AMERICAN SOCIETY
FOR HORTICULTURAL SCIENCE
OFFICERS 1967-68

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American Society for Horticultural Science
615 Elm Street, St. Joseph, Michigan 49085

Program and Local Arrangements – 65th Annual Meeting,
University of California, Davis 95616

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Banquet	Harold P. Olmo
Barbecue	Klayton E. Nelson
Camping Facilities	Dale E. Kester
Campus Tour and Open House	William J. Flocker
Collegiate Activities	Dillon S. Brown
Extension Banquet	George A. Marlowe, Jr.
Housing	Paul Hansche
Ladies and Families Programs	H. B. Richardson
Premeeting Tours	James A. Beutel
Printed Program	L. L. Claypool
Signs	William H. Griggs
Transportation	George A. Marlowe, Jr.

ASHS Headquarters - Davis

Saturday-Sunday (Aug. 17, 18)	550 Oxford Circle
11:00 a.m. - 10:00 p.m.	(916) 756-5910
Monday-Wednesday (Aug. 19-21)	Chemistry 159
8:00 a.m. - 4:00 p.m.	(916) 752-2061

65 th
ANNUAL MEETING

AMERICAN SOCIETY FOR
HORTICULTURAL SCIENCE

University of California
Davis Campus
August 18-21, 1968

TO THE AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE:

Welcome to the Davis campus of the University of California. Exchange of knowledge is a common goal of universities and scientific societies. We are always pleased to open our campus to the scientific community, and particularly the horticultural sciences, which have been a major force on our campus since it opened in 1908. We are proud of the many contributions our faculty and staff members have made in these areas in teaching and research. And we are proud of the honors your Society has bestowed on our scientists in recognition of these contributions.

In this Centennial Year of the University of California, I am very pleased you have chosen to meet at Davis. Members of your Society have played a significant role in the development of the University. As we look ahead to the next 100 years of our institution, we are certain the horticultural scientists will continue to play a significant role in the future of the University of California.

Emil M. Mrak
Chancellor

TO THE UNIVERSITY OF CALIFORNIA:

We of the American Society for Horticultural Science congratulate the University of California on this, its 100th anniversary. We are honored that our society's 65th annual meeting is being held on the Davis campus of the University of California as one of the events in its centennial celebration. We believe that the mutual goals and interests of these two organizations have resulted in significant benefits, not only to agriculture, but to mankind as a whole. We offer our best wishes for the continued growth in stature and service of a great University.

Neil W. Stuart
President
American Society for
Horticultural Science

UNIVERSITY OF CALIFORNIA

When it was first established, the University's "tiny band of scholars" numbered 10 faculty and 38 students. In the fall of 1967, the University had more than 7,400 full-time teachers and 90,000 full-time students.

More than 200 different curricula and majors are now offered, leading to degrees, certificates, or credentials.

The nine campuses (Berkeley, Davis, Irvine, Los Angeles, Riverside, San Diego, San Francisco, Santa Barbara and Santa Cruz) are only part of the educational and research complex. The University also operates 6 major research units not on the campuses (2 devoted primarily to atomic energy, 1 to engineering, 1 to physiology, 1 to astronomy, and 1 to radio astronomy); 9 agricultural field stations, 3 department experimental areas, a forestry summer camp, and several wildlife and fisheries research stations; 53 Agricultural Extension offices (serving 56 counties); 8 University Extension local headquarters. In addition, the Hastings College of the Law and the San Francisco Art Institute, both in San Francisco, are affiliated with the University.

THE DAVIS CAMPUS was founded in 1906—as a farm school and experimental farm. Later, short courses were added, and College of Agriculture students from Berkeley came to Davis for their production work. Complete four-year work began in 1922. In 1948 the School of Veterinary Medicine was established. The over-all emphasis of the program changed with the establishment, in 1951, of the College of Letters and Science. In 1959 Davis became a general campus, with authority to add new major fields, schools, college, and to expand the graduate program. In 1962 a College of Engineering was added, and in 1966 the School of Law. The School of Medicine will accept its first students in 1968.

In the fall of 1967 there were 10,000 students enrolled at Davis; 2,800 of these were graduate students. Academically, Davis enjoys an international reputation; each year some 550 students from 60 countries or more are drawn to this campus for study and research. In the fall of 1967 there were 1,300 academic and 2,800 non-academic employees.

The Davis campus now comprises 3,774 acres including the central academic campus and its research fields and facilities.

THE COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES and the Agricultural Experiment Station have 329 academic and 423 non-academic staff in 25 departments (not including those on grant funds). These people serve in and are served by a number of organized research units on the campus. The *Agricultural History Center* collects, studies and records man's efforts in the production of food, fiber and other essentials. The *Agricultural Toxicology and Residue Research Laboratory* and the *Food Protection and Toxicology Center* are concerned with health problems arising from the use of agricultural chemicals, and with the detection of pesticide residues, the storage and elimination of toxic chemicals in mammals, and the decomposition of pesticides. The *Computer Center*, now equipped with IBM 7044, soon will be getting more advanced equipment to effectively serve teaching, research and administrative needs. The *Electron Microscope Laboratory* has three electron microscopes for studying cytological ultra-structure and viruses. The *International Agriculture Center* serves international agriculture by helping to arrange personnel exchanges with research agencies in foreign countries. The *Kearney Foundation of Soil Science* pursues basic studies related to soil-forming processes and plant-soil interrelationships including nitrogen economy and salt influences on soil chemistry. The *University Arboretum* provides materials for teaching and research in the plant sciences.

The American Society for Horticultural Science was organized September 9, 1903, at Boston, Massachusetts. The Society's objectives are to promote and encourage scientific research and education in all branches of horticulture, including the breeding, physiology, nutrition, management, harvesting, handling, storage, processing, and utilization of fruit and nut crops, vegetable crops, and floriculture and ornamental plants. These goals are furthered through:

1) Sponsorship of annual and regional meetings at which members and invited speakers discuss results and methods of scientific research; share information and experiences relating to undergraduate and graduate instruction and extension education; and participate in tours and other activities which contribute to the advancement of improved horticultural practices and enhancement of the profession.

HISTORY AND MISSION OF THE ASHS

2) Dissemination of horticultural knowledge to members and subscribers all over the world through publication of two 700- to 1000-page volumes of the Society's *Proceedings* each year containing detailed scientific research papers; through publication of four issues of *HortScience* each year containing brief or condensed research reports, annual meeting abstracts and symposium papers, feature and review-type articles, philosophical articles and editorials, book reviews, personnel news notes, announcements, and reports of Society activities; through publication of three *Newsletters* annually; and through other publications such as proceedings of special conferences.

3) Cooperation with other agricultural and biological organizations concerned with matters relating to horticultural science and education.

4) Leadership in national and international horticultural matters.

During the banquet at each annual meeting, the Society gives special recognition to members who have been elected Fellows of the Society because of their outstanding contributions to horticultural science and the profession, their leadership in or service to the horticultural industry, and/or their service to the Society. Awards are also presented to the authors of outstanding research papers (in nine categories) published in the previous year's volumes of the *Proceedings*. An award for distinguished teaching, up to four awards for meritorious Collegiate Branch papers presented at the annual meeting, and a plaque to the Outstanding Horticulture Club of the year are also presented at the annual banquet.

Total membership in the Society as of December 15, 1967, was 2,878. The Society's publications also go to over 1,000 subscribers (mostly libraries) in a total of 92 countries.

National Headquarters of the Society are at 615 Elm Street, St. Joseph, Michigan 49085.

INDEX TO SESSIONS

MONDAY, AUGUST 19

TUESDAY, AUGUST 20

WEDNESDAY, AUGUST 21

GENERAL INFORMATION

The ASHS office will be located in Room 159, Chemistry Building (17). Phone 916-752-2061.

Registration and information desks will be located at 550 Oxford Circle, Saturday and Sunday, August 17 and 18. Monday through Wednesday, August 19-21, the desks will be located in the lobby outside Room 194, Chemistry Building (17).

Preregistration, housing, and premeeting tour applications were enclosed with the April *Newsletter.* Additional applications may be secured from the ASHS, 615 Elm Street, St. Joseph, Michigan 49085.

Mail and *telegrams* should be addressed to ASHS Meetings, Conference Administration, University of California, Davis, California 95616. Phone 916-752-2527.

Airline reservations and *reconfirmation desk.* On Tuesday, August 20, and Wednesday, August 21, Patterson Travel Agency will maintain a booth at the Registration Desk to assist you with your return travel arrangements.

Registration Information.

The Registration Desk will be open during the following hours:

Wednesday, August 14 through Friday, August 16 - 1:00-5:00 p.m., Oxford Circle
Saturday, August 17, and Sunday, August 18 - 11:00 a.m.-10:00 p.m. Oxford Circle
Monday, August 19 through Wednesday, August 21 - 8:00 a.m.-4:00 p.m., Chemistry Building (17)

Registration fees.

$10.00 - Advance registrations received by mail *on* or *before* July 15.

$12.00 - Late registrations received *after* July 15 by mail or at the meetings.

$2.00 - Graduate or undergraduate students who register in advance by mail *on* or *before* July 15.

$4.00 - Graduate or undergraduate students who register *after* July 15.

Registration acknowledgments

ASHS will acknowledge all advance registrations received up to July 15. These acknowledgments must be presented upon arrival at the Registration Center *located at 550 Oxford Circle, August 17 and 18, and at the Chemistry Building, August 19 onward.*

Refunds

ASHS will refund "prepaid" advance registration fees on all cancellations received in writing or by telegram before noon Saturday, August 17. *NO REFUNDS WILL BE MADE AFTER THAT DATE.*

Housing Information

Housing will be available at 550 Oxford Circle (Emerson Hall and Webster Hall), an air-conditioned residence complex. All delegates will live in suites consisting of two or three bedrooms, a living room, and one or two baths. Delegates with families will be assigned together in a separate section of the building. Three swimming pools will be available at the residence hall free of charge.

Assignments

Persons desiring to be assigned to the same room may accomplish this by submitting their housing application forms at the same time and in the same envelope to ASHS Housing, 550 Oxford Circle, Davis, California 95616. Children under 2 years of age, requiring cribs and baby beds, may occupy their parents' room without any additional charge, but the parents must provide the necessary beds. Children from 3 to 11 years of age will be charged a room rate of one-half the adult rate.

Services

Room and board charges include complete room service (bed making, room cleaning, linen, and towels) and a meal service which offers a wide variety of dishes in unlimited quantities. For the convenience of those who will be participating in tours and other activities that will take them away from the campus during the noon hours, lunch is optional. Since the residence hall complex is located off University grounds, alcoholic beverages are permitted. Pets and firearms are not permitted.

Room and board rates (do not include registration fee)

	Room & board	*Room & board (no lunch)*
Adults	$36.00	$33.00
Children (11 years and under)	21.00	18.00

No charge for children 2 years old or younger.

Room and board charges will include the room Sunday through Wednesday nights and meals from Monday breakfast through Thursday breakfast (excluding dinner Tuesday night, which is the ASHS Banquet). Lunch can be at Tercero Dining Commons (75) on campus by arrangement. Rate adjustments will be made for those arriving and departing early or late.

Rooms will be available beginning August 14 at $6.00 per night. Accommodations will be available for those wishing to remain after the conference through Saturday, August 24. No room charge for August 15 will be made to those who must spend the night of August 15 in Salinas (while on one of the tours).

Those wishing to request housing should write to:

ASHS Housing, 550 Oxford Circle, Davis, California 95616 prior to July 15, 1968.

Residents of Oxford Circle can be reached by telephone at the following numbers:

Emerson Hall		*Webster Hall*
(916) 756-5910	8:30 a.m.-10:00 p.m.	(916) 756-5913
756-2516	10:00 p.m.-8:30 a.m. (emergency)	756-3509

Meal Information

For those not selecting the room and board plan, casual meals will be available at:

550 Oxford Circle	Adults & children over 11 yrs.	Children under 11 yrs. of age
Breakfast: 7:00-8:30 a.m.	$1.25	$ .60
Lunch: 11:45 a.m.-1:15 p.m.	1.50	.75
Dinner: 5:00-6:30 p.m.	2.25	1.15

Tercero Hall Dining Commons (75)		
Breakfast: 7:00-8:15 a.m.	1.05	1.05
Lunch: 11:00 a.m.-1:15 p.m.	1.20	1.20
Dinner: 4:30-6:30 p.m.	1.45	1.45

Check at Information Desk for Sunday meal schedule.

Davis restaurants

Larry Blake's	705 First Street, Davis
Mandy's Pancake House	Interstate 80, Davis entrance
Mexican Kitchen	330 G Street, Davis
Mr. B's Brandin' Iron	223 F Street, Davis
Quessie's Foods & Fountain	613 Second Street, Davis
Topper's Steak House	325 F Street, Davis
Voyager Inn	Interstate 80, 2½ miles east of Davis

OFF-CAMPUS ACCOMMODATIONS

Motel accommodations *cannot* be handled by the ASHS Housing Committee; so they must be made by the individual, directly with the motel of his choice.

Davis Motels		*Motel Rates*
Davis Motel (756-0910)	Single:	$ 7.28
Hwy. 40 & Richards Blvd.	Double:	9.36
Davis, California 95616	Twin:	10.40
Voyager Inn (756-2200)	Single:	$ 9.00
Interstate 80	Double:	11.00
Davis, California 95616	Twin:	12.00
Yolano Lodge (756-1040)	Single:	$ 8.50
221 D Street	Double:	11.00
Davis, California 95616	Twin:	13.00

Woodland Motels (approximately 20 minutes from Davis)

Cinderella Motel (662-1091)	Single:	$ 9.00
99 West Main Street	Double:	11.00
Woodland, California 95695	Twin:	12.48
Knight's Inn (662-9335)	Single:	$ 8.00
53 West Main Street	Double:	9.00
Woodland, California 95695	Twin:	10.00
Woodland Motel (662-4681)	Twin:	$ 9.00
127 Main Street	Double:	8.00
Woodland, California 95695	Two Doubles:	12.00
	Double & Twin:	10.00

West Sacramento (approximately 20 minutes from Davis)

Bel Air Motel (371-9440)	Single:	$ 6.24
1600 West Capitol Avenue	Double:	8.32
West Sacramento, Calif. 95691	Twin:	None
Imperial Lodge (371-9696)	Single:	$ 6.24
824 West Capitol Avenue	Double:	8.32
West Sacramento, Calif. 95691	Double:	10.40
Town House (371-6401)	Single:	None
940 West Capitol Avenue	Double:	$ 8.00
West Sacramento, Calif. 95691	Twin:	10.00

There are many other motels in the West Sacramento and downtown Sacramento areas which are within convenient driving distance of Davis. Consult the AAA or motel association lists.

Trailer and Camper Information

Facilities for trailers and campers (no tents) will be available during the time of the meetings at the Dixon Fairgrounds, Dixon, California, about a 20-minute drive from Davis. The cost is $1.50 per night. Specific instructions for using this facility will be supplied to those requesting it. For information write: ASHS Camping, c/o Dr. D. E. Kester, Department of Pomology, University of California, Davis, California 95616.

No tent camping will be available in the Davis area.

Members of ASHS who plan to attend the Annual Meeting are encouraged to detach this Program-Abstracts Insert and bring it with them to the meeting; otherwise, additional copies available at the meeting will cost $1.00 per copy.

Transportation

Air — Davis is served by the Sacramento Metropolitan Airport, with flights connecting Los Angeles, San Francisco, Oregon, and Washington on United, Western, PSA, West Coast, Air West, and Skymark airlines. Bus transportation to and from Davis will be provided at a nominal charge on August 14, 17, 18, 21, and 22. Busses will run on a two-hour schedule and will be clearly identified. Airline desks will be informed of the service.

Private planes may land at the University Airport (on campus). From 8:00 a.m. to 8:00 p.m. radio University Airport for landing instructions when within 10 to 15 miles. Beacon and runway lights are on all night. Left-hand landing pattern. Tie-downs and gasoline available.

Highway — Davis is about 14 miles west of Sacramento on Interstate 80 and Interstate 5 (U.S. 99W).

Bus — Greyhound Bus Lines stop regularly at Davis, connecting with the major north-south and east-west routes.

Rail — Southern Pacific provides daily service to and from Portland, Oregon. Southern Pacific and Western Pacific operate trains between Chicago and Sacramento. (One or both of the latter may be discontinued before the meetings!)

Campus Access

The campus operates as a closed campus. Due to street and other construction, some of the streets normally open may be closed. California Avenue, extending through the campus in a north-south direction, will be open.

Parking

A map showing the areas on campus which may be used for parking will be provided in the registration packet.

Parking permits will be issued to registrants driving cars. Lots 7 and 9 are most accessible to the meeting areas and will be available for parking.

Shuttle Bus Service

Shuttle bus service will be provided between 550 Oxford Circle and the meeting area. A map showing the route will be provided in the registration packet.

Taxicab Service

	Phone
Davis Cab	753-7272
J & R Taxi	756-2112

What to Wear

Davis is located in the Sacramento Valley, where daily maximum temperatures average about 95°F in mid-August. There is a normal differential of 40°F between daily maximums and minimums. All living, dining and meeting areas for the Meetings are air-conditioned. If you plan to visit San Francisco or the north coastal area, warm clothing will be needed. San Francisco can be chilly on August evenings.

Recreational Activities

Swimming

For those not staying at 550 Oxford Circle or for those wishing to use the University recreational pool, the rate is 35 cents per person per day. Hours: 11:00 a.m. to 7:00 p.m.

Bowling

The Memorial Union has 16 bowling lanes that will be open from 12:00 noon until 10:00 p.m. daily except Sunday

Golf

There are two full-length, 18-hole, private club courses and one short 18-hole municipal course in the area. Arrangements have been made to permit play on the club courses (except Monday) at usual guest rates.

Ladies' and Family Information

An information and reception desk will be set up at 550 Oxford Circle to assist families with maps, travel information, and information on campus tours, family activities, and nearby places of interest. A ladies' "get acquainted" coffee will be held on Monday, August 19, at 10:00 a.m. at 550 Oxford Circle.

MEDICAL SERVICE

On Campus

Student Health Center (emergency service only); phone 752-2300.

Off Campus

Phone the Davis Medical Exchange, 753-5605 or 756-1344.

CHURCHES

A list of churches in Davis will be available at the Registration Desk. These also are listed in the classified directory of the telephone book.

TOURS OF MECHANIZED PRODUCTION OF FRUITS, VEGETABLES, AND ORNAMENTALS

Several tours are planned for August 15, 16, and 17. Each tour will feature harvesting and production mechanization and will be in major crop production areas of California. All tours are planned with air-conditioned busses.

Vegetable Crops

The two-day vegetable tour to the Salinas area, August 15 and 16, will feature several phases of mechanization in production, harvesting, and packing of lettuce, carrots, celery, broccoli, cauliflower, artichokes, asparagus, onions, and potatoes.

The Saturday morning tour near Davis, August 17, will emphasize mechanized growing and harvesting of processing tomatoes and pickling cucumbers. The afternoon tour will show grape growing and wine production.

Ornamentals

A two-day floriculture, nursery, and landscape tour of the San Francisco Bay and Salinas areas will be held on August 15 and 16. Mechanization in greenhouse production of carnations, chrysanthemums, and roses will feature propagation, bed construction, irrigation, grading, and handling of cut flowers and greenhouse construction and materials. On Saturday morning, August 17, a tour of mechanization of container-grown plants in Sacramento will be followed by a wine and grape production tour in the afternoon.

