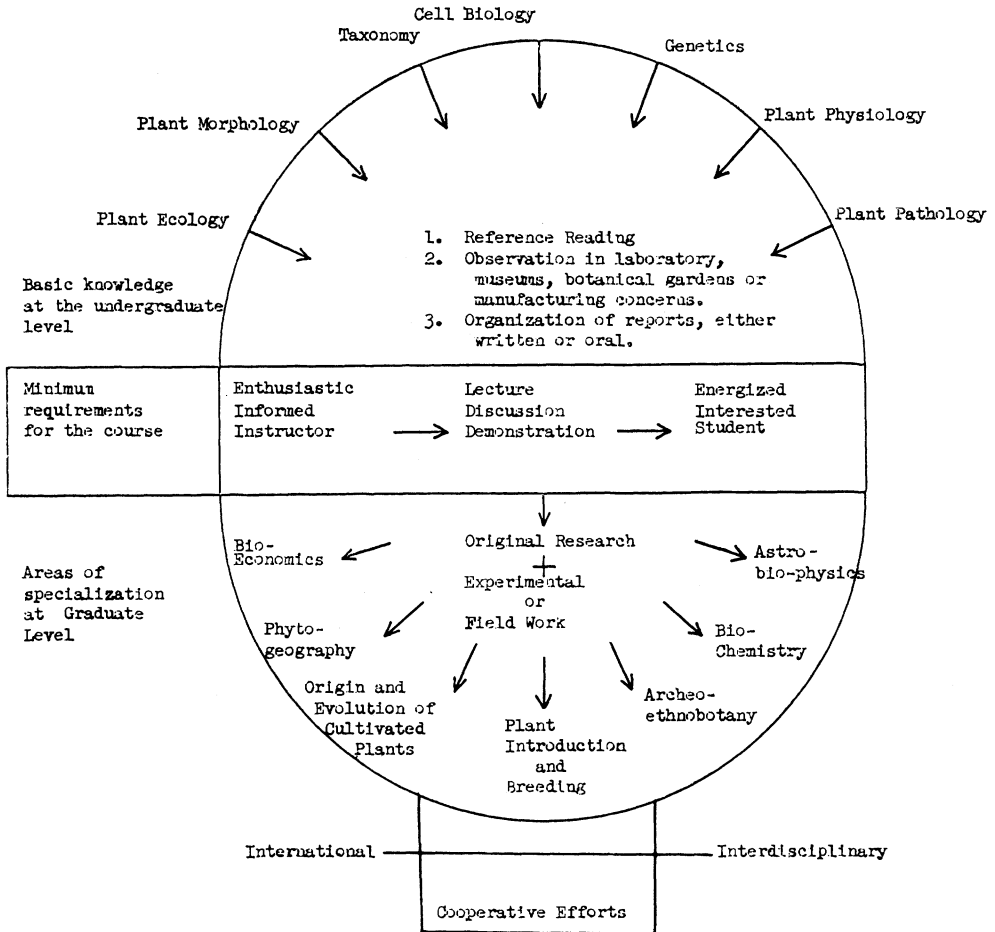


Fig. 5. Diagram or "flow sheet" for a theoretical operation of an undergraduate and graduate program of teaching of economic botany in a college or university.

cialized fields shown in the lower half of the diagram.

Only a few schools at present may be equipped to carry out such an expanding program, but it is one worth considering for the future as curriculum adjustments come along. The field of Economic Botany has high potential in this respect for both the specialized and the general education of the college student of tomorrow.

Acknowledgments

First and foremost my thanks go to those more than 135 teachers or administrators of college courses in Economic Botany who so promptly filled out and returned the questionnaires sent them, and especially those who gave me additional personal information about their courses. This has added immeasurably to the contents of this survey.

It would be prohibitive of time and space to list them all individually, but I am nevertheless deeply appreciative of their assistance.

Thanks are also due the following:

To Dr. Eugene Kirchherr and his graduate assistant Bert Nelson, of the Geography Department, for their assistance in the preparation of the cartography and figures.

To Dr. Richard Schultes for information and for the photograph of his course in Bogotá, Colombia, in the summer of 1963.

To Dr. Sydney Greenfield for his reading of the preliminary manuscript and his helpful suggestions and criticism.

To Dr. George Parmelee for the photographs of the Beal-Garfield Botanic Gardens at Michigan State University, East Lansing.

To Mrs. Forrest Schuyler, my typist for her untiring patience and efforts during the preparation of this paper.

To the Faculty Research Fund Committee of Western Michigan University for the grant of funds used to assist in the publication of this paper.

To any whose record was inadvertently omitted in this survey, I am deeply apologetic. I hope that they will take the time to write me personally so that the error can be corrected in any future study.

Literature Cited

1. Food—One Tool in International Economic Development, Iowa State University Center for Agriculture and Economic Adjustment, Iowa State University Press, Ames, Iowa, 1962.
2. Solving World Food Problems. 1963. *United Nations Review*, 10 No. 7; 34-41.
3. Freedom from Hunger Campaign. 1964. *United Nations Review*, 11 No. 2; 26.
4. Fosberg, F. Raymond. 1948. *Economic Botany, A Modern Concept*, *Economic Botany* 2: 3-14.
5. Lier, Frank G. Personal correspondence, March 21, 1963.
6. Hill, A. F. 1952. *Economic Botany*, 2nd Ed. McGraw-Hill.
7. Schery, R. W. 1952. *Plants for Man*, Prentice-Hall.
8. Hutchinson, J., and R. Melville. 1948 *The Story of Plants and Their Uses to Man*, P. R. Gawthorn, Ltd., London.
9. Stanford, E. E. 1934. *Economic Plants*, Appleton-Century-Crofts, Inc.
10. Hayward, Herman E. 1938. *The Structure of Economic Plants*, Macmillan Co.
11. Bailey, Liberty H. 1949. *Manual of Cultivated Plants*, rev. ed. Macmillan Co.
12. Luomala, Katherine. 1963. *Ethnobotany of the Gilbert Islands*, Honolulu.
13. Towle, Margaret A. 1962. *Ethnobotany of Pre-Columbian Peru*, Aldine Publishing Co., Chicago.
14. Waterhouse, J. S. 1962. *Mimeographed Bibliography for Economic Biology*, March.
15. Faulks, R. J. 1958. *An Introduction to Ethnobotany*, Moredale Publishers, Ltd., London.
16. Greenfield, Sydney S. 1963. (Abstract of Paper) *Economic Botany for Liberal Arts Students*, *American Journal of Botany*, 50, No. 6, Part 2:639, July.
17. Klinger, Bruno, from personal notes on questionnaire reply, May 22, 1963.
18. Roth, Elma A., from personal notes on questionnaire reply, March 19, 1963.
19. Stanley, Oran B., from personal notes on questionnaire reply, April 3, 1963.
20. Questionnaire replies from all but 2 of the schools listed at the end of this article (Georgia State College at Atlanta and State University N. Y. College of Education at Brockport did not reply)