Fruits and Nuts

The fruit tour, August 16, of the Sutter 'Peach Bowl' will show mechanical cling peach harvesting and equipment used to harvest prunes, walnuts, and almonds. The Saturday tour, August 17, will feature pear tree modification for fresh fruit harvesting with mechanical aids and a general pear production tour of the Sacramento River district. The afternoon portion of the tour will feature grape irrigation and wine production.

Registration for Tour

Payment is to be made when the preregistration form is returned, due July 15. See April *Newsletter* for preregistration form and other tour information.

Refunds and Cancellations

Refunds will be made on cancellations received in writing or by telegram before noon, August 10, 1968.

If any tour is cancelled because of insufficient interest, notification and refund will be made by August 1, along with a list of tours still available.

RIVERSIDE OPEN HOUSE

The Department of Horticultural Sciences and the Department of Vegetable Crops, University of California, Riverside, will hold open house on Tuesday, August 13. Persons with special interests who plan to attend should write in advance directly to the departments involved.

DEPARTMENT DIRECTORY DAVIS CAMPUS

	Phone Number[1]
AGRICULTURAL ECONOMICS 112 Voorhies Hall (81)[2]	752-1514
AGRICULTURAL ENGINEERING 2030 Engineering Bldg. (24)	752-0102
AGRICULTURAL EXTENSION SERVICE Agric. Ext. Bldg. (3)	752-0570
AGRICULTURAL TOXICOLOGY 111 Agric. Toxicology (4)	752-1142
AGRONOMY 131 Hunt Hall (37)	752-1703
BIOCHEMISTRY AND BIOPHYSICS 554 Hutchison Hall (38)	752-0210
BOTANY 143 Robbins Hall (61)	752-0617
ENTOMOLOGY 120 Robbins Hall (61)	752-0475
ENVIRONMENTAL HORTICULTURE Environmental Horticulture (26)	752-0130
FOOD SCIENCE AND TECHNOLOGY 126 Cruess Hall (20)	752-1465
GENETICS 201 Hutchison Hall (38)	752-0200
NEMATOLOGY 223 Hoagland Hall (32)	752-1403
PLANT PATHOLOGY 354 Hutchison Hall (38)	752-0300
POMOLOGY 1035 Wickson Hall (83)	752-0122
SOILS AND PLANT NUTRITION 139-B Hoagland Hall (32)	752-1406
VEGETABLE CROPS 150 Hunt Hall (37)	752-0516
VITICULTURE AND ENOLOGY 1023 Wickson Hall (83)	752-0380
WATER SCIENCE AND ENGINEERING 121 Veihmeyer Hall (80)	752-0453
WEED CONTROL-BOTANY 143 Robbins Hall (61)	752-0612

1. When dialing from a campus phone, dial last five digits.
2. Building number shown on Campus map.

BARBECUES, BREAKFASTS AND BANQUETS

Barbecue

California-style, with a horticultural emphasis, Sunday, August 18. Social hour for all ages at 6:00 p.m. Barbecue for all at 7:00 p.m. Location: Student (Putah Creek) Recreation Lodge. If driving, see lower left corner of campus map for directions. Transportation will be provided, leaving from 550 Oxford Circle. Price, $3.25 per person. Deadline for reservations, July 15.

Administrator's Breakfast

Monday, August 19, at 7:00 a.m. Tercero Dining Commons (74) Room 206-208. $1.75 per person. By invitation only.

Ladies' "Get Acquainted" Coffee

Monday, August 19 at 10:00 a.m. at 550 Oxford Circle the ladies are invited to a "Get Acquainted" Coffee.

Extension Horticulture Banquet

Monday, August 19, at 6:30 p.m. Segundo Annex (63). Tickets, $4.50. Deadline for purchase of tickets, 10:00 a.m., Monday, August 19.

ASHS Banquet

Tuesday, August 20, at Freeborn Hall (28). Social hour at 6:30 p.m.; dinner at 7:30 p.m. Price, $6.00 per person. Deadline for purchasing tickets, 5:00 p.m. Monday, August 19.

MEETINGS

SUNDAY August 18 9:30 a.m.

BOARD OF DIRECTORS
Henry M. Munger, Chairman
Study Library
550 Oxford Circle

MONDAY August 19 4:45 p.m.

WESTERN REGION ASHS
Charles K. Labanauskas, Chairman
Chemistry 179

TUESDAY August 20 4:10 p.m.

ASHS BUSINESS MEETING
Neil W. Stuart, President
Chemistry 194

COMMITTEE MEETINGS

FRIDAY, August 16

6:00 p.m. EDITORIAL COMMITTEE
Sylvan H. Wittwer, Chairman
Emerson Study
550 Oxford Circle

SATURDAY, August 17

2:00 p.m. FINANCE COMMITTEE
John P. Mahlstede, Chairman
Study Library
550 Oxford Circle

6:00 p.m. EDITORIAL COMMITTEE
Sylvan H. Wittwer, Chairman
Emerson Study
550 Oxford Circle

7:00 p.m. EXECUTIVE COMMITTEE
Henry M. Munger, Chairman
Study Library
550 Oxford Circle

SUNDAY, August 18

8:00 a.m. MINERAL NUTRITION OF HORTICULTURAL CROPS COMMITTEE
Alvin L. Kenworthy, Chairman
Breakfast - Dining Room
Meeting - Emerson Study
550 Oxford Circle

9:30 a.m. BOARD OF DIRECTORS
Henry M. Munger, Chairman
Study Library
550 Oxford Circle

10:00 a.m. FRUIT BREEDING COMMITTEE
George D. Oberle, Chairman
Webster Study
550 Oxford Circle

10:00 a.m. BEAUTIFICATION, RECREATION, AND LAND USE COMMITTEE
Eliot C. Roberts, Chairman
Emerson Project Room
550 Oxford Circle

MONDAY, August 19

4:30 p.m. VEGETABLE BREEDING AND VARIETIES COMMITTEE
Dermot P. Coyne, Chairman
Engineering 1132

COLLEGIATE BRANCH ACTIVITIES

SUNDAY

Collegiate Branch members attending the barbecue on Sunday evening, August 18, may plan to eat together. They should assemble at 550 Oxford Circle housing unit at 6:00 p.m. for transportation as a group to Putah Creek Lodge, the site of the barbecue.

The Collegiate Branch Business Meeting will be held in the Study Library at 550 Oxford Circle on Sunday, August 18, immediately after the barbecue. Group transportation back to Oxford Circle from the barbecue will be provided.

MONDAY

Collegiate Branch - Student Papers Session, 1:15 p.m. Monday, 1066 Engineering Building.

Check at Information Desk for other activities.

SPECIAL SESSIONS

	Session Number
PLENARY SESSION	
Monday, 8:30 a.m.	(1)
PRESIDENT'S MESSAGE Chemistry 194	
GENERAL SESSIONS	
Tuesday, 8:30 a.m.	
EVALUATION OF UNIVERSITY TEACHING OF BIOLOGY Chemistry 179	(15)
PHYTOTRONS: TOOLS FOR HORTICULTURAL RESEARCH Engineering 2129	(16)
THE PLANT HORMONES– SOME ADVANCES AND SOME MOOT QUESTIONS Chemistry 194	(17)
Wednesday, 8:30 a.m.	
CONCEPT OF YIELD IN HORTICULTURE Chemistry 179	(29)
CELL AND ORGAN CULTURE IN HORTICULTURAL RESEARCH Engineering 2129	(30)
MECHANIZATION IN AGRICULTURE Chemistry 194	(31)

SYMPOSIA

	Session Number
Monday, 9:45 a.m.	
POTASSIUM IN HORTICULTURE Chemistry 194	(2)
Monday, 1:30 p.m.	
HORTICULTURAL PLANT BREEDING I Chemistry 194	(10)
Tuesday, 9:30 a.m.	
CHEMICAL REGULATION OF PLANT PROCESSES Chemistry 194	(18)
Tuesday, 1:30 p.m.	
HORTICULTURAL PLANT BREEDING II Chemistry 194	(26)
NATURE, MECHANISMS AND CONTROL OF RIPENING Chemistry 179	(27)
Wednesday, 9:30 a.m.	
MECHANIZED GROWING AND HARVESTING OF FRUIT AND VEGETABLE CROPS Chemistry 194	(32)

CONTRIBUTED PAPER SESSIONS

Each paper is scheduled to have 12 minutes for presentation and 3 minutes for discussion.

Each session will have a timer to assist the presiding chairman. Each speaker will be given a one-minute warning before his time is up. Each speaker is requested to cooperate so the sessions will be kept on schedule.

If a scheduled paper is not presented, the time will be used for discussion or a recess. Papers are to be presented when scheduled.

A 2" x 2" slide projector will be provided. Please give your slides to the projectionist before your presentation.

One person is to present not more than two contributed papers. He must be the author or coauthor of the papers presented.

ROOMS FOR RELAXING AND CHATTING

A room in each building is available during meeting recesses and at other times for relaxing and chatting with your colleagues. They are:

Chemistry 176
Engineering 1134

Should you have refreshments in these rooms, please help keep them clean by placing refuse in the containers provided.

REFRESHMENTS

Refreshments will be available in the lobbies in the Chemistry Building (17) near room 176 and in the Engineering Building (24) from 9:15 a.m. to 4 p.m. Monday through Wednesday.

Other Snack bars on campus include:

	Sun.	Mon.-Fri.
Memorial Union (45)	10:00-5:00	8:00-5:00
Silo Fountain (64)		8:30-4:00

SUNDAY AFTERNOON

DEPARTMENTAL OPEN HOUSES, EXHIBITS AND CAMPUS TOUR

4:00 RESEARCH HIGHLIGHTS TOUR

Leaves from 550 Oxford Circle

Elephant train tour of research facilities and developments with stops and discussions to learn about

1) Precision planting and harvesting equipment
   Department of Agricultural Engineering
2) Latest developments in wine making
   Department of Viticulture and Enology
3) Canning peaches in research pilot plant
   Department of Food Science and Technology
4) Rotating phytotron using natural and artificial light
   New greenhouse area
5) Controlled-temperature facilities
   Mann Laboratory - Department of Vegetable Crops

4:00-6:00 DEPARTMENTAL OPEN HOUSES

Nine departments will be open for visits with their staffs and for seeing exhibits or research of interest. These include:

Department	*Building*	*Map Location*
Agricultural Engineering	Engineering (Courtyard)	(24)
Agricultural Toxicology	Agr. Toxicology	(4)
Environmental Horticulture	Env. Hort.	(26)
Food Science and Technology	Cruess Hall	(20)
Pomology	Wickson Hall	(83)
Soils and Plant Nutrition	Hoagland Hall	(32)
Vegetable Crops	Mann Lab.	(42)
Viticulture and Enology	Wickson Hall	(83)
Water Science and Engineering	Veihmeyer Hall	(80)

SUNDAY EVENING

6:00 BARBECUE

Student (Putah Creek) Recreation Lodge
Transportation from 550 Oxford Circle
6:00 Social hour (all ages)
7:00 Barbecue

8:00 SPECIAL DISCUSSION:

PLANT PATENTS AND ALTERNATE METHODS OF BREEDER PROTECTION (Primarily sexually propagated plants)
Chemistry 179

Presiding: Henry M. Munger, Chairman
Board of Directors, ASHS
Cornell University
Ithaca, New York

Panel: Charles M. Jones
Department of Horticulture
Purdue University
Lafayette, Indiana

William Pardee, Director
International Crop Improvement Association, and Member of ASTA Subcommittee on Breeders Rights
Department of Plant Breeding and Biometry
Cornell University
Ithaca, New York

M. C. Parker, Research Director
Gallatin Valley Seed Co.
Twin Falls, Idaho

Allenby White, Chairman
ASTA Breeders Rights Study Committee
Vice President for Research
Northrup, King and Co.
Minneapolis, Minnesota

Interested persons are invited to attend and participate.

8:00 COLLEGIATE BRANCH MEETING

Study Library
550 Oxford Circle

Additional copies of this Program-Abstracts Insert are available as separates, and may be ordered by mail at $1.25 per copy (including postage) either before or after the Annual Meeting from the Society's headquarters office: American Society for Horticultural Science, P. O. Box 109, St. Joseph, Michigan 49085, USA.

(1) PLENARY SESSION
Chemistry 194

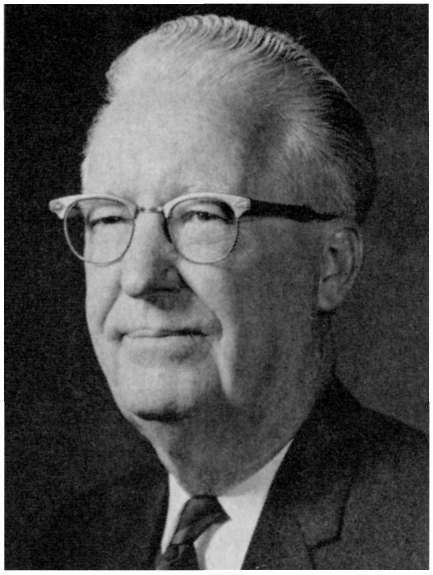
Presiding: Edward C. Maxie, General Chairman, 1968 Meeting, University of California, Davis

8:30 Welcome to California and its University

James H. Meyer, Dean
College of Agricultural and Environmental Sciences
University of California, Davis

President's Message:
THE CHALLENGE TO HORTICULTURE **1**

Neil W. Stuart, President
American Society for Horticultural Science
Crops Research Division, ARS, USDA
Plant Industry Station,
Beltsville, Maryland



Neil W. Stuart was born in 1908 on a fruit and dairy farm in southwestern Michigan. He took a BS degree at Michigan State College in 1929 with a major in horticulture. After teaching vocational agriculture for a year he entered the University of New Hampshire earning an MS in 1932 with major work in horticulture and agricultural chemistry. Stuart then went to the University of Maryland to take a PhD in plant physiology in 1934. He worked in the Maryland Agricultural Experiment station for 2 years, then joined the U. S. Department of Agriculture staff at Beltsville, Maryland. His major research has been in cold hardiness, plant propagation, nutrition and soilless culture and the effect of temperature and light on the storage and forcing of flower bulbs. He pioneered in the application of growth regulating chemicals to hydrangeas, azaleas, and other flowering plants and is continuing this line of work at Beltsville at the present time.

Seven Concurrent Sessions

(2) SYMPOSIUM: POTASSIUM IN HORTICULTURE
Chemistry 194

Sponsored by: Mineral Nutrition Committee, ASHS
Presiding: A. L. Kenworthy, Chairman, Mineral Nutrition Committee, ASHS, Michigan State University, East Lansing.

9:45 **Potassium in Relation to Food Production** **2**
Roger P. Humbert, Vice President, American Potash Institute and Foundation for International Potash Research, Los Gatos, California.

POTASSIUM NEEDS, DIAGNOSIS AND USE

10:30 **Subtropical Fruits** **3**
W. W. Jones, Department of Horticulture Science, University of California, Riverside.

10:50 **Deciduous Fruits, Including Small Fruits** **4**
C. G. Forshey, Cornell University, Hudson Valley Laboratory, Highland, New York.

11:10 **Vegetable Crops** **5**
Gerald E. Wilcox, Department of Horticulture, Purdue University, Lafayette, Indiana.

11:30 **Floriculture Crops** **6**
James W. Boodley, Department of Floriculture and Ornamental Horticulture, Cornell University, Ithaca, New York.

11:50 **Landscape Plants** **7**
Harold Davidson, Department of Horticulture, Michigan State University, East Lansing.

12:10 **Summary-Discussion** **8**
S. MacCallum King, Mgr., Fert.-Crops System Research, Int. Mineral and Chem. Corp., Libertyville, Illinois.

12:30 **Adjourn**

(3) POSTHARVEST HORTICULTURE: MODIFIED ATMOSPHERES
Chemistry 166

Presiding: D. V. Fisher, Chairman, Postharvest Horticulture Section, ASHS, Canada Department of Agriculture, Summerland, British Columbia.

9:45 **The Influence of Storage Atmosphere and Temperatures on Seed Potato Physiology and Performance. 9**
Workman, Milton N., and **James Twomey,** Colorado State Univ., Fort Collins.

Russet Burbank seed potatoes, 4 to 6 ounces in weight, were stored at 0° and 5°C in various levels of O_2 and CO_2. Periodically during the storage season samples were removed for observation of sprouting behavior, bud and parenchyma tissue respiration measurements and determination of the rate of leakage of electrolytes from tissue sections. The performance of the seed potatoes remaining at the end of storage was evaluated in randomized complete block field trials. The degree of CO_2 toxicity was increased by decreasing the O_2 concentration and the temperature of the storage environment. Generally, a progressive reduction in performance with increases in storage CO_2 did not occur. Rather an abrupt drop from excellent performance to failure resulted. Beginning toxicity during the storage season could occasionally be detected by an increase in the rate of CO_2 evolution from potato buds and an increase in electrolyte leakage.

10:00 Controlled Atmosphere Storage Studies with Sweet Potatoes. 10

Mattus, George E., and **F. M. Hassan,** Virginia Polytechnic Inst., Blacksburg.

Several cultivars of sweet potatoes were held as test lots under different levels of controlled atmospheres (CA). Cured and uncured roots were held in refrigerated CA rooms and in non-CA refrigerated rooms. Sweet potatoes stored at above 10% CO_2 or below 7% O_2 often developed alcoholic or off-flavors. Roots at 2 to 3% CO_2 and 7% O_2 were better than check roots as indicated by percent of acceptable tasting roots and lower total losses due to decay, weight loss, and dry matter loss. Centennial and Jersey benefited most from CA storage. Porto Rico and Goldrush benefited to a lesser extent but Oklamar and Nemagold did not respond well to CA. Decay losses were greatest for uncured roots that were not held in CA storage.

10:15 Growth and Respiration of Topped Radishes in Low Oxygen Atmospheres as Affected by Partial and Total Pressures. 11

Dewey, D. H., L. L. Morris, and **D. H. Appert,** Michigan State Univ., East Lansing, and Univ. of California, Davis.

Topped radish roots of market maturity were held at 15°C in subnormal oxygen tensions developed by manipulation of partial and total pressures. Growth of new tops from lateral buds and of root hairs was measured after 1 week; carbon dioxide evolution was measured daily for the treatments at one and two atmospheres and oxygen consumption was measured occasionally for all total pressures. Growth was reduced by decreasing the partial pressure of oxygen. Minimum growth occurred in the lowest oxygen partial pressure (7.6 mm Hg) at a total pressure of 2 atmospheres. For a given partial pressure, growth was enhanced by decreasing total pressure to 0.5 atmosphere and was reduced by increasing the pressure to 2 atmospheres. Respiratory activity was affected primarily by the partial pressure of oxygen. The growth results suggest the presence of a gaseous inhibitor, possibly ethylene, which is concentrated by a high and diluted by a low atmospheric pressure.

10:30 Modified Atmosphere Storage of Danish Cabbage. 12

Isenberg, Francis M., and **Robert M. Sayles,** Cornell Univ., Ithaca, New York.

Danish cabbage was stored for several years from late November until April at 32° F. and in various combinations CO_2, O_2 and N_2. The best combinations of gas mixtures ranged between 2½ to 5 per cent of O_2 and CO_2 with N_2 making up the remainder. These combinations reduced weight loss due to respiration and also trimming loss. In atmospheres of low O_2 and CO_2 tension, heads retained their green color, were succulent and firm, and remained dormant longer. Very low O_2 and CO_2 treatments had a sweeter taste than normal cabbage, while treatments with slightly higher CO_2 had more pungent tastes characteristic of fresh cabbage. Treatments with 7½% O_2 and air checks were bland in taste. Color data were recorded by Hunter Color Difference Meter. Semi-commercial tests were tried one year using a propane gas generator. These results were similar to laboratory results.

10:45 Recess

11:00 Response of Celery to Controlled Atmospheres under Simulated Transport Conditions. 13

Morris, L. L., and **D. Janecke,** Univ. of California, Davis.

In a series of experiments, celery was subjected to levels of O_2 from 0 to 21%, and levels of CO_2 up to 20%, under conditions of time and temperature simulating commercial transport. A reduced O_2 concentration, below 5%, can have slight benefit in extending shelf life. Very low levels, below 1%, can be harmful especially at the higher transit temperatures. Increased CO_2 can appear to be beneficial at the termination of the transit period but injury is likely to become apparent with subsequent holding in air. Respiration measurements were made with the celery under CA and after its transfer to air. Comparisons of intact stalks and segmented petioles were made. The results point more toward limitations than to promise for the commercial use of CA during transport of celery.

11:15 Further Studies on Controlled Atmosphere Storage of Bartlett Pears. 14

Claypool, L. L., Univ. of California, Davis.

First pick Bartlett pears ranging in individual firmness between 16.5 and 20 pounds were fully tolerant for 6 months to an atmosphere containing 1% O_2 and 5% CO_2. Fruit harvested from the same trees 12 days later were mostly tolerant to the same atmosphere, except for a percentage corresponding roughly to those fruits approximating 15 pounds or less. Pears harvested an additional 9 days later and only slightly softer were intolerant to elevated CO_2. Flesh firmness tests at advanced stages of maturity did not relate sufficiently to differences in physiological status to be useful. Favorable response to 0.5% O_2 without elevated CO_2 was obtained at all maturity levels. Storage life for the best lots in 0.5% O_2 were a little less than for the best lots in 1% O_2, 5% CO_2.

11:30 Controlled Atmosphere Storage Effects on Ripening and Decay of Tomatoes. 15

Parsons, C. S., and **R. E. Anderson,** Agricultural Research Service, Beltsville, Maryland.

Ripening of mature-green tomatoes stored in an atmosphere containing 3% O_2, with or without 5% CO_2, was inhibited during 3 and 6 weeks' storage at 55° F. (12.8° C.). Fruits stored in air at 55° ripened to a pink or red color in 3 weeks. Tomatoes removed from the low-oxygen atmospheres ripened to a full red color in 2 weeks at 65° (18.3° C.) and had a normal flavor. Decay during ripening at 65° was most rapid in air-stored fruits. Tomatoes previously held in 3% O_2 with 5% CO_2 decayed more rapidly than tomatoes held in 3% O_2 without CO_2. Some injury developed in tomatoes stored 6 and 9 weeks at 55° in 3% O_2 with 5% CO_2 but not in 3% O_2 without CO_2. Immersing tomatoes for two minutes in 125° water after 3 weeks storage at 55° reduced the amount of decay during ripening at 65°.

11:45 Effects of Oxygen and Ethylene Levels on Color Changes of Citrus During Degreening. 16

Jahn, Otto L., and **William G. Chance, Jr.,** USDA, Orlando, Florida.

A series of tests was run between September and December 1967 relating various oxygen and ethylene levels to chlorophyll changes in Hamlin oranges and several other citrus fruits. Generally increasing O_2 levels from 10 to 50% or ethylene levels from 0 to 50 ppm increased the rate of color change. No additional response was evident from ethylene levels between 50 and 20,000 ppm, and no consistent additive response of ethylene and oxygen was apparent. The color responses were influenced by temperature, variety, and the length of the degreening period.

EXTENSION HORTICULTURE BANQUET

6:30 Monday

Segundo Annex, UCD Campus

(Ticket deadline 10:00 a.m. Monday)

(4) FRUIT AND VEGETABLE CROPS: NATURAL AND INDUCED ABSCISSION

Chemistry 179

Presiding: M. J. Bukovac, Michigan State Univ., East Lansing.

9:45 Chemical Promotion of Cherry Fruit Abscission. 17

Bukovac, M. J., and **R. P. Larsen,** and **C. E. Kesner,** Michigan State Univ., East Lansing.

Influence of salicylic acid (500 ppm), ascorbic acid (2%), iodoacetic acid (300 ppm) and Amchem 66-329 (500-4000 ppm) was established on promotion of fruit abscission. Only a slight reduction in fruit separation force was observed with salicylic, ascorbic, and iodoacetic acids. Marked foliage injury and leaf abscission was induced with iodoacetic acid. Amchem 66-329 reduced force necessary to separate the fruit from its pedicel by 70% at 2000 and 4000 ppm. Maximum promotion of fruit abscission occurred 10 to 15 days after treatment. Some leaf abscission was noted on basal portions of current seasons growth, old spurs and weak wood on the interior of the tree. Exudation from lenticels and pruning wounds occurred on trees sprayed with higher concentrations — more exudation on trees of low than high vigor. This chemical, in an aqueous medium, degrades to ethylene and the rate of ethylene release was markedly enhanced as the pH was increased.

10:00 Abscission Layer Development in the Sour Cherry (*Prunus cerasus* L.) 18

Stosser, R., and **H. P. Rasmussen,** and **M. J. Bukovac,** Michigan State Univ., East Lansing.

Abscission layer formation in the sour cherry during fruit maturation occurred between the fruit and the pedicel but not between the pedicel and the spur. First visual evidence of abscission layer formation was 10 to 12 days before maturity. The layer was composed of 5 to 8 rows of cells in the transition zone between the fruit and pedicel and was first identified by a loss in affinity for hematoxylin. This was followed by cell separation without rupturing of cell walls. Later cell wall collapse was apparent. Walls of those cells immediately distal and proximal to the line of separation were characterized by being thinner and these cells were prone to separate easily. No abscission layer was apparent through the vascular bundles and no cell division was noted during fruit separation.

10:15 The Distribution of an Inhibitor Similar to Abscisic Acid in Young Fruits of Peach and Cherry. 19

Davison, R. M., and **M. J. Bukovac,** Michigan State Univ., East Lansing.

An acidic inhibitor which appears identical with abscisic acid when compared in various solvent systems on silica gel thin layers (Rf 0•25-0•40 in butanol/NH_4OHx1/100, 5:1, Rf •45-0•55 in isopropanol/NH_4OH/H_2O, 10:1:1; Rf 0•60-0•80 in butanol/acetic acid/H_2O, 4:5:1) is present at comparable levels in seed, endocarp and mesocarp tissues of peach fruitlets, and in seed and cortex of cherry fruitlets tested at early stages of development before pit hardening. This pattern of distribution contrasts with known patterns of distribution of growth promoting substances in these same tissues. Inhibitor levels assayed by the wheat coleoptile section test after elution of active regions from chromatograms indicate activity equivalent to 1-2 μg abscisic acid per gram dry weight of tissue.

10:30 Influence of Some Weak Acids on Abscission of Citrus Fruits. 20

Wilson, W. C., and **R. H. Biggs,** Univ. of Florida, Lake Alfred.

Ascorbic acid and several other weak acids promoted the abscission of citrus fruits under field conditions when concentrations from 1-4% (10,000-40,000 ppm) were sprayed on the entire tree. Preferential action of acids inducing greater fruit abscission than leaf abscission was

the general pattern. When acids were buffered, there was a decreased effectiveness of the chemical on fruit abscission and pitting. Since injury will induce ethylene production by fruits, and there were similarities between the action of ethylene and the acids, attempts were made to determine whether the acids were acting via injury with subsequent increases in ethylene production or through other mechanisms.

10:45 Induction of Berry Anscission in *Vitis vinifera* by Morphactins. 21

Weaver, Robert J., and **Robert M. Pool,** Univ. of California, Davis.

Two derivatives of fluorene-9-carboxylic acid, termed morphactins, were tested on both seeded (Muscat of Alexandria) and seedless (Thompson Seedless and Black Corinth) grapes. Berry abscission was induced when the compounds were applied at the fruit-set stage or two weeks later. When morphactins were applied near maturity, no berry drop occurred, but the strength of berry attachment was reduced. An auxin (4-CPA) counteracted the morphactin response indicating that the morphactin response may involve auxin metabolism.

11:00 Recess

11:15 Regulation of Growth, Flowering and Fruit Abscission of Apples and Peaches with Amchem 66-329. 22

Edgerton, L. J., and **W. J. Greenhalgh,** Cornell Univ., Ithaca, New York.

A new growth regulator Amchem 66-329 was applied to apple and peach branches or young trees at several stages of development from prebloom to harvest. Application at 1000 to 2000 ppm during the prebloom to early post bloom stages virtually eliminated all fruit with little or no phytotoxicity. Vegetative growth was checked and flower bud formation promoted in some cases. From one week after bloom to four weeks after bloom fruit set could be reduced but it was not possible to eliminate the fruit in all cases without phytotoxicity. Application from then until a few weeks before maturity had little effect on abscission. Fruit abscission at maturity was promoted with application of Amchem 66-329.

11:30 Concentrate Spray-thinning of Apples. 23

Thompson, A. H., and **B. L. Rogers,** Univ. of Maryland, College Park.

Several field experiments from 1963 to 1967, largely on Rome Beauty variety, indicated that Sevin at concentrations ranging from dilute (1 lb/100 gallons 50% powder) to 33X effectively thinned with no significant variation among spray treatments. Incorporation of standard pesticides for the season in like concentration with Sevin did not alter thinning results. Concentration of a standard NAA treatment at 3X and 6X produced the same significant thinning as the dilute spray on Golden Delicious. Dilute and concentrate spray thinning is often hard to estimate visually. Fruit volume at harvest is shown to be a sensitive index of thinning response, and differences in harvest volume can be picked up fairly early in the season with reliability. The wide latitude of Sevin as a thinner is underlined.

11:45 Chemical Abscission of Tomato Flowers. 24

Collin, George H., Hort. Res. Inst. of Ontario, Simcoe, Canada.

Two chemicals, propanil (33% emulsifiable concentrate of 3, 4-dichloropropionanilide) and Amchem 66-329 were tested for promoting abscission of tomato flowers. In the field, applications to remove the first flowers compacted harvest pattern and increased total yield. In the greenhouse a standard technique was used to measure abscission activity; water solutions of propanil and Amchem 66-329 were applied to the pedicel of pollinated tomato flowers and either fruit set or flower drop was recorded. Dilute concentrations of propanil, 500 to 1000 ppm, caused flower abscission. Amchem 66-329 caused flower

abscission and retarded fruit development at 50 to 100 ppm. Abscission following the application of propanil and Amchem 66-329 was influenced by fruit load and temperature. Application of propanil or Amchem 66-329 to expanding leaves resulted in flower abscission. Their effects were similar whether applied to the pedicel or leaf.

12:00 Stimulation of Flower Bud Abscission and Concencentration of Fruit Set in Tomato. 25

Garrison, Stephen A., and **George A. Taylor,** Rutgers Univ., New Brunswick, New Jersey.

In greenhouse experiments, tomato plants with fruits and flowers (Expt. I) or flowers (Expt. II) in the first cluster were sprayed to runoff with 0, 250, 500, 1000 or 2000 ppm Amchem 66-329. The number of flower buds abscissed in the first three clusters was recorded 10 days after applying the chemical. Amchem 66-329 at concentrations of 500 ppm, 1000, and 2000 ppm produced 63, 71 and 85% flower bud abscission, respectively. The higher rates (1000 and 2000 ppm) of 66-329 caused severe epinasty of the leaves and stimulated senescence of the older leaves. These effects are similar to the effects of ethylene on tomato plants. At 500 ppm, Amchem 66-329 stimulated flower bud abscission but produced only moderate epinastic effects. Amchem 66-329 could be useful in concentrating fruit set of tomato and other crops.

(5) FRUIT: BREEDING AND GENETICS

Engineering 1120

Presiding: Thomas K. Toyama, Irrigation Exp. Sta., Prosser, Washington.

9:45 Genetic Control of Chilling Requirements of Almond and Almond Hybrid Seeds. 26

Kester, Dale E., Univ. of California, Davis.

Populations of seeds were produced by controlled crosses among almond and peach varieties with different chilling requirements. Seeds were stratified individually at 50°F. The chilling requirement of an individual seed was considered as the time between the start of stratification and time that significant radicle elongation occurred. Chilling requirement of seed populations was affected by both maternal and paternal parent. The greater the chilling requirements of the parents, the longer the stratification time was required in the resulting seeds. Use of different pollen parents with the same seed parent caused increases in stratification time of one to two months. Two late blooming mutants of 'Nonpareil,' when used as parents, had the same effect on seed chilling requirement as 'Nonpareil'.

10:00 Some Characteristics of *Prunus* Introductions of Interest in Almond Breeding. 27

Warfield, David L., and **Dale E. Kester,** Univ. of California, Davis.

Individual clones and seedling populations of several *Prunus* introductions have been studied that have almond-like characteristics but are sufficiently morphologically distinct from known almond cultivars to be listed as separate "species." High crossability has been found between eight such supposed "species" and almond cultivars. One introduction from Yugoslavia is interesting for almond breeding because of late bloom, early ripening, small tree and nut size and desirable kernel appearance although its tree growth habit, thorniness and kernel bitterness would be undesirable. Seedling characteristics of F_1 hybrids between the latter group and almond cultivars are intermediate between the parents.

10:15 Breeding Peaches for Root-knot Nematode Resistance. 28

Sharpe, Ralph H., and **C. O. Hesse, B. F. Lownsberry,** and **C. J. Hansen,** Univ. of Florida, Gainesville, Univ. of California, Davis.

Five peach rootstock selections show immunity to root-knot nematode diseases caused by *Meloidogyne incognita* (Kofoid and White) Chitwood and *M. javanica* (Treub) Chitwood. These are the first peach rootstocks which remain free from galls when exposed to both these root-knot nematode species. They are derived from a 1949 cross in Chico, California of *Prunus davidiana* with a Chinese peach. A new species or strain of root-knot nematode has been discovered in Florida which will cause root-knot disease in these selections.

10:30 Segregation Patterns for Fire Blight Resistance in *Pyrus*. 29

Layne, R. E. C., and **L. F. Hough,** and **Catherine H. Bailey,** Canada Dept. of Agriculture, Harrow, Ontario, Rutgers Univ., New Brunswick, New Jersey.

Intraspecific and interspecific hybrids of *P. communis* L., *P. serotina* Rehd., and *P. ussuriensis* Maxim., having high, intermediate or low levels of resistance to fire blight (*Erwinia amylovora*) were compared for ability to transmit resistance to their offspring. Continuous distributions rather than discontinuous segregation were obtained among all seedling progenies regardless of species source or level of resistance. Some segregation patterns were suggestive of qualitative inheritance while others were more representative of quantitative inheritance. More than one type of segregation pattern was associated with each species source of resistance but none was specific for a particular species. The breeding value of the most prepotent *P. communis* sources was considered to be superior to the other two species sources in view of the larger size and higher quality of fruit associated with *P. communis*.

10:45 Increased Reversion of an Apple Sport Following X Irradiation and Pruning. 30

Pratt, Charlotte, and **D. K. Pireclu,** New York Exp. Sta., Geneva.

Dormant scions of a spontaneous sport of Rhode Island Greening with furrowed fruits, which tends to produce a few Greening-type fruits, were exposed to 0, 2000, or 3000 rads of gamma rays and topworked in 1963. Half the scions were pruned to the basal 1-2 buds or to growth abnormalities in 1964. The fruits harvested from each scion in 1965-1967 were classified as furrowed or unfurrowed. The percentages of scions producing nonfurrowed fruits wholly or partially were as follows: in the non-pruned group, 25% of the controls, 61% and 100% of the irradiated scions; in the pruned group, 55% of the controls, 90% and 100% of the irradiated scions. Thus, severe pruning stimulated the breaking-up of a probable chimera either following a low radiation dose or alone. It appears to be another tool for the detection of chimeral sports.

11:00 Recess

11:15 Breeding and Instron Evaluation of Strawberry Firmness. 31

Ourecky, Donald K., and **M. C. Bourne,** New York Exp. Sta., Geneva.

Strawberry skin toughness and flesh firmness were determined by the use of an Instron for a wide range of cultivars and selections. The Instron recorded a force-distance curve as a Dunkley cherry pitter, with a flat face, was driven synchronously through the fruit. Three distinct peaks in the curves indicated force required to break through the skin, fibrous nature of the flesh and core and total resistance to puncture. Tennessee Shipper and Redglow were the original sources of firmness for N.Y. 254 and N.Y. 844, respectively, used in the breeding program.

These selections transmit firmness in high percentages to their progeny. The influence of temperature upon strawberry skin and flesh is correlated with firmness. Firm fleshed clones decrease in firmness more rapidly than soft-fleshed clones as fruit temperature increases. Size of fruit and state of maturity significantly influence skin toughness and flesh firmness.

11:30 Genetic Sources of Winter Hardiness in Grapes. 32

Markarian, Deran, Curtice-Burns, Inc., Rochester, New York.

The intent of this study was to identify sources of hardiness suitable for variety development in the Northeastern United States. Approximately 400 seedlings each of 55 varieties were evaluated for 5 years under field conditions at East Lansing, Michigan. Ten varieties provided progenies in numbers sufficient to indicate usable background levels of hardiness. Considering the low recovery of hardy seedlings, the results suggest efforts to recover higher levels of hardiness and improved types through crosses between the varieties of highest resistance offer the best probability for success.

11:45 Fertility of Advanced Generations of *Vinifera-rotundifolia* Hybrids. 33

Olmo, Harold P., Univ. of California, Davis.

Seedlings grown from backcrossing of hybrid *vinifera* x *rotundifolia* to *vinifera* have yielded very fertile vines of good fruit quality. Transfer of genetic factors for disease and insect resistance appears possible in advanced generations, with the good fruit quality of *vinifera* retained.

12:00 Methods of Handling *Vitis rotundifolia* Seed in a Muscadine Grape Breeding Program. 34

Nesbitt, W. B., North Carolina State Univ., Raleigh.

A split-plot, complete factorial, experiment was designed to test the effects of direct planting or stratification in sand or stratification in polyethylene bags for 5 weeks in combination with 10 seed treatments on open pollinated seed of two cultivars of *V. rotundifolia*. The seed treatments were a ferban dip, Phygen XL dust, Cerasan M dust, soaks of 5, 20 and 60 minutes in 50% HCl, scarification in concentrated H_2SO_4 for 15, 30, and 45 minutes, and the check. In general, the best combination was separation by fermentation, treatment with 50% HCl for 20 minutes and stratification in sand for 5 weeks or longer before planting because of rapid emergence, good germination, and reduction in disease.

12:15 Paper Withdrawn 35

(6) VEGETABLE CROPS: CULTURE

Engineering 2129

Presiding: John D. Downes, Michigan State Univ., East Lansing.

9:45 Vegetative Propagation of Mature Asparagus Plants. 36

Andreassen, David C., and **J. Howard Ellison,** Rutgers, New Brunswick, New Jersey.

Meristem cuttings were made from lateral branches of shoots from mature asparagus plants before cladophylls developed. After being sterilized, the cuttings were cultured aseptically on a Murashige and Skoog nutrient agar, modified by Takatori, Murashige, and Stillman, at 25°C in the dark. A thin ring of callus formed at the base of the cuttings within two weeks. Root initials developed from the callus a week later. After four weeks the cuttings were subcultured aseptically on an auxin-free nutrient agar in the light. The roots continued to grow and, as new shoots developed cladophylls, the plantlets

were transferred to an aerated water culture tank, where the tops hardened off. The plants were potted in a sterile humus soil, where normal growth continued. This technique will permit the production of high quality clonal hybrid seed on a commercial scale.

10:00 Asparagus Yields and Size of Planted Crown. 37

Downes, J. D., and **Knudt J. Miller,** Michigan State Univ., East Lansing.

Crowns of Cal. 309 varying in weight from 5 to 100 g planted in 1964 produced an average 22 lbs/A yield increase with each 10 g increase in crown size in 1966. In 1967 an average of 74 lbs/A increase in yield per 10 g increase in crown size was obtained. Spears greater than ⅜″ in diameter accounted for 72% of harvested spear numbers but also accounted for 83% of harvested weight in 1967. In 1967 average number of harvested spears varied from 8 to 24 per crown, with an average increase of 0.51 spears/crown/10 gm increase in weight of crown planted in 1964.

10:15 Influence of Asphalt Moisture Barriers on Yield of Vegetable Crops on Lakeland Fine Sand. 38

Saxena, Gopal K., and **Luther C. Hammond,** and **Hosea W. Lundy,** Univ. of Florida, Gainesville.

Asphalt moisture barriers placed at a depth of 24 inches in well-drained Lakeland fine sand increased soil moisture storage and the yield of most vegetables during spring and fall of 1967 and spring of 1968. Crops included were snap beans, Southern peas, summer squash, cucumbers, sweet corn, sweet potatoes, Irish potatoes, bell peppers, cabbage, onions, tomatoes and eggplant. With summer squash, cucumbers, sweet corn, and eggplants, plant population was included as a variable, whereas with snap beans, sweet potatoes, bell peppers, cabbage and tomatoes three rates of fertilization were included. The effectiveness of the barrier in increasing crop yields was enhanced with irrigation, higher plant population and fertilization rate increments.

10:30 The Effects of Root Sectioning and Chemicals on Sweet Potato Plant Production. 39

Whatley, Booker T., Southern Univ., Baton Rouge, Louisiana.

Roots of the 'Centennial' Variety of *Ipomoea Batatas* were sectioned and treated with Captan, DMSO, Semesan Bel and combinations of these chemicals using 5 soaking intervals. A 5 x 4 x 5 factorial arrangement of treatments in a randomized block design with 3 replications was used. A significant difference was found between chemicals and number of plants and mean weight of plants produced. Combinations of chemicals were better in both cases than chemicals used independently. DMSO yield significantly more plants than Captan or Semesan Bel, however the 3 single chemicals gave plants of equal average weight. Number and weight of plants obtained from DMSO x Captan and DMSO x Semesan Bel were not significantly different. Whole roots produced a greater number and a higher average weight of plants than individual sections. The middle section gave significantly more plants than the end. Soaking time had no effect upon number of plants or average weight of plants.

10:45 Performance of Tomato Cultivars After Various Types of Transplant Clipping. 40

Jaworski, C. A., and **R. E. Webb, G. E. Wilcox,** and **S. A. Garrison,** USDA, Tifton, Georgia and Beltsville, Maryland, Purdue Univ., Lafayette, Indiana, and Rutgers Univ., New Brunswick, New Jersey.

The performance of H-1350, H-1409, C-17, Fireball, and Roma tomato transplants that received different clipping treatments at Tifton, Georgia were evaluated at Lafayette, Indiana and the Plant Industry Station. Field-grown transplants were left unclipped, control clipped (1 inch of growth removed, terminal bud left intact), or moderately

clipped (terminal bud and flower cluster removed). Moderately clipped transplants of the five cultivars performed as well as non-clipped plants, but control-clipped transplants produced significantly lower yields than moderately clipped transplants. At Rutgers University, moderately clipped C-17 transplants produced significantly lower yields than non-clipped plants. Most of the data in this study and in recently published reports indicate that moderately clipped transplants perform as well as non-clipped transplants.

11:00 Recess

11:15 Premature Heading of Broccoli Varieties as Affected by Transplant Size. 41

Baggett, J. R., and **H. J. Mack,** Oregon State Univ., Corvallis.

Premature production of small, unusable head in broccoli (*Brassica oleracea* var. *italica*) was strongly influenced by size of transplant and by variety. Large transplants (fresh weight about 35 g/plant) produced up to 100% premature heads in Coastal, the most susceptible variety used. Medium size transplants (about 12 g/plant) usually produced about 50% premature heads, while small transplants (about 4 g/plant) usually produced less than 25%. In Northwest Waltham the % of premature heads generally ranged from 0 to 25%. Transplant size rather than age appeared to be the determining factor. No major effects on premature heading were obtained from nitrogen rates or planting dates.

11:30 The Chronological and Morphological Time of Reproductive Development of the Apical Meristem of *Brassica Oleracea* Var. *Italica*. cv. Coastal. 42

Gauss, James F., and **George A. Taylor,** Rutgers Univ., New Brunswick, New Jersey.

Various histological criteria were employed in studying the chronological and morphological development of the apex of field-grown plants of *Brassica oleracea* var *italica*, cv. Coastal. The earliest evidence of reproductive differentiation was five weeks after sowing or at the time of macroscopic appearance and unfolding of the eighth true leaf. First order floral stalks began to appear at seven weeks or at the time of macroscopic appearance of the 14th true leaf. Thus the time interval for the transition from a vegetative to a reproductive apex appears to be approximately two weeks under field conditions. By nine weeeks second order floral stalk initiation and hence button formation predominated.

11:45 Dormancy of Onion Sets as Influenced by Irradiation, Gibberellin and Temperature Treatments. 43

Hopen, H. J., and **R. R. Dedolph, W. F. Whiteside,** and **W. Chorney,** Univ. of Illinois, and Argonne Nat. Lab., Washington, D. C.

Freshly harvested onion sets were irradiated (0 through 12,800 Rad, Cobalt 60 source) and held for short periods at 5, 25, and 45° C. They were also treated with K-gibberellate (A_3) at 0, 10, 100, and 1000 ppm concentration to assess the effects of these treatments on dormancy as indexed by greenhouse studies in 1966 and 1967. Use of a factorial design enabled measurement of individual and joint effects of all treatments and treatment combinations. These data show that 45° storage temperature over 24 hours materially decreased percent sprouting. Irradiation was deleterious above 800 Rad at the temperatures employed with a 72 hour storage period. K-gibberellate was ineffective in increasing sprouting at the temperatures employed. These data collectively imply that periodic problems with erratic and slow sprouting of freshly harvested, southern planted onion sets can be overcome by avoiding high temperatures shortly after harvest.

12:00 Chemical Weed Control in Pickling Cucumbers. 44

Monaco, Thomas J., and **C. H. Miller,** North Carolina State Univ., Raleigh.

Extensive testing and evaluation of herbicides for potential use in pickling cucumbers has been conducted for the past three years. Several herbicides which have shown promise include nitralin, the methyl ester of amiben, bensulide, DCPA, sindone, and benefin. The first two herbicides were applied postplant preemergence while the remainder were applied preplant and incorporated to a depth of two inches. All of the treatments have given good to excellent weed control with little or no deleterious effect upon cucumber production. These results have been observed on both spring and fall crops.

12:15 Factors Affecting the Performance of Preemergence and Postemergence Herbicides in Pickling Cucumbers. 45

Putman, Alan R., Michigan State Univ., East Lansing.

Promising preemergence and postemergence herbicides were evaluated on hybrid varieties of pickling cucumbers both in the field and under controlled environment conditions. Acceptable weed control with adequate crop tolerance was obtained with preemergence applications of amiben (methyl ester), NPA + DNBP, NPA + bensulide, NPA + amiben (methyl ester), and bensulide + amiben (methyl ester). Cucumber tolerance decreased as the organic matter and clay content of the soil decreased. Weed control was unsatisfactory if the soil was dry at the time of application. Satisfactory weed control was obtained with surface applications of trifluralin and nitralin but crop tolerance was marginal. The postemergence herbicide Monsanto CP49814 selectively controlled emerged weeds in cucumbers, but crop tolerance was influencd by temperature and stage of growth of the cucumber plants at the time of application.

(7) VEGETABLE CROPS: BREEDING

Engineering 1066

Presiding: G. W. Bohn, USDA Horticultural Field Station, La Jolla, California.

9:45 Response of Tomato Mutants to Population Pressure. 46

Fery, Richard L., and **Jules Janick,** Purdue Univ., Lafayette, Indiana.

Five vine types (determinate, indeterminate, jointless, birdsnest, and dwarf) were grown in an "equidistant" arrangement at 5 population levels (3,000, 7,000, 17,000, 41,000, and 100,000 plants/acre) with multiple and "single-shot" harvests. With all vine types the yield per acre increased asymptotically with increasing population and resulted in similar maximum yields. With multiple harvests maximum yields were obtained at the low population level for the large vined types and at the intermediate population levels for the miniature vined types; higher populations were required for maximum yields with the "single-shot" harvest. Earliness (1st harvest yield/total yield x 100 for multiple harvest) and yield concentration (marketable fruit yield/total fruit yield x 100 for "single-shot" harvest) increased for all mutants as the population increased. Fruit set decreased as plant population increased with all mutants.

10:00 Studies of Phenotypic Response to Population Density and Competition in the Tomato. 47

George, B. F., and **L. C. Peirce,** Univ. of New Hampshire, Durham.

The effects of two population densities were tested on pure stands of each of three inbred tomato varieties and their three hybrids, and on mixed stands composed of the inbreds and hybrids in equal proportions. Selections made from mixed stands at each population level were similar for earliness and fruit size but showed an interaction for concentrated ripening. Variation in stability of each character within

and between treatments was found among entries. Hybrids exhibited more phenotypic stability over the two population densities than did entries as a group. However, the most stable single entry was an inbred. This same inbred also showed excellent competitive ability in dense mixed stands. The data suggest that aggressive phenotypes showing relative superiority in a high-density F_2 might not be as superior in a low-density F_2. Such a phenotype also might not express this superiority in a pure stand at any spacing.

10:15 Independent Assortment of Young Plant Characters in Muskmelon, *Cucumis melo* L. 48

Bohn, Guy W., and **Joseph Principle**, USDA, La Jolla, California.

Use of genic male-sterility in commercial production of F_1 hybrid muskmelons would be aided by marking male-sterile plants with an easily recognized seedling character. Similarly, selection for disease-resistance in the absence of the disease would be aided by such a marker. Seven simply inherited muskmelon characters were tested for linkage: brachytic bush, *b;* glabrous, *gl;* male-steriles 1 and 2, ms^1, ms^2; nectarless, *n;* powdery mildew resistance, pm^2, and yellow green, *y*. Chi square values from F_2 data yielded little indication of linkage among 15 of 21 possible character pairs. Freedom from linkage was verified in test crosses of 6 pairs. In addition, ms^1 and ms^2 were reported earlier to segregate independently. Total information for each character pair was based on populations ranging from 221 to 1354 and averaging 487 plants. The mutants apparently occurred at random in the genome.

10:30 Inheritance of Eight Economic Characters in Broccoli. 49

Dickson, M. H., New York Agric. Exp. Sta., Geneva.

The inheritance of several economic characters in broccoli will be discussed. Large cotyledons, tallness, starring, leafy heads, and earliness were due to single dominant genes. Puffy bud, and blindness were controlled by recessive gene. Open bud was very susceptible to environment and behaved as a dominant under hot summer conditions and as a recessive under cool conditions.

10:45 The Inheritance and Nature of Albinism, Involucre Shape, and Chlorophyll Deficiency in Lettuce. 50

Ryder, Edward J., USDA, Salinas, California.

Albinism, involucre shape, and chlorophyll deficiency are each inherited as single gene recessive traits. Plants showing the albino character die in the seedling stage, before appearance of the first true leaf. Normal involucre shape is slender with a concave taper towards the tip. The mutant type appears swollen and the taper is straight or convex. Chlorophyll deficiency is manifested as either an albino, which dies early, or a yellowish plant. The latter continues to grow slowly, producing either whitish or yellowish leaves, which later turn green. In the late rosette stage, the leaves are green as soon as they appear. As the plant bolts, the young leaves are at first yellow, later turning green. The immature involucres are yellowish, turning green when the flower opens. The flower is golden colored, compared to the normal yellow.

11:00 Genetic Control of Chlorophyll Degradation in *Phaseolus vulgaris.* 51

Bouwkamp, John C., and **Shigemi Honma**, Michigan State Univ., East Lansing.

A snap bean line derived from a cross with Flageolot showed a character which prevented chlorophyll degradation. Investigations were made

concerning the genetics and physiology of this character. Chlorophyll content of chlorophyll degrading and non-degrading lines were made at 0, 5, and 10 days on excised leaves using the technique described by MacKinney for chlorophyll extraction and measurement. The rate of chlorophyll degradation was found to be much higher in the chlorophyll degradating lines. Genetic investigations suggest that 2 genes are involved in controlling this characteristic, one of which is epistatic.

11:15 Recess

11:30 Genetic and Physiological Studies of Variegated Mutants in Beans (*Phaseolus vulgaris* L.) and Implications for Selection. 52

Coyne, Dermot P., Univ. of Nebraska, Lincoln.

The effect of temperature and photoperiod on the expression of a variegated mutant in Stringless Green Refugee (mutant found by Dr. R. W. Goth, U.S.D.A.) was investigated. The plants were grown at 60, 70 and 80° F and at 8- and 14-hour photoperiods. Variegation was almost entirely suppressed at 80°F. This may be due to gene derepression or high enzyme reaction rates. Roguing of this mutant in seed stocks should be conducted at lower temperature levels. Complete elimination of variegated plants was observed in segregating generations derived from crosses with two OSU Bush Blue Lake lines. This suggests that a gamete killer is operative. In crosses with G. N. 1140 and G. N. Nebr. #1, irregular ratios of normal and variegated plants were observed in segregating generations. A two-element mutator unstable gene system is involved in determining a second different type of variegated mutant.

11:45 Some Further Genetic and Physiological Studies of Photoperiodism in Beans. 53

Coyne, Dermot P., Univ. of Nebraska, Lincoln.

Two complementary dominant genes determined delayed flowering under long days and high temperature in the field in the crosses between 2 green bean varieties (day neutral) and G. N. Nebr. #1 sel. 27 (short day). Under long days and a lower temperature regime, the parents flowered close together and a large amount of transgressive segregation for delayed flowering was noted. Coupling linkage was involved between genes for the indeterminate plant habit and photoperiodic response. Foliar applications of CCC, 500 ppm caused G. N. Nebr. #1 sel. 27 line to flower as early under long days (14 hours) as when grown under short days (8 hours).

12:00 Quantitative Differences in Volatile Compound Composition Among Some Tomato Varities. 54

Stevens, M. A., Campbell Inst. for Agric. Res., Cinnaminson, New Jersey.

Volatile compounds in tomatoes were investigated using gas chromatography (GC). Lower boiling compounds were studied by gas-entrainment on-column trapping. Tomato essence was obtained by a distillation-extraction concentration procedure. A study of tomato varieties, Campbell 146 and Campbell 1327, indicated heritable differences in the concentration of three compounds. One of these has not been completely characterized, but it appears to be a potent heterocyclic nitrogen compound. The identity of the other two has been confirmed by GC retention time and fingerprint infrared as methyl salicylate and eugenol. Quantification of these compounds and investigation of their flavor thresholds indicates that they may be a factor in the flavor differences between these two varieties. Campbell 146 has a higher concentration of the three compounds. Other compounds which appear to differ quantitatively among certain varieties are 6-methyl-5-hepten-2-one, citral and geranylacetone. The inheritance of compounds that show clear-cut heritable differences will be studied.

12:15 Developmental Morphology of Four Distinct Growth Habit Phenotypes of *Cucurbita Maxima* Duch. 55

Weinheimer, William H., and **E. C. Abbe,** and **D. W. Davis,** Univ. of Minnesota, St. Paul.

Developmental growth studies were initiated to determine what anatomical differences might explain observed distinct phenotypes — bush, extreme dwarf, and vine. At intervals of time the following data were recorded: total plant length; length of every tenth internode (from 5 to 55); and average cell length. Total lengths of each phenotype were significantly different. Rate of production of internodes showed significant differences between vine, and bush or extreme dwarf. However measured differences were only 5-6 internodes and were of insufficient magnitude to explain plant type differences. The next level of morphogenetic analysis deals with rate, frequency, and total number of cell divisions, and rate and degree of cell elongation. Detailed analysis of cell division and enlargement reveals that the genes for bush and extreme dwarf are expressed through all of these morphogenetic pathways. Details of the developmental systems analyses are presented.

(8) FLORICULTURE: LILY PHYSIOLOGY

Engineering 1062

Presiding: Harold F. Wilkins, Univ. of Minnesota, St. Paul.

9:45 The Interaction of Photoperiod and Temperature On The Growth of the Easter Lily (*Lilium longiflorum* Thunb. 'Georgia' and 'Nellie White'). 56

Wilkins, Harold F., and **Richard E. Widmer,** Univ. of Minnesota, St. Paul.

'Georgia' and 'Nellie White' plants from non-precooled bulbs were grown at 60 or 70°F, and immediately upon emergence were exposed to 0, 4, 8, 12 to 52 sequential long days (LD). After the designated LD treatments, half of the plants grown at 70° were shifted to 60° and half of the plants grown at 60° were shifted to 70°. The lily plants were responsive to LD's at either temperature. The LD effect received at 60° was not erased at 70°, but the flowering of 'Nellie White' cultivar was delayed by higher temperature. 'Georgia' and 'Nellie White' bulbs were given 40°F cold treatment for 0, 1, 2, 3, 4, 5, or 6 weeks. Immediately upon shoot emergence the above respective treatments were given 6, 5, 4, 3, 2, 1, or 0 weeks of LD. Hence, all plants were treated for a total of 6 weeks. This experiment was devised to determine the direct substitutional interrelationship between LD's and cold.

10:00 Growth Responses of Twin Shoots From Non-Precooled "Double Nose" Bulbs of *Lilium longiflorum* Thunb. 'Croft' to Different Light Qualities and Durations. 57

Wilkins, Harold F., and **Richard E. Widmer,** Univ. of Minnesota, St. Paul.

Immediately upon emergence 'Croft' lily plants with two shoots were subjected for 30 days to treatments of red (R), far-red (F-R), long days (LD), or short days (SD). These light treatments were applied to both shoots symmetrically or asymmetrically. Asymmetrical treatments were accomplished by placing partitions between the two shoots and by lighting both halves with all possible treatment combinations. The ability of the light stimuli to be translocated was evident in the asymmetrical shoot treatments. All asymmetrical light combinations reduced stem elongation and delayed flowering. Symmetrical LD or F-R light treatments promoted stem elongation and flowering. Symmetrical SD or R treatments reduced stem elongation and delayed flowering. The 'Croft' lily responded to these several light treatments as a typical LD plant.

10:15 Physiology of Dormancy in *L. longiflorum*. 58

Shyr, Shio-ying, and **L. T. Blaney,** Oregon State Univ., Corvallis.

Response in plant growth and composition to bulb scale removal, vernalization, preheating, and chemical stimuli were used to study the physiology of dormancy in *L. longiflorum*. Responses suggested that daughter scales are the main source of dormancy up to time of bulb maturity. Ratio of new/old scales may be used for a bulb maturity index. When new and old scales are equally distributed, the bulb is approaching maturity. The source of dormancy is equally distributed in new and old scales at this time. Dormancy can be overcome by cold storage, hot water plus cold storage, heating soil before bloom, GAM_3, IAA, Amchem 66-329 or ethylene treatment. Vernalization increased certain amino acids in the scales. Cold storage was deleterious to flowering potential. The longer the bulbs were stored, the greater the reduction in number of flowers initiated. The size of apex may be directly correlated to flower number in this case. High temperature tends to devernalize plants from vernalized bulbs, cold temperature also tends to vernalize plants from non-vernalized bulbs.

10:30 Effects of Leaf Removal and Darkening on Mother Axis Flowering and Dominance Over Daughter in *Lilium longiflorum* 'Croft'. 59

Roberts, A. N., Oregon State Univ., Corvallis.

Plants from strongly and weakly vernalized bulbs were used to study leaf function in flower induction by chilling and natural long day treatment and in mother axis elongation and dominance over the daughter. Strongly vernalized bulbs were "programmed" to flower in a set number of days with given number of leaves and flower initials, whether in light or darkness, and with or without leaves. Weakly vernalized bulbs flowered with or without leaves under natural long days but with higher leaf numbers and times required. Such plants grown in the dark did not flower, and with continuous leaf removal unfolded 261 leaves in 363 days and remained active. Plants with leaves were twice as tall as those defoliated, except that strongly vernalized plants in darkness were little affected in height by defoliation. Leaf removal or darkening of the mother axis from strongly vernalized bulbs caused loss of mother dominance over daughter.

10:45 Influence of Vernalization and Long Days on Flowering of 'Ace' Easter Lily (*Lilium longiflorum Thunb.*) 60

Bahadur, R., and **L. T. Blaney,** Oregon State Univ., Corvallis.

Plants from bulbs stored 0, 2, 3, and 6 weeks at 40°F were given various amounts of long day treatment at several stages of plant development to determine the relative effectiveness of vernalization, long day treatment, or combinations thereof in floral induction. Although two different physiological mechanisms seemed to be involved, both treatments were effective in early floral induction. Vernalization appeared slightly more effective than long day treatment and a combination of the two was no more effective than either alone, if adequate. Within limits, the longer the vernalization or long day treatment the earlier the flowering. This and other information available suggests that 'Ace' Easter Lily is a quantitative long day plant. Long day induction, like vernalization, reduced the number of floral initials.

11:00 A Report on Field Vernalization and Devernalization Studies of Pacific Northwest-Grown *Lilium longiflorum* cv Ace. 61

Weiler, Thomas C., and **Robert W. Langhans,** Cornell Univ., Ithaca, New York.

The terms "field vernalization" (often used to include cooling in shed storage and transportation) and "devernalization" have been used in discussions and the literature on Easter lilies without conclusive evidence for either in *Lilium longiflorum*. Initial studies of these phenomena on Pa-

cific Northwest-grown 'Ace' indicate that Easter lily bulbs may accumulate detectable amounts of vernalization before they reach Mid-Western and Eastern storage facilities. The occurrence of a devernalization phenomenon was not clearly demonstrated by the data when heating treatments were applied before or after cool storage. These treatments were compared using flowering percentages of 70°F-grown plants and forcing data from 60°- and 70°-grown plants.

MONDAY AFTERNOON

(9) COLLEGIATE BRANCH: STUDENT PAPERS

Engineering 1066

Presiding: Milton Workman, Chairman, Collegiate Activities Committee, Colorado State University, Fort Collins.

1:15 Evaluation of an Education in Horticulture Through a Cooperative Program. 62

McNiel, Robert E., Iowa State Univ., Ames.

In 1963, I became the first student to enter the 4½ year nursery management cooperative program at Iowa State University. The program was designed to incorporate five on-the-job training sessions with thirteen quarters of class work. During the past few years, I completed this program and term it a very successful educational tool. With the on-the-job training sessions, I was able to work at five different nurseries in the midwest. Included were wholesale, mail order, florist-garden center, container and turf nurseries. All rather large and respected operations. Each firm cooperated in my learning, in that I was moved through their different departments. Through this I was able to learn many facets of propagation and plant care from each firm. And in addition, from individual firms I learned about sales, advertising, storage, weed control, fertilization, mechanization, and business management.

1:30 A Genetics Problem in Phalaenopsis Breeding. 63

Hyatt, Donald W., Virginia Polytechnic Inst., Blacksburg.

The major purpose of this project was to eventually produce a large, yellow-flowered Phalaenopsis orchid. Previous efforts by orchid hybridists have failed due to the occurrence of sterile triploid progeny. By the use of colchicine, the triploid number of chromosomes was doubled in two such plants, resulting in a fertile hexaploid condition. A controlled environment was used to minimize all outside errors. The hexaploid seedlings will be self-pollinated when mature and through segregation of characteristics in the F_2 generation, the desired Phalaenopsis should be obtained. The genetics of the plants and crosses involved have been carefully studied and theoretical probabilities calculated. It is predicted that one out of every 36 plants will have the desired characteristics of large size and clear yellow color.

1:45 Lighting for Production Timing of Carnations. 64

Rudolph, Carolyn D., and **W. D. Holley**, Colorado State Univ., Fort Collins.

One and two year carnations were lighted (10-50 ft-candles) from 10pm to 2am at four week intervals starting Dec. 1, Jan. 1, Feb. 1. Longer periods of lighting were started Mar. 1 and Apr. 1. CO_2 level was maintained at approximately 1000 ppm from Nov. 1 to Mar. 1. On 2-year plants yield increase began seven weeks after lighting was started. On one-year lighted plants production started two weeks earlier than unlighted crops and the response continued for about eight weeks. Interrupted photoperiod retarded the development of lateral shoots. This response may have possible uses for lighting in timing of spring holiday crops and accelerating yields normally produced in June and July.

2:00 Evaluation of Artificial Freezing Damage to Strawberry Crowns. 65

Flore, James A., Michigan State Univ., East Lansing.

Dormant strawberry plants were cooled to temperatures of either 0, −5, −10, or −15 degrees centigrade and then maintained at this temperature for 24 hours in a freezing chamber. The temperature was then gradually raised to 0°C and plants held at 0°C for 24 hours. Roots and leaf material were removed, crowns washed, cut in half and placed in distilled water for 24 hours to allow electrolytes to diffuse into solution. Electrical conductivity was measured and then samples autoclaved for one hour. Samples were held at room temperature an additional 24 hours and then a second conductance determination made. The second reading was assigned a value of 100 to represent total conductivity. Highly significant differences in percentage conductivity resulted between treatments. No significant differences occurred between different sized crown within a treatment. Representative plants were potted and placed on a greenhouse bench. Plants subjected to −15°C failed to grow.

2:15 Evaluation of Fruit Abscission of Sweet Cherry Varieties. 66

Fox, Bruce R., Michigan State Univ., East Lansing.

Fruit abscission was evaluated during the growing season for four sweet cherry varieties—Schmidt, Windsor, Napoleon, and Stark's Gold—to study the feasibility and optimum time for mechanical harvest of the fruit. A push and pull gauge was used to measure the force required to remove the cherry or stem. Flesh firmness was also measured for harvested fruit using a quadrant style durometer. Flesh firmness decreased throughout the season and fruit removal became easier. The force necessary for fruit removal varied greatly between fruits on the same tree but this difference decreased as the season progressed. However, differences between flesh firmness of cherries on the same tree showed no change.

2:30 Effects of N-dimethylamino Succinamic Acid (Alar) on Maturity and Size of Pocahontas Strawberries. 67

Schaefer, Ronald L., Delaware Valley College, Doylestown, Pennsylvania.

One of the greatest hindrances to the horticulturist is the inability of the strawberry to remain firm, both on the plant, and through various marketing channels. Some researchers have found that the application of the growth retardant Alar on fruits other than strawberries decreases fruit size, thus increasing firmness. This experiment's objective is to determine the effects of Alar on strawberries. Uniform plants of Pocahontas variety were brought into a greenhouse in mid-February, and were grown under natural light conditions existing in the greenhouse. The plants were sprayed with 500, 1,500, and 2,500 ppm of Alar at 3 intervals between bloom and fruit maturity. Random samples will be selected at harvest and compared with controls to determine firmness, size, and soluble solids. Harvest time will be determined by picking the fruit when it acquires a red-orange color characteristic of Pocahontas control plants.

2:45 Effects of N-dimethylamino Succinamic Acid (Alar), (2-chloroethyl Trimethylammonium Chloride (CCC), Gibberellic Acid (GA), and Maleic Hydrazide (MH) on Bolting in Lettuce. 68

Dickerson, George W., New Mexico State Univ., Las Cruces.

Field grown plots of Great Lakes 659 lettuce were sprayed with four growth regulating chemicals at the four-leaf stage and again at the eight-leaf stage. Alar (5000 ppm) reduced internal seedstalk formation in harvested lettuce by 57%. Alar caused heavily fringed leaves, early maturity, and reduced head size. GA (50 ppm) caused elongated stems which eventually terminated in small heads or seedstalks. Alar

(2500 ppm) plus 50 ppm GA gave about the same response as GA alone. MH (500 ppm) caused inhibition of the terminal meristem, ragged leaves, and growth of lateral buds which formed small heads or seedstalks. CCC (1500 ppm) caused marginal chlorosis of leaves, but plants recovered before harvest. CCC appeared to retard seedstalk formation, but not to the extent of the Alar treatment.

3:00 Recess

3:15 Influence of Spacing on Potato Yields. 69

Hilger, John H., Purdue Univ., Lafayette, Indiana.

The Superior potato variety was grown in rows 16 and 32 inches wide and 9 inches apart in the row. The purpose was to compare yield performance and net profit at the two populations. The narrow row spacing gave higher total yields, smaller tubers and decreased profits over the wider row spacing.

3:30 Efficacy of a Stale Seedbed Approach for Providing Weed Control in Pickling Cucumbers. 70

Hess, Frederick D., and **Alan R. Putnam,** Michigan State Univ., East Lansing.

A stale seedbed technique, utilizing paraquat as a contact herbicide, was compared with conventional seedbed preparation, planting, and application of preemergence herbicides. Paraquat at 0.5 and 1.0 lb/A provided excellent control of emerged weeds. The preemergence herbicids amiben (methylester), NPA, and NPA + DNBP prevented further weed growth when used at rates lower than that required on a conventional seedbed. In all tests, the weed control and cucumber yields obtained utilizing the stale seedbed technique were equal or superior to those obtained using preemergence herbicides on a newly prepared seedbed. Fewer weeds germinated in plots where paraquat was employed as compared to similar plots receiving tillage.

3:45 Effects of N-dimethylamino Succinamic Acid on the Size of Potatoes. 71

Funt, Richard C., Delaware Valley College, Doylestown, Pennsylvania.

Under certain field conditions potatoes, especially of the Kennebec variety, obtain a large size which is objectionable to the consumer as well as some processors. This project's aim is to find what effects will show favorable results as to an average medium-size potato. Potatoes of the Kennebec variety were planted and sprayed with different parts per million of Alar at different physiological developments of the plant and thus hoping to find a rate and physiological time to apply Alar to produce average and uniform size potatoes.

4:00 Interactive Effects of Gibberellic Acid and Alar on Bush Bean Growth. 72

Attarian, A. Ronald, Delaware Valley College, Doylestown, Pennsylvania.

A study will be conducted to determine the effects and interactions of gibberellic acid and Alar on plant growth. Contendor bush beans will be used. Specific attention will be given to the developmental characteristics of the pods. Applications will be applied to one block at the development of the primary leaves. The second block will receive application at blossom-time. A randomized block system will be used; each block will have four replicates (total of five). Various concentrations of each chemical will be used, both individually and together. The chemicals will be applied by spray. Ninety four-inch clay pots will be used. The plants will be grown under greenhouse conditions. All data and observations will be recorded at regular intervals. Positive results are expected within several months.

4:15 Nutrition of Carnation in Perlite Compared to Soil. 73

Hartman, Larry D., Colorado State Univ., Fort Collins.

The experiment was designed to determine the differential effects of fifteen nutrient solution treatments on carnation plants grown in soil compared to those grown in perlite. With imbalanced nutrient solutions (e.g. those containing high concentrations of NH_4, Cl, H_2PO_4), the soil acted as a buffer to reduce the deleterious effect of the nutrient solution. However, plants grown in perlite and watered with a balanced nutrient solution had a significantly greater yield than the comparable soil grown group.

4:30 Electrophoretic Study of Soluble Proteins of Dianthus Callus Cultures. 74

Donoghue, Deborah, Brent H. McCown, and **LeRoy G. Holm,** Univ. of Wisconsin, Madison.

Three cultivars of *Dianthus* callus cultures grown in two environmental conditions were studied. The tissue was analyzed by modified disc gel electrophoresis. Difficulties with the previously reported *Dianthus* leaf and stem extraction were encountered. The extracted protein seemed too complex and failed to enter gels. Complexing was a time dependent reaction. Enzyme analysis however, showed proteins were still active and not denatured. Various modifications of the extraction procedure were tried, including urea in extract and gels, metabisulfate, EDTA, Triton and calcium buffer systems. An extraction procedure to give reliable results will be discussed. The resulting banding was compared with the stem tissue of the *Dianthus* plants. Marked similarities and differences were observed. Acid phosphotases, esterases, peroxidases and several dehydrogenases were studied. The banding was generally comparable with the banding of the stem tissue of the original *Dianthus* plants.

4:45 ASHS WESTERN REGION, Business Meeting
Charles K. Labanauskas, Chairman
Chemistry 179

(10) SYMPOSIUM: HORTICULTURAL PLANT BREEDING I

Chemistry 194

Sponsored by: Fruit Breeding Committee, ASHS; Vegetable Breeding and Varieties Committee, ASHS; and Floriculture, Ornamental and Landscape Horticulture Section, ASHS.

Presiding: George D. Oberle, Chairman, Fruit Breeding Committee, ASHS, Virginia Polytechnic Institute, Blacksburg.

1:30 Horticulture Germ Plasm: It's Exploration and Preservation. 75

Donald W. Barton, Director, N. Y. State Agr. Exp. Station, Geneva.

2:15 Implications of the New Genetics in the Breeding of Horticultural Plants. 76

Craig, Richard, Pennsylvania State Univ., University Park.

2:55 Recess

3:10 Selection Systems and Vegetable Crop Improvement. 77

Peirce, L. C., University of New Hampshire, Durham.

3:50 The Challenging Situation in Developing Superior Fruit Cultivars. 78

Spangelo, Lloyd P. S., Canada Dept. of Agric., Kentville, Nova Scotia.

4:30 Adjourn

4:30 **VEGETABLE BREEDING AND VARIETIES COMMITTEE MEETING**
Dermot P. Coyne, Chairman
Engineering 1132

4:45 **ASHS WESTERN REGION,**
Business Meeting
Charles K. Labanauskas, Chairman
Chemistry 179

(11) POSTHARVEST HORTICULTURE: MATURITY, RIPENING AND QUALITY
Chemistry 166

Presiding: George E. Mattus, Virginia Polytechnic Institute, Blacksburg.

1:30 Maturity Separation of Green Tomatoes by Light Transmission. 79

Worthington, John T., and **John N. Yeatman,** USDA, Beltsville, Maryland.

Spectral curves (350-800 nm) for intact green tomatoes were obtained with a single beam spectrophotometer designed for measurement of very dense biological material. From these spectral curves two wavelength pairs (510 and 580 nm, and 580 and 640 nm) were selected because they afforded a separation of immature from mature-green tomatoes. Narrow-band interference filters were used in a 4-filter difference meter to measure the difference in optical density [△OD(510-580 nm) and △OD(580-640 nm)] to separate tomatoes into maturity categories. The △OD values for both wavelength pairs had to be interpreted simultaneously by the instrument operator since a single wavelength pair did not give as good a separation. All sorted tomatoes were held at 60°F for ripening. Separation of immature from mature-green tomatoes was directly related to both visual color judgment and reflectance colorimeter measurement, except where tomatoes contained voids.

1:45 Progress in Maturity Measurement of Blueberries Using Light Transmittance Technique. 80

Ballinger, Walter E., and **John N. Yeatman** and **Lee J. Kushman,** North Carolina State Univ., Raleigh.

Sorting of harvested blueberries according to ripeness or condition is a problem which will be accentuated by mechanical harvesting. A light transmittance difference meter was modified to accept and measure pigmentation in individual whole blueberries to determine the feasibility of nondestructively sorting according to their anthocyanin content. Differences in light transmittance readings ($\triangle OD_{\lambda_1}$-λ_2) of Berkeley fruit were correlated (r) with destructive ripeness measurements such as anthocyanin content per cm² of berry surface (r=0.941), anthocyanin content (μg) per berry (r=0.929), acidity (as % citric) (r=−0.823), per cent soluble solids (r=0.765), and soluble solids to acid ratio (r=0.803). The technique of light transmittance measurement appears promising as a means of sorting the various degrees of ripeness represented in mechanically harvested blueberries.

2:00 Heat-Unit Functions for the Storage Ripening of Processing Apples. 81

LaBelle, Robert L., Cornell Univ., Geneva, New York.

R. I. Greening apples harvested about two weeks apart in each of the 1963-65 seasons were stored at several constant temperatures in the range 30-65°F. Ripening was monitored by periodic determinations of soluble solids, total acid, and flesh color. Semi-logarithmic plots of soluble solids-acid ratio or of hue (Hunter a/b) as measures of ripeness against storage time at constant temperature proved reasonably linear. Slopes of this relation provided measures of ripening rate in terms of either parameter. When the logarithms of these empirical coefficients were in turn plotted against storage temperature, the relationship was again nearly linear — the slope now defining the effect of storage temperature on ripening rate. This temperature coefficient varied only slightly between harvest dates but very significantly with season. An exponential storage heat-unit function is implied, with ripening rates greater than zero through freezing.

2:15 Storage and Ripening of the Magness Pear. 82

Scott, Leland E., and **James Hicks,** Univ. of Maryland, College Park.

Magness pears showed significant ripening responses during normal atmosphere storage at 32°F with decreases in firmness of approximately eight pounds during the first three months of storage. Changes in firmness, soluble solids, pH, titratable acidity and alcohol insoluble solids as affected by date of harvest, length of storage, and ripening at 65°F were measured. The most important changes were decreases in firmness and in titratable acidity. Ripening at 65°F was normal after four months storage at 32°F. Close correlation was found between firmness determinations made with a Magness-Taylor pressure tester fitted with a "mechanical thumb." This indicates that the "thumb" may be used to follow softening of individual fruits during storage and/or ripening.

2:30 Post-Harvest Texture Changes in Montmorency Cherries. 83

LaBelle, Robert L., Cornell Univ., Geneva, New York.

Successive harvests of cherries were subjected to periods of soaking in water or holding in air at both high and low temperatures. More sensitive measurement of texture was possible, using the Instron universal testing machine to record force-deformation curves on individual cherries and small samples, than heretofore in such tests. Measurements included modulus of elasticity and bio-yield point of whole fruit, pitting force, and resistance to compression-extrusion of pitted fruit, both fresh and canned. High-temperature treatment gave tougher cherries exhibiting much greater resistance to extrusion, higher yield points, about equal pitting force, and lower elasticity. Holding in air, compared to soaking, provided similar results except that resistance to extrusion was not greater. Chilling fruit for only one hour at 35°F induced little change in texture. Two modes of firmness are differentiated — toughness and turgor.

2:45 Chemical Composition of Eleven Varieties of Muscadine Grapes. 84

Carroll, Daniel E., and **Maurice W. Hoover** and **William B. Nesbitt,** North Carolina State Univ., Raleigh.

This paper presents an accumulation of data for three growing seasons on the chemical composition of 11 varieties of Muscadine grapes grown commercially in North Carolina. The quantities of glucose, fructose, sucrose, malate, tartrate and citrate were quantitated by paper chromatography. Total acidity, pH, and soluble solids were also determined. Considerable variation in the composition of the grapes was observed from one season to the next. However, three trends were noted: (1) approximately equal quantities of fructos and glucose were found for each variety, (2) concentration of citric acid was very low and never exceeded 0.08%, (3) when total acidity was unusually high for a season (1967), the increase was due principally to a large increase in malic acid.

3:00 The Influence of Mineral Nutrition on the Yield, Respiration Rates and Internal Quality of Charleston Gray Watermelon Fruit. 85

Paterson, D. R., and **O. E. Smith,** and **W. K. Nip,** Texas A&M Univ., College Station.

Charleston Gray watermelons were grown in a 2^3 N X P X K factorial experiment in 1965. P at 18 pounds per acre caused a highly significant decrease in the rate of CO_2 evolution of watermelon fruit over a 14-day storage period. There were highly significant N X P, N X K, P X K, and N X P X K interactions in the respiration study. When K was used at 83 pounds per acre, both N and P had little effect on the rate of CO_2 evolution. When no K was applied the application of P decreased the rate of respiration more at the 50 than at the zero rate of N application. Eighteen pounds of P per acre caused a significant reduction in specific gravity and in the soluble solids content of the fruit. The use of K at 83 pounds per acre resulted in a significant reduction in the pH of the watermelon fruit.

3:15 Recess

3:30 A Study of the Color and Pungency in Peppers. 86

Love, John E., Robert J. Black, Roysell J. Constantin, and **Earl P. Barrios,** Louisiana State Univ., Baton Rouge.

A study has been made on the color and pungency of several varieties of *Capsicum frutescens* and *Capsicum annuum*. Both qualitative and quantitative differences existed in the color of the different pepper varieties. For example, the pigment content for the variety Flora Gem was 4 mg per 100 gms of tissue, while the total carotenoids for Tabasco was 74 mg for the same weight of tissue. Capsanthin was found to be the most abundant pigment component in all varieties examined and accounted for approximately 40% of the total pigments in Cayenne and about 30% in Tabasco. The capsaicin content in the oleoresin of several varieties ranged from 0.2% for the mildest variety (Paparika) to 10% for the most pungent variety (Tabasco).

3:45 Preliminary Results of Using Sodium Dihydro Acetate Applications to Reduce Discoloration of Snapbeans Damaged by Machine Harvesting. 87

Isenberg, Francis M., Donald J. Lisk, and **Roger F. Sansted,** Cornell Univ., Ithaca, New York.

Snapbeans harvested by machine usually suffer considerable damage due to cuts, bruises and abrasions. Frequently these damaged areas become brown or black within a very short period, making the beans undesirable either for processing or for packaging for fresh market. The damage is especially noticable on the wax varieties. It has not been possible to simulate the discoloration at will in the laboratory and field observations indicate that severe damage is quite erratic in occurrence, also. In 1965, a number of chemicals were screened, and one, sodium dihydroacetate, showed promise in controlling the condition. In 1966, tests with this chemical alone also indicated reduction of discoloration in beans cut and stored over 2 weeks at 40° in polyethylene. In 1967, the results were disappointing since the discoloration failed to occur in the field and could not be induced in the laboratory. Residue analyses for both seasons are reported.

4:00 Post-Harvest Changes in Southern Peas. 88

Worthington, J. W., and **E. E. Burns,** Texas A&M Univ., College Station.

Southern peas are difficult to shell when they are harvested at an immature stage. To overcome this, processors have resorted to a rather severe sweat process to increase the per cent shell-out. Post-harvest changes associated with varieties, maturity, and elevated temperatures were studied in four varieties of southern peas. The texture studies showed that firmness increased with maturity. There were no significant differences in the texture of the different varieties. Moisture declined with maturity. The moisture level declined inversely with the first two temperatures, but increased again at 120°F. There was no significant difference in reducing sugars due to a change in maturity. Except for the Brown Crowder variety, there was a tremendous increase in reducing sugars after storage at 120°F. There was a significant interaction of maturity and storage on the total sugars. Total sugars of fresh peas or peas stored at 120°F. were not significantly different from that of the rehydrated seed. Alcohol insoluble solids increased with maturity in fresh peas. There was an individual respiratory response of varieties to elevated temperatures.

4:15 Internal Can Corrosion by Processed Sweet Potatoes as Affected by Phenol Oxidase Activity and Nitrate Content. 89

Smittle, Doyle A., and **L. E. Scott,** Univ. of Maryland, College Park.

Cultivars of sweet potatoes which caused severe can corrosion had a high nitrate content and a high phenol oxidase activity. Can corrosion was increased by high levels of nitrogen fertilization when the phenol oxidase activity was not controlled. However, when phenol oxidase activity was restricted, very little corrosion occurred regardless of nitrate level. Tin removal from the can is proposed to be a solubilization-chelation reaction. Nitrates or other oxidizing agents oxidize the tin, thus increasing solubility. Quinones produced by phenol oxidase activity then chelate the tin from solution. Severe can corrosion did not occur if either the nitrate content of the sweet potatoes was low or quinone formation was controlled. Addition of EDTA increased tin removal while addition of iron or calcium salts had the opposite effect. It is proposed that Fe^{++} and Ca^{++} compete with tin for chelation sites.

4:45 ASHS WESTERN REGION,
Business Meeting
Charles K. Labanauskas, Chairman
Chemistry 179

(12) VEGETABLE CROPS: GROWTH REGULATORS

Engineering 2129

Presiding: Edwin B. Oyer, Cornell Univ., Ithaca, New York.

1:30 Brussels Sprouts Growth and Production as Influenced by N-dimethylamino Succinamic Acid (Alar). 90

Tompkins, Daniel R., and **R. A. Norton,** Washington State Univ., Puyallup.

In 1967, foliar sprays of 3000-6000 ppm of Alar were applied to Jade Cross Brussels sprouts plants in the field. Alar treated plants did not have to be hand topped because the chemical stopped stalk elongation. Plants treated with Alar early had very firm sprouts that were ready to harvest about 2½ weeks earlier than topped plants but yields were lower since the plants were much shorter. Plants treated with Alar late produced as well as topped or untopped plants and had sprouts that were more firm than either.

1:45 Effects of Alar Treatments on Growth, Flowering, and Fruiting of Greenhouse Tomato Cultivars. 91

Read, Paul E., Univ. of Minnesota, St. Paul.

Treatment of several greenhouse tomato cultivars grown in a "Ring Culture" system with 1000 ppm and 2500 ppm Alar 85 at the first true leaf stage subsequently led to earlier flowering and fruiting than experienced with untreated plants. Later treatments (2500 ppm at the fourth true leaf stage) caused a slight delay in flowering in some cultivars. Increased branching of the inflorescence and an increase in the number of flowers per cluster were also observed as a result of treatment at the first true leaf stage with no accompanying reduction in plant vigor or height. These results are similar to those reported earlier for Alar-treated processing tomato cultivars. Additional experiments showed no difference in effect when Technical Grade Alar, Alar 85 and B-Nine were compared.

2:00 Influence of Growth Retardants on Growth, Nutrient Content, and Yields of Tomato Plants Grown with Various Fertility Levels. 92

Knavel, Dean E., Univ. of Kentucky, Lexington.

Cycocel was more effective for reducing plant growth than was Alar, regardless of fertility level. The greatest dwarfing effect by Alar was obtained when plants were grown with low N (0.5 lb/cu yd), and when plants were grown with low dolomite (5 lb/cu yd) with high N (1.0 lb/cu yd). Cycocel and Alar-treated plants contained more N, P, and Ca than untreated plants. Untreated plants contained more K than had the treated plants. Plants treated with Cycocel contained more Mg than other plants. Alar-treated plants contained no more Ca than untreated plants. Interactions existed between nutrient levels in the growing medium and growth retardants for their effects on growth, nutrient uptake, and early yields. Fruits from Alar-treated plants were smaller than those of Cycocel-treated and untreated plants. Growth retardants and fertility levels used in these studies had no effect on total yields.

2:15 Effect of N-dimenthylamino Succinamic Acid (Alar) on Vegetable Growth of Chile Pepper (*Capsicum frutescens*) Plants. 93

Wilbert, G. G., and R. M. Nakayama, New Mexico State Univ., Las Cruces.

Plants of an indeterminate variety of chile pepper were treated with foliar applications of Alar at 0 to 10000 ppm concentrations. Treatment effect on plant height was apparent seven days after treatment, but differences were not significant. A significant reduction in stem length was recorded 14 and 21 days after treatment at 1000 to 10,000 ppm. Total number of microscopically visible internodes, branches, and fully expanded leaves were inversely proportional to Alar concentrations. Alar had no significant effect on fresh and dry weight of top growth and roots, stem diameter, petiole, and midrib length.

2:30 Chemical Alteration of Sex Expression in Cucumbers and Cantaloupes. 94

Irving, R. M., and M. A. Zawawi, Oklahoma State Univ., Stillwater.

Spray applications of several growth regulators or plant hormones on sex expression of cucumbers and cantaloupes were evaluated. TIBA (2,3,5-triiodobenzoic acid) at 25 ppm and B-Nine (N-dimethylamino-succinamic acid) at 3 concentrations were particularly effective in promoting the femaleness in cucumbers grown in the greenhouse. The increased TIBA stimulation of female flowers ranged from 100% to 200%. TIBA also increased the number of male flowers, but significantly lowered the male/female ratio. In most cases, indole-acetic acid and gibberellic acid, at the concentrations used, failed to significantly alter sex expression. Application of TIBA to cucumbers at the onset of first bloom in the field increased the number of fruits but did not significantly increase total yields. Treatment of cantaloupes with TIBA and B-Nine at the same developmental stage resulted in a significantly greater number of fruits and a corresponding increase in yield.

2:45 Gibberellin A_4/A_7, for Induction of Staminate Flowers on the Gynoecious Cucumber. 95

Pike, Leonard M., and **C. E. Peterson**, Texas A&M Univ., College Station.

Gibberellin A_4/A_7 was compared with GA_3 for staminate flower induction on an inbred gynoecious cucumber line grown under field conditions in Michigan. Gibberellin A_4/A_7 spray applications at 50 ppm were found to induce significantly greater numbers of staminate flowers than GA_3 applied at 1000 ppm without causing excessive stem elongation or brittleness often associated with high dosage of GA_3.

3:00 The Effect of the Near Ultra-Violet Light (3000A-4000A) on the Physiological Development of Cucumbers *Cucumis sativius*, Cultivar Spartan Dawn. 96

McKenzie, J. Ian, and **Herman Tiessen**, Univ. of Guelph, Ontario.

Spartan Dawn cucumber plants were grown in growth chambers for 40 days under a white fluorescent-tungsten control (5,600 micro watts per sq cm) and two levels of U-v fluorescent tubes supplemented with tungsten bulbs (5,560 micro watts per sq cm, and 12,400 micro watts per sq cm). Plant height and tendril number increased directly with the level of U-v light, however there was no effect on leaf number or percent dry weight. Increasing U-v light levels hastened cotyledon senescence and delayed flowering. The sex expression under the high U-v light level was changed in the first five flowers from female to male. The ovules of the flowers under the low U-v were much smaller than the control. Bioassays indicate the endogenous levels of gibberellins are increased by U-v light irradation.

3:15 Recess

3:30 Influence of Gibberellin Upon Time of Bud Development in Globe Artichoke (*Cynara scolymus*). 97

Snyder, Marvin J., Norman C. Welch, and **Vincent E. Rubatzky**, Univ. of California, Davis.

Applications of Gibberellic acid (GA) were made to globe artichoke plants prior to normal bud enlargement in the fall and to similar plants during an active period of bud development in the spring. A significant acceleration of bud development from treated over non-treated plants was obtained. The acceleration was more pronounced when GA was applied in the fall. Single applications of 25 or 50 ppm appeared to be adequate in effecting this response. Final yield for treated and non-treated plants were nearly equivalent except that GA treated plants, at either time of application, produced a greater proportion of total buds earlier. GA application, because of the ability to advance normal bud development, could serve to relieve the usual occurrence of overproduction in March and April and displace some of it to December-February, when production is usually lower.

3:45 The Effect of 2-chloroethyl Trimethylammonium Chloride (CCC) and N^6-benzyladenine on Growth and Flowering of Squash Plants. 98

Abdel-Gawad, Hesham A., and **H. J. Ketellapper**, Univ. of California, Davis.

N^6-benzyladenine at 500 ppm retarded the growth of squash plants grown in a greenhouse, stimulated the growth of lateral buds, retarded the development of male flowers, and completely inhibited the appearance of any female flower. In some instances benzyladenine affected morphogenetic processes since it stimulated both vegetative growth and flower development on the tendrils. CCC retarded growth, influenced plant senescence and modified flower sex expression. CCC at 2000 ppm under short day condition (8 hours light) was the most effective

treatment in enhancing the appearance of the first pistillate flower at a lower node and in delaying plant senescence. However the same concentration showed an inhibitory effect on the initiation and development of male flowers.

4:00 Growth Regulators to Control Lettuce Bolting. 99

Foster, R. E., Univ. of Arizona, Mesa.

Preliminary to field experimentation, Great Lakes lettuce plants greenhouse grown at low temperature and short day to three different ages were transferred to high-temperature, long-day conditions to induce bolting. Plants 30 or 40 days old at the start of induction treatment (I.T.) showed stem elongation much more quickly than those 50 days old. Maleic hydrazide and ortho-chloro-phenoxypropionic acid sprayed once in various concentrations on plants before I.T. suppressed stem elongation on plants of all ages. Applied after I.T., the materials retarded stem growth of the younger plants but were much less effective on the oldest set. MH at 200 ppm and 2CPP at 400 ppm were the best formulations found.

4:15 Effects of CIPC Applications to Individual Eyes of Potato Tubers on Type and Pattern of Sprout Development. 100

Lee, Mie-Soon, and **Elmer E. Ewing,** Cornell Univ., Ithaca, New York.

Aqueous suspensions of CIPC were applied to individual eyes of potato tubers. When one lateral eye per tuber was left untreated, growth at that eye varied from normal to somewhat rosetted. Evidence indicated that CIPC volatilization caused rosetting of untreated sprouts. If all eyes except one were treated with 4000 ppm CIPC, and the remaining eye was treated with concentrations ranging from 0 to 800 ppm, then growth at lateral eyes showed no significant response to different concentrations. If apical rather than lateral eyes were subjected to these treatments, increasing CIPC concentrations over the same range greatly suppressed sprout growth. Apical eyes were most sensitive to CIPC when lateral eyes were not inhibited by high concentrations of CIPC. Rosetted sprouts developed at lateral eyes more than at apical eyes. CIPC-treated seed-pieces planted in soil eventually sprouted even though equivalent pieces kept in air remained inhibited.

4:30 Comparison of Staminate Flower Production on Gynoecious Strains of Cucumbers by Pure Gibberellins (A_3, A_4, A_7, and A_{13}) and Mixtures. 101

Clark, Robert K. Jr., and **Donald S. Kenney,** AMDAL Co., North Chicago, Illinois.

Recently, a mixture of Gibberellin A_4 and Gibberellin A_7, made by fermentation of *Gibberella fujikuroi,* has become available in quantity. It was deemed advisable to compare the properties of this mixture with pure GA_4 and GA_7. If the mixture could give the same response as each pure component, it could be substituted at a greatly reduced cost. Gibberellin A_{13} was also tested. Data will be presented to show the relative activities of Gibberellins A_3, A_4, A_7, and A_{13} and a mixture of Gibberellin A_4 and A_7 for male flower production on gynoecious strains of cucumbers.

4:45 ASHS WESTERN REGION,
Business Meeting
Charles K. Labanauskas, Chairman
Chemistry 179

(13) FRUIT: ENVIRONMENTAL EFFECTS
Chemistry 179

Presiding: Melvin N. Westwood, Oregon State Univ., Corvallis.

1:45 Radial Trunk Growth of Almonds as Affected by Soil Moisture and Crop Density. 102

Uriu, K., P. E. Martin, and R. M. Hagan, Univ. of California, Davis.

Radial trunk growth was measured with Verner dendrometers for 4 consecutive years on mature almond trees under 4 irrigation treatments. Two of the 4 years were low crop years and 2, high crop. Trunk growth rates and total seasonal growth were affected by crop density, soil moisture conditions, and evaporative conditions. Early in the season before soil moisture became inadequate, the rate of trunk growth was inversely correlated with crop density. Response to early season irrigation was obtained during years of heavy crop. Also response to irrigation on total seasonal growth was greatest in years of high crop density.

2:00 Seasonal Fluctuation of Flavanones in Elberta Peach Flower Buds During and After the Completion of Rest. 103

El-Mansy, Hussein I., David R. Walker, and **J. LaMar Anderson,** Utah State Univ., Logan.

Determination of flavanones extracted from peach flower buds was accomplished using chemical methods. Bioassay techniques previously used required considerably more time and more variation occurred. In addition, results obtained with bioassays were designed only to measure the net effect of promotion and/or inhibition of cell enlargement and may not act the same *in vitro* as *in vivo.* In Elberta peach flower buds, the flavanone content was much higher during rest than after the rest period was completed. The highest quantities observed were in late summer when the results were expressed on gram fresh weight basis. On the other hand, flavanone content remained about the same, in spite of high quantities in mid-winter, when results were expressed on an individual bud basis. The lowest values were observed just prior to bloom, indicating a dilution factor as the buds grow and swell in the spring.

2:15 Effects of Alternating 40°F with Higher Temperatures on Satisfying the Chilling Requirements of Peach Trees. 104

Tunsuwan, Tragool, and **Hollis H. Bowen,** Texas A&M Univ., College Station.

Three varieties of June budded peach trees with different chilling requirements were dug at the end of the growing season and alternated between 40°F and several higher temperatures. Temperatures were interspersed during the chilling period at different intervals and for different durations. Trees of each variety were subjected to the same number of total hours at 40°F. Trees alternated between 40°F and 60°F at 48-hour internals began visible growth earlier than those that had been held at a constant 40°F. Interspersing temperatures of increasing magnitude and for increasing durations during the chilling period hastened bud activity at the termination of the chilling period. This relationship was true regardless of the chilling requirement of the variety and the time of interspersal during the chilling period.

2:30 Biochemical Comparison of Six Peach Varieties of Varying Degrees of Cold Hardiness. 105

Lasheen, Aly M., Carl E. Chaplin, and **Ronald N. Harmon,** Univ. of Kentucky, Lexington.

Six peach varieties (S. H. Hale, Loring, Mayflower, New, Daroga, and Lizzie) exhibiting varying degrees of cold hardiness, were grown under similar conditions in Kentucky and compared biochemically.

Bud analyses for total proteins, free amino acids, total sugars, reducing sugars, and starch indicate some correlation between the degree of hardiness and the biochemical makeup of these varieties. An increase in total reserve food seems to be associated with increased hardiness in some varieties. On the other hand, an increase in total free amino acid seems to be associated with decreased hardiness in other varieties. Some individual free amino acids may be more effective in this respect than others.

2:45 Temperature-Induced Premature Ripening of Bartlett Pears. 106

Hansen, Elmer, and **W. M. Mellenthin,** Oregon State Univ., Corvallis.

Pre-ripening of Bartlett pears, a physiological disorder, occurring in certain growing areas during abnormally cool growing seasons, has been reproduced by use of temperature controlled limb cages. Fruit was exposed to 40-45°F night temperature and 65° day temperature for 4 weeks prior to commercial maturity. After 2 weeks, pressure test decreased from 21 to 14 lbs and to 5 lbs in 4 weeks. Fruit on untreated limbs had a pressure test of 17 lbs at the end of the 4-week period. Citric acid in untreated fruit increased from 140 to 283 mg/100 gm F.W. but decreased to 76 mg in the fruit maintained in the reduced temperature range. Decrease in chlorophyll and increase in tannin contents also occurred in the pears which ripened prematurely. The data indicate that the normal pattern of metabolism during maturation is altered by exposure to cool temperatures.

3:00 Recess

3:15 Wind Pollination in Pear. 107

Westwood M. N., and **P. B. Lombard,** Oregon State Univ., Corvallis.

Unopened flowers of several pear varieties were emasculated, half of which were hand cross-pollinated and half untreated and exposed only to pollen in the air. Effects of wind pollination varied with the variety used. Some set no fruit at all, some set seedless fruit, and some set fruit with normal seeds.

3:30 Factors Influencing the Performance of Individual Buds and Spurs on Mature Red Delicious Apple Trees. 108

Heinicke, Arthur J., Cornell Univ., Ithaca, New York.

A study during eight successive seasons regarding the performance of individual spurs on mature Red Delicious apple trees in response to experimental treatments designed to modify shoot growth indicates that flowers may be developed under many conditions. There is, however, a wide variation in the potential of flower clusters on the same or different branches to set and mature fruits, even with good pollination. Much of this variation is due to the age of the wood giving rise to the current bearing surface, and to the influences of polarity, gravity and exposures that affect the initial and subsequent development of each bud with its supporting tissues. The performance of individual apical meristems presumably under the control of growth regulating substances ultimately depends upon the ability of each spur to compete at critical times with other tissues for water, carbohydrates, nitrogen and mineral nutrients.

3:45 Winter Protection of Strawberry Plants by Physical and Chemical Methods. 109

Norton, Robert A., Washington State Univ., Mount Vernon.

Previous studies have shown that the dominant factor responsibile for the breakdown of strawberry plants, cv. Northwest, in refrigerated storage was freezing injury in the field prior to digging. Various types of physical means, including mulches of plastic sheeting and numerous organic materials, were tested in field and controlled freezing tests. In

addition, chemical treatments of Alar, decenylsuccinic acid, and antitranspirants were applied prior to controlled freezing tests and as fall applications in the field. Black polyethylene applied in early December and removed by March 1 effectively protected plants for extended periods of temperatures of 0° F and was superior to other physical and chemical treatments. Alar increased cold tolerance by about 5° and delayed blooming and fruiting by about 5-7 days. Application of black polyethylene mulches for winter protection, though effective, presented some problems with application and removal.

4:00 Freeze Protecting Strawberries with Foam Insulation. 109A

Chesness, J. L., H. J. Braud, and **P. L. Hawthorne,** Louisiana State Univ., Baton Rouge.

Four field test plots were set up to ascertain the effectiveness of foam insulation material for protecting strawberries against freeze damage. Each plot was instrumented to determine soil and air temperatures four inches below and above the soil surface. A portable foam generator with its attendant mechanical accessories was designed and mounted on a tractor to supply the foam for the tests. Five one and two-night field trials were conducted between February 7 and March 12, 1968, employing a four-inch foam blanket. Soil surface temperatures (for the five tests) under the foam were 11° to 19° F warmer (depending on freeze severity) than unprotected surface temperatures. The "half life" (2" depth) of the foam varied from 18 hours to 39 hours, depending on the mixture used. Visual examination indicated no freeze damage to the blooms or other adverse physiological effects on the plants covered with the foam.

4:15 The Effects of Simulated Rain and Dew on Fluoride Accumulation by Citrus Foliage. 110

Brewer, Robert F., R. O. Perez, and **F. H. Sutherland,** Univ. of California, Riverside.

Washington navel orange trees were exposed to atmospheres containing 1-2 parts per billion HF by weight for approximately 9 months. One group of 6 trees was drenched weekly for 1 hour to simulate a heavy shower. A second group was sprinkled daily with a fine water mist to simulate a heavy morning dew. A third group received no special treatment but was exposed to the HF gas. A fourth group was grown in a duplicate greenhouse receiving no HF gas. Both the weekly 1 hour drenchings and the daily sprinklings resulted in reduced fluoride accumulation by the citrus foliage. The drenchings were especially effective in reducing fluoride uptake and its usual toxic effects on the citrus trees.

4:30 Pruning Effects on Growth and Fruiting of Lisbon Lemons. 111

Rodney, D. R., H. F. Tate, J. R. Kuykendall, and **R. E. Grounds,** Univ. of Arizona, Tucson.

Lisbon lemon trees (old lime) on Rouch lemon rootstocks were differentially pruned starting with 4-year-old trees in 1959. Four pruning treatments were compared with controls which were unpruned except for removal of shoots on the trunk below the scaffold branches as was done for all treatments. Trunk circumference increases during the 8-year period, 1959-67, were not significantly affected by any pruning treatments. For the years 1961 to 1963, yields were greater for the control trees than for those of any pruning treatment. During the period 1964 to 1967, trees in the treatment in which vigorous, sucker-type shoots were removed have equalled or surpassed the control trees in yields. The trees of this pruning treatment have the advantage that their centers are free of sucker-type shoots so that operations such as pest control and harvest are facilitated.

4:45 ASHS WESTERN REGION,
Business Meeting
Charles K. Labanauskas, Chairman
Chemistry 179

(14) ORNAMENTALS: SOIL AMENDMENTS AND NUTRITION

Engineering 1062

Presiding: Harold B. Tukey, Jr., Cornell Univ., Ithaca, New York.

1:45 A Proposed Method for Evaluation of Wetting Agents on Organic Amendments Used in Horticulture. 112

Sheldrake, Raymond, Jr., and **O. A. Matkin,** Cornell Univ., Ithaca, New York and Soil and Plant Lab., Orange, California.

Materials used for removing surface tension and improving the wetting ability are very well developed in other industries. However, limited information is available concerning surfactants or wetting agents used to facilitate wetting or specifically re-wetting of organic amendments such as peat moss or wood residuals. A rapid method will be presented which can be used to evaluate the activity of wetting agent compounds and to test their phytotoxicity. Sphagnum peat moss was used in this study of some 35 wetting agents. The dry, untreated peat moss was practically impossible to wet and required 5 to 7 days. Treatment with a wetting agent can reduce this time to from one to 10 minutes depending upon concentration. Three concentrations: 1, 0.3, and 0.1 percent were compared. All materials were subjected to a toxicity test using ryegrass and radish as a test plant. This method will be presented as a possible standard method. The reproducibility of results is excellent and the method is not very time consuming.

2:00 Utilization of Processed Garbage as a Soil Amendment in the Production of Selected Greenhouse Crops. 113

Sanderson, K. C. and **W. C. Martin, Jr.,** Auburn Univ., Auburn, Alabama.

Processed garbage was utilized as a soil amendment in a series of tests conducted with *Chrysanthemum morifolium, Antirrhinum majus, Lilium longiflorum,* and *Petunia hybrida.* Soil analysis of media containing 25-50% processed garbage revealed low nitrogen, phosphorous, and calcium levels, excessively high pH and high soluble salts. Processed garbage underwent a rapid breakdown in greenhouse culture causing nitrogen deficiency symptoms. Cut and potted chrysanthemums and Easter lilies grown in garbage-amended media were shorter than plants grown in peat-amended media. Flowering stems cut from chrysanthemums, grown in garbage-amended media weighed less than those grown in peat-amended media. The leaves of chrysanthemums, snapdragons, and petunias often exhibited injury, i.e., scorched margins. Processed garbage apparently contains a phytotoxic substance. Potted chrysanthemums grown in garbage-amended media had more breaks per plant than peat-amended plants. Easter lilies grown in garbage-amended media had slightly fewer flowers than those grown in peat-amended media.

2:15 Absorption of Nutrients by Dormant Plants and Its Practical Implications. 114

Good, G. L., and **H. B. Tukey, Jr.,** Cornell Univ., Ithaca, New York.

Experiments concerned with root growth and ion uptake of dormant plants were studied in root temperature chambers placed in growth rooms so that both air and root temperatures could be controlled. Roots of dormant privet (*Ligustrum ibolium*) and winged euonymus (*E. alatus*) grew well at root temperatures of 55°F., whereas temperatures of 45° and 35° limited growth. ^{32}P absorption by the roots and subsequent translocation to the stems were influenced by both root and air temperature. Field experiments indicated that nutrients applied to nursery crops in the fall could be absorbed and translocated to the stems and foliage, contributing to the dormant reserves of the plants, thus influencing the growth of the plants during the following spring.

2:30 Microbial Immobilization of Excessive Soluble Salts in Soils. 115

Koths, Jay S., Univ. of Connecticut, Storrs.

Microbial numbers increase rapidly when sucrose is applied to soil. Salts in the soil are immobilized through incorporation into the rapidly forming microbial tissue. In Connecticut greenhouse soils, the conductivity reading (1:2 extraction) was found to decrease 20 to 30 x 10-5 mhos when sucrose was applied at 10 lbs/100 gal/400 sq. ft. Spot watering of seedlings or rooted cuttings with 20 to 30 lbs/100 gal will lower salts locally and reduce transplanting shock caused by marginally high salts. The salt reduction is rapid, even in pasteurized soil. The sucrose may disappear from the soil in 24-48 hours while bacterial numbers increase 10 to 100-fold. Nitrate compensation may be necessary if soil nitrates are low. The salts are gradually returned to the soil solution as microbial numbers decline and the plants become established.

2:45 Diagnostic Flow Chart for the Evaluation of the Macronutrient Status of Carnation. 116

Green, James L., and **W. D. Holley,** Colorado State Univ., Fort Collins.

A method of evaluating the macronutrient status of carnation plants has been designed that takes into consideration: 1) the plant growth rate, 2) species-related mechanisms of ion accumulation as affected by inhibition and competition among ions in the applied nutrient solution, 3) pH, total ion concentration, and ion imbalances in the nutrient solution. Nutrient studies on carnation culminated in the design of a diagnostic flow chart based on tissue analyses' values. For each individual tissue sample the specific pathway on the chart that is followed, and the values for specific elements along that pathway, varies with the plant growth rate and balance of other ions in the tissue.

3:00 Foliar Analysis of Floricultural Plants. 117

Lindstrom, Richard S., Virginia Polytechnic Inst., Blacksburg.

Plants of *Rosa hybrida,* cv. Forever Yours and *Euphorbia pulcherrima,* cv. Paul Mikkelsen were grown in quartz sand and various modified Hoagland solutions were applied to induce deficiencies in a predetermined number of macro and micrometabolic elements. When deficiency symptoms appeared, the leaves were removed and the critical nutrient level for that nutrient was established by kjeldahl and spectrographic analysis procedures. Leaves were removed from various locations on the plant to ascertain the possibility of using one leaf to determine the nutrient status of the plant.

3:15 A Study of the Release Rate and Form of Nitrogen from Nine Slow-Release Fertilizers. 118

Sheldrake, Raymond, Jr., and **O. A. Matkin,** Cornell Univ., Ithaca, New York and Soil and Plant Lab., Orange, California.

Nine forms of commercially available slow release fertilizer compounds were compared in a laboratory leaching experiment. Each treatment was leached once each week for 16 weeks or longer. A quantitative and qualitative analysis was made on the leachate each week. Analyses were determined for total nitrogen, nitrate nitrogen, ammonia nitrogen, phosphate phosphorus, potassium, and magnesium. The standard of comparison was a constant liquid feed leaching formulated to provide 1000 mg of nitrogen during the 16 week period. The nitrogen recovery from the three replications of this treatment provided an excellent check on the methods used. Ninety-nine percent of the nitrogen was recovered from this treatment. The type and amount per week of nitrogen released will be presented. In 3 of the materials, less than 50 percent was recovered after 16 weeks and these were carried further for a total of 25 weeks.

3:30 Recess

3:45 The Effects of External Phosphorus Concentration and Internal Redistribution on the Spring Episode of Growth of Woody Ornamental Plants. 119

Meyer, Martin M., Jr., Univ. of Illinois, Urbana.

Taxus cuspidata, Juniperus chinensis 'Keteleeri' and *Berberis mentorensis* were grown with various levels of phosphorus during one growing season. During the dormant season some plants were analysed for phosphorus content. Other plants were grown six weeks in the spring in solutions containing phosphorus-32. Phosphorus applied the previous growing season influenced the growth of the plants the following spring. There was considerable redistribution of phosphorus from the previous season's growth into the new tissues. This redistribution varied with the internal phosphorus content from the previous season and with the external phosphorus-32 supplied during the spring episode of growth.

4:00 Influence of Nitrogen and Potassium Levels on Ash, Soluble Sugars, and Nitrogen Fractions in *Agrostis palustris.* 120

Markland, Flave E., and **Eliot C. Roberts,** Univ. of Florida, Gainesville.

Solution culture techniques were used to control levels of nitrogen and potassium supplied to a vegetative strain of *Agrostis palustris* (creeping bentgrass). Three levels each of nitrogen and potassium were combined in a 3 x 3 factorial with nine replicates of each treatment combination. Foliage was harvested at two-week intervals beginning on 3/31 and ending on 6/9. Percent ash expressed on a fresh weight basis decreased as nitrogen supply to the plant increased. As nitrogen supply increased, percent ash (on a dry weight basis) decreased; however, as potassium supply increased ash content increased. Soluble sugars varied directly with nitrogen levels. Potassium supply caused a quadratic response in accumulation of soluble sugars. A decreasing potassium supply resulted in a significant increase in the soluble nitrogen fraction in leaf tissue.

4:15 The Influence of Mulching, Soil Mix, and Fertilization on Winter Survival of Container-Grown Stock. 121

Jorgensen, Carl J. C., and **F. L. S. O'Rourke,** Colorado State Univ., Fort Collins.

Silver maple, Tammy juniper, Moffett juniper, and Japanese barberry were planted in 5-gallon containers. Four soil mixes containing loam, sand, peat and sawdust in these proportions: 2-2-1-1, 2-2-2-1, 2-2-2-2, and 2-1-1-0 were tested. Various fertilizer levels were applied during the growing season. The growth of the four species varied. Silver maple grew best in the 2-2-2-2 mix, Moffett juniper in the 2-1-1-0, and Tammy juniper in the 2-2-1-1 medium. Growth of Tammy juniper responded significantly to the high fertilizer level. Increase in winter mortality occurred where high levels of fertilizer had been applied. Plants were overwintered under three different systems: 1) set close together, well mulched with sawdust and watered bi-monthly, 2) set close without mulch and watered bi-monthly, 3) set close without mulch and watered monthly. Mulched plants showed less mortality and were more vigorous in the spring. Monthly watering was slightly superior to bi-monthly watering.

4:30 Characterization of the Soil Mixture Subsystem by a "Profile." 122

Furuta, Tok, Univ. of California, Riverside.

A major subsystem in the system of ornamental crop production is the soil mixture. Its physical, chemical and biological characteristics interact to influence plant growth directly, or indirectly by influencing some other factor such as nutrition. Specific data on hydraulic conductivity, cation exchange capacity, moisture release and other physical, chemical, and biological characteristics are required to develop a "profile" to fully evaluate this subsystem for its influence in a given system of growing plants. The same data is needed for evaluating the

interaction of other subsystems with soil mixtures on growth of plants. This method of systems analysis will also delineate areas where additional data is needed or research would be most productive.

4:45 ASHS WESTERN REGION,
Business Meeting
Charles K. Labanauskas, Chairman
Chemistry 179

MONDAY EVENING

6:30 EXTENSION HORTICULTURE BANQUET
Segundo Annex (63)
University of California, Davis

INFORMAL DISCUSSION GROUPS

All discussion groups are open to interested persons.

7:30 VEGETABLE BREEDING AND VARIETY SESSION
Engineering 2129

Presiding: Dermot P. Coyne, Chairman, Vegetable Breeding and Varieties Committee, ASHS, University of Nebraska, Lincoln.

1. **Unstable Gene Systems in Vegetable Crops and Implications for Selection.**
   Oscar H. Pearson, Cornell Univ., Ithaca, New York.
2. **Breeding Vegetable Crops Resistant to Environmental Stress.**
   R. W. Robinson, New York State Agric. Exp. Station, Geneva.
3. **Education and Training of Graduate Students in Plant Breeding for the Future.**
   C. V. Hall, Kansas State Univ., Manhattan
   Allen P. Trotter, Asgrow Seed, Orange, Connecticut
   C. E. Peterson, Michigan State Univ., East Lansing
4. **Discussion**

8:00 POMOLOGICAL RESPONSES TO AMCHEM 66-329
Engineering 1120

Presiding: L. J. Edgerton, Cornell Univ., Ithaca, New York.

8:00 NUTRITIONAL EVALUATION FOR FLORICULTURE
Engineering 1062

Presiding: John W. White, Pennsylvania State Univ., University Park.

8:00 HORTICULTURAL OPPORTUNITIES AND CHALLENGES IN THE AREA OF THE FUNCTIONAL AND ESTHETIC ENVIRONMENT, INCLUDING PARKS, RECREATION, BEAUTIFICATION AND CONSERVATION.
Engineering 1066

Presiding: Eliot C. Roberts, Chairman, Beautification, Recreation and Land Use Committee, ASHS.

8:00 POSTHARVEST HORTICULTURE
Engineering 1060

Presiding: D. V. Fisher, Chairman, Post-harvest Horticulture Committee, ASHS, Canada Dept. of Agric. Res. Station, Summerland, British Columbia.

8:30 CONCURRENT GENERAL SESSIONS

(15) EVALUATION OF UNIVERSITY TEACHING OF BIOLOGY
Chemistry 179

Presiding: Richard W. Harris, Program Chairman, University of California, Davis.

The Faculty at Davis sponsored research on the attributes of good and poor teaching and the evaluation of teaching. Aspects of the study relevant to teaching biology will be discussed. **123**

Milton Hildebrand, Co-Director, Study of Teaching and Methods of Evaluating Teaching, Dept. of Zoology, Univ. of California, Davis.

(16) PHYTOTRONS: TOOLS FOR HORTICULTURAL RESEARCH
Engineering 2129

Presiding: Harry C. Kohl, Jr., Univ. of California, Davis.

A description of what constitutes a phytotron and a discussion of the types of problems that can be investigated advantageously in a phytotron. **124**

Harry Hellmers, Professor, Director of Phytotron, Dept. of Botany, Duke Univ., Durham, North Carolina.

(17) THE PLANT HORMONES: SOME ADVANCES AND SOME MOOT QUESTIONS
Chemistry 194

Presiding: Lawrence L. Rappaport, Program Committee, Univ. of California, Davis.

Insights into the current and future roles of plant hormones in regulation of vegetative, reproductive, and aging processes in horticultural plants. **125**

Anton Lang, Director, Michigan State Univ./Atomic Energy Com. Plant Res. Lab., East Lansing.

(18) SYMPOSIUM: CHEMICAL REGULATION OF PLANT PROCESSES
Chemistry 194

Presiding: Anton Lang, Michigan State Univ., East Lansing.

9:30 **Control of Vegetative Growth and Flowering.** **126**
Sachs, Roy M., Univ. of California, Davis.

10:05 **Fruit Set and Development.** **127**
Crane, Julian C., Univ. of California, Davis.

10:40 **Recess**

10:55 **Hormones and Fruit Ripening.** **128**
Dilley, David R., Michigan State Univ., East Lansing.

11:30 **Aging, Senescence and Abscission.** **129**
Addicott, Fredrick T., Univ. of California, Davis.

12:05 **Discussion**

12:30 **Adjourn**

(19) FRUIT: NUTRITION
Chemistry 179

Presiding: Gene H. Oberly, Cornell Univ., Ithaca, New York.

9:30 **Nutrient Analysis of Plant Tissue by Use of the Electron Microprobe X-Ray Analyzer.** **130**
Kenworthy, A. L., and **Cyril Bould,** Michigan State Univ., East Lansing, and Long Ashton Res. Station, Bristol, England.

Several methods of sample preparation for microprobe analysis were studied. Many of these were not satisfactory because of crystal formation or lack of uniform distribution in the scanning field. Dissolving plant ash in HNO_3 + $CoNO_3$ and dispersing solution in bovine serum albumin (BSA) resulted in good distribution when submitted on polished carbon discs as 1) nano-liter drops or 2) 14 micro cryostat sections. K, Ca, Ma, and P could be determined. More elements could be determined by: 1) digesting tissue with HNO_3 + $CoNO_3$ prior to ashing, 2) embedding a pellet of ash in H_3BO_3 brickets for submitting to microprobe. This permitted determinations for K, Ca, Mg, P, Mn, Fe, Cu, Zn, Al, Ba, Na, Si, Al, and total ash. Analytical variance and calibration curves will be presented.

9:45 **Foliar Absorption of Boron by Bartlett Pears.** **131**
Crandall, O. C., and **C. G. Woodbridge,** Washington State Univ., Pullman.

Soluble boron sprays at the rates of one and two pounds of material in 100 gals of water were applied to Bartlett pear trees at each of the following times: 2-14 days before harvest; 19 days after harvest; 12 days before full bloom; 45 days after full bloom; and 95 days after full bloom. Boron was determined in flower clusters at full bloom, in leaves 45, 95, and 106 days after full bloom, and in the fruit at harvest time. Post harvest, preharvest, and prepink application times, listed in order of effectiveness, controlled blossom blast. Sprays applied 45 days after bloom or within 2 weeks of harvest had only moderate effects on the boron content of fruit but when applied 95 days after bloom, both leaf and fruit boron was greatly increased. No harmful effects on storage or ripening was apparent with the boron content of fruit between 50 – 75 ppm.

10:00 **Magnesium Nutrition of Apple Trees as Affected by a Wide Range of Fertilizer Materials.** **132**
Smith, Cyril B., Pennsylvania State Univ., University Park.

The effects of various fertilizer materials on magesium absorption were studied in a commercial apple orchard where liming had been adequate but magnesium leaf content was low. Nine treatments were applied to Jonathan and Red Rome trees over a 5-year period. Treatments included 3 carriers of magnesium (magnesium sulfate, Mag Ad and Alcan Magnesia), 4 carriers of nitrogen (ammonium nitrate, sodium nitrate, ammonium sulfate and urea), and high rates of triple superphosphate and muriate of potash. Twelve-element analyses of leaf samples taken at 3 periods each season showed effects on absorption of magnesium and other elements. Magnesium sulfate (applied annually) and Alcan Magnesia (applied 1963) increased magnesium uptake. Ammonium sulfate restricted magnesium uptake; other nitrogen carriers had little effect. The high phosphorus rate had little effect but the high potassium rate significantly lowered leaf content of magnesium and calcium.

10:15 **The Relationship Between Calcium, Magnesium, and Potassium Accumulation and Titratable Acidity in the Leaves of Selected McIntosh Apple Clones.** **133**
Ddungu, John C. M., and **Russell Eggert,** Univ. of New Hampshire, Durham.

Water extracts of dry leaf tissues from selected McIntosh apple clones were analyzed by sodium hydroxide titration and by atomic absorption spectrophotometry. It was shown that titratable acidity increases in

the leaves as the growing season advances. The data suggest that calcium and magnesium which accumulate in the leaves are the principal cations involved in neutralizing this acidity. A relatively constant pH thus may be maintained in leaf tissues. It is theorized that changes in leaf pH may be a major cause of damage characteristic of some mineral deficiencies in apples.

10:30 The Synthesis of Glutamate and Aspartate in Peach and Apple Roots. 134

Titus, John S., Walter Splittstoesser, and **Patricia Spencer,** Univ. of Illinois, Urbana.

The synthesis of asparate and glutamate from α-ketoglutarate-5-^{14}C and fumarate 1-4-^{14}C was studied in excised peach and apple roots. The label from both substrates appeared rapidly in both amino acids and accumulated steadily over five-hour experimental periods. Within three minutes both glutamate and aspartate were labeled from fumarate, but only glutamate was labeled from α-ketoglutarate at this time. These incorporation patterns suggest that carbohydrates which enter the citric acid cycle give rise to the amino acids involved in nitrogen translocation in both peach and apple.

10:45 Recess

11:00 Influence of Nitrogen on the Concentration of Arginine and Total Free Amino Acids in Grape Tissue. 135

Kliewer, W. Mark, and **James A. Cook,** Univ. of California, Davis.

The concentration of arginine, total free amino acids, soluble nitrogen and insoluble nitrogen in ten different parts of Thompson Seedless grapevines were determined at various times during the season on vines grown in the greenhouse in a sponge rok medium which were irrigated with one of six different Hoagland solutions; 0, 1/32, 1/16, 1/8, 1/4, and 1/2 strength. Arginine and total free amino acids were at maximum concentrations in the roots and aerial woody tissues at budburst and at minimum levels during the latter part of the growing season. The concentration of total free amino acids and arginine in the root and cane tissues increased steadily with increases in the level of nitrogen in the nutrient solutions with about a 5 and 10 fold range in concentration of these two groups of compounds respectively. The basal two-thirds of canes and the largest size roots were highest in arginine and free amino acids.

11:15 The Influence of Different Levels of Potassium and Magnesium on Leaf Composition, Brix, and Acidity of Valencia Oranges under Field Conditions. 136

Rodriguez, Saulo J., E. Hernandez-Medina, and **Reinaldo del Valle,** Univ. of Puerto Rico, Rio Piedras.

Five levels of magnesium were factorially combined with five levels of potassium. The differential treatments were applied to eight-year-old Valencia orange trees grafted in grapefruit. Fruit samples were analyzed for Brix and total acidity, while the leaf samples were analyzed for potassium, calcium and magnesium. Analysis of variance did not reveal significant differences in the Brix readings and total acidity of the fruits. The potassium and the calcium content in the leaves differed significantly but not so the magnesium content. There was a positive correlation between leaf potassium levels and acidty, and negative correlations between calcium with potassium and magnesium with potassium.

11:30 Seasonal Changes in Nitrogen and Carbohydrate Metabolism in Redblush Grapefruit on Three Rootstocks. 137

Wutscher, Heinz K., USDA, Weslaco, Texas.

Analyses of root, twig and leaf samples collected from Redblush grapefruit trees on Cleopatra mandarin, rough lemons and sour orange root-

stocks every month from November to March showed higher nitrogen levels in the leaves and twigs of trees on rough lemon rootstocks at the onset of the cold season. Differences in non-protein nitrogen and sugars are discussed.

11:45 Nutritional Effects Connected with Sheepnosing, A Disorder of Grapefruit. 138

Wutscher, Heinz K., USDA, Weslaco, Texas.

Sheepnosing results in obovoid fruit with high collared and depressed bases which lowers its fresh fruit value. This disorder is not equally common in all citrus areas in South Texas and there are pronounced differences from grove to grove on the same farm. Soil pH is apparently not a factor, but trees bearing fruit with high levels of titrable acidity are more severely affected; these trees usually have lower potassium concentrations in the leaves.

(20) VEGETABLE CROPS: BREEDING, DISEASE AND INSECT RESISTANCE

Engineering 1120

Presiding: Henry M. Munger, Cornell Univ., Ithaca, New York.

9:30 Nature and Inheritance of Resistance to Red Clover Vein Mosaic Virus in *Pisum sativum.* 139

Baggett, J. R., and **J. D. Tsai,** Oregon State Univ., Corvallis.

An economic resistance to a strain of Red Clover Vein Mosaic in pea cultivars and breeding lines has been studied in the greenhouse. Resistant plants are infected by the virus and carry it in substantial concentration, but are symptomless. Plant size may be reduced and mild symptoms may be expressed in some lines under some conditions, but in the more resistant genotypes symptoms have never been observed and reductions in growth are not apparent. The symptomless reaction is controlled by a single recessive gene, probably with modifiers which influence the occurrence of mild symptoms. Studies are being made on the effects of the virus on the growth rates of infected plants and on the effects of environmental factors on symptom expression.

9:45 Breeding Glasshouse Cucumbers in the Netherlands. 140

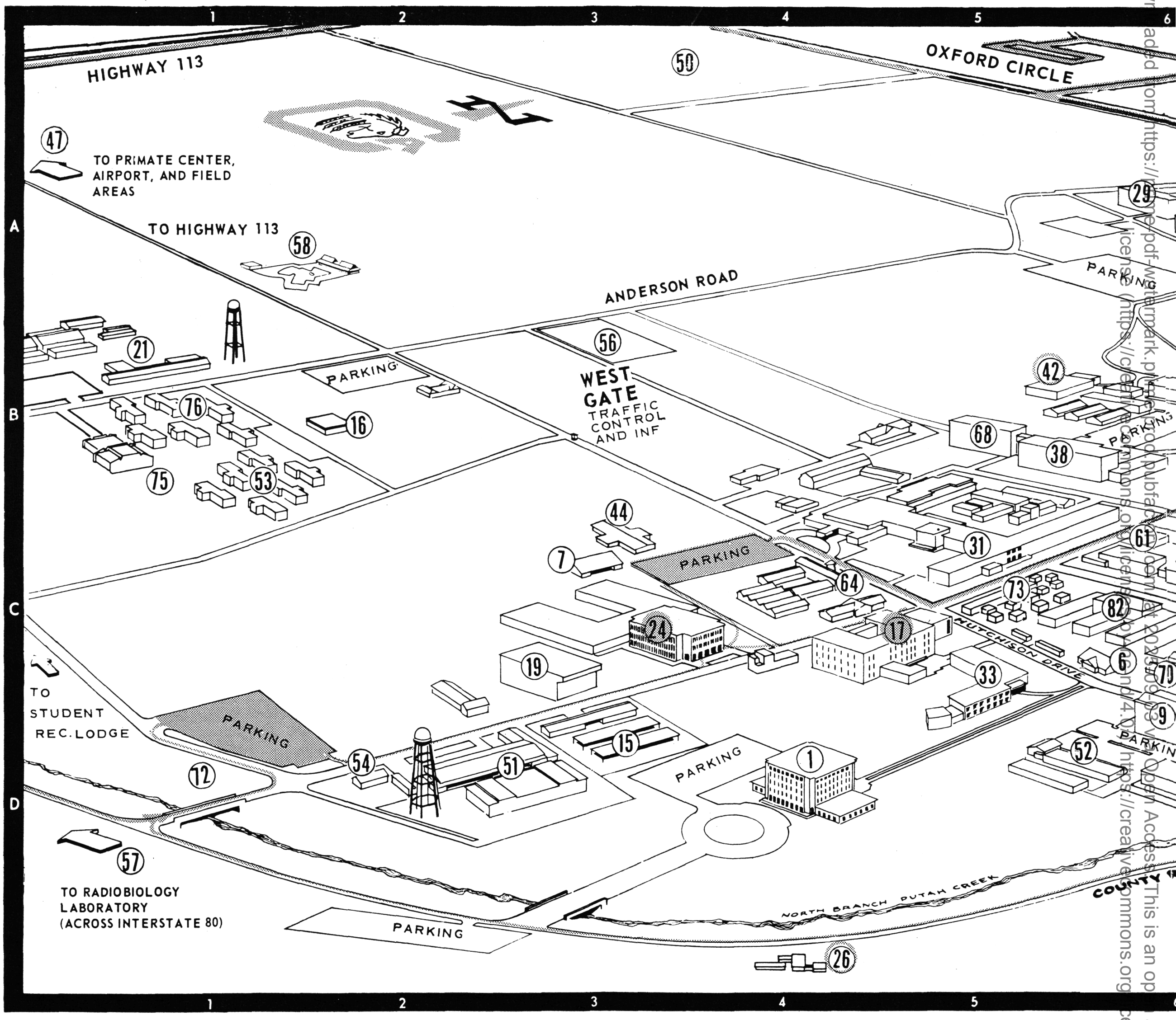
Kooistra, E., Inst. of Hort. Plant Breeding, Wageningen, Netherlands.

With the introduction of scab- and spot-resistant varieties these diseases practically disappeared. Absolute freedom from bitter principle finally solved a serious quality problem arisen from modifying the cultural method. By breeding female-flowered varieties, attempts are made to avoid the danger of seed fruits in varieties with a parthenocarpic setting of fruit. A high degree of tolerance of Cucumis virus 1, which is now also being incorporated, seems sufficient. On the other hand, the non-appearance of visible disease symptoms following infection with Cucumis virus 2 was not found to guarantee a solution of the virus problem. A promising character seems to be a high degree of resistance to powdery mildew, derived from crosses between various partially resistant parents.

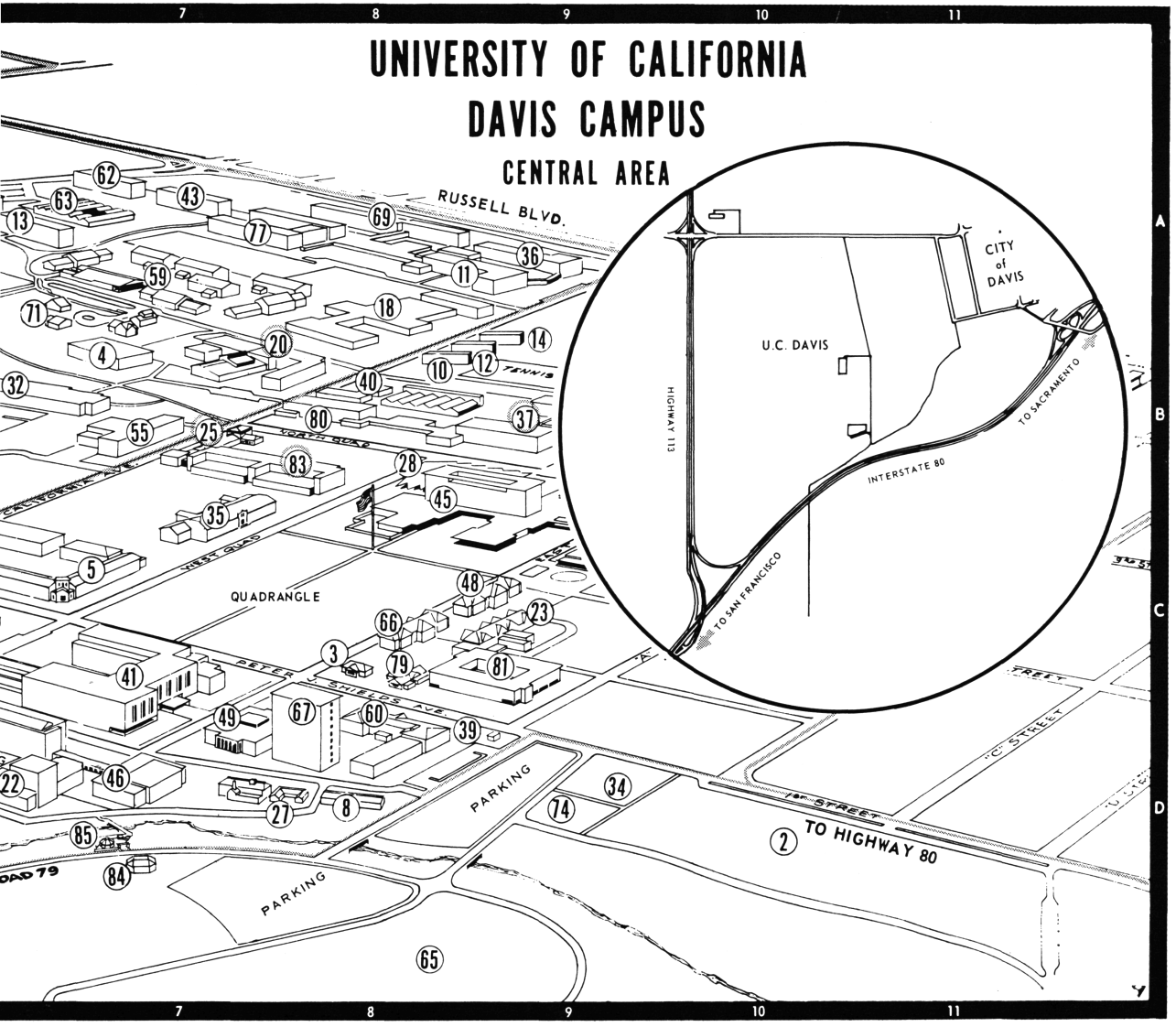
10:00 The Effect of Scab Resistance on Fruit Length in Slicing Cucumbers. 141

Wilson, James N., and **Henry M. Munger,** Cornell Univ., Ithaca, New York.

It has been difficult to combine scab resistance with adequate fruit length in slicing cucumbers. Fruit length and width measurements were taken on progenies derived from as many as nine backcrosses to Ash-



1 Administration Building D-4
2 Aggie Villa D-10
3 Agricultural Extension C-8
4 Agricultural Toxicilogy B-7
5 Animal Science C-7
6 Applied Behavorial Sciences C-6
7 Architects and Engineers C-3
8 Art Laboratory D-8
9 Art Building D-6
10 Ash Hall B-8
11 Beckett Hall A-8
12 Birch Hall B-9
13 Bixby Hall A-6
14 Cedar Hall B-9
15 Central Garage D-3
16 Central Services B-2
17 Chemistry Building C-5
18 Cowell Student Health Center B-8
19 Crocker Nuclear Laboratory C-3
20 Cruess Hall B-7
21 Dairy Cattle Research B-1
22 Dramatic Art Building D-6
23 East Hall C-9
24 Engineering Building C-3
25 Enology Laboratory B-7
26 Environmental Horticulture D-4
27 Fire House D-7
28 Freeborn Hall D-8
29 Gilmore Hall A-6
30 Gymnasium B-10
31 Haring Hall C-5
32 Hoagland Hall B-6
33 Home Economics Building D-5
34 Home Management D-9
35 Horticulture Building C-7
36 Hughes Hall A-9
37 Hunt Hall B-9
38 Hutchison Hall
39 Information Booth
40 Irrigation Labora
41 Library C-7
42 Louis Mann Labo
43 Malcolm Hall A
44 Medical Building (Tempora
45 Memorial Union
46 Music Building
47 National Center Biology A-1



48 North Hall C-8
49 Olson Hall D-7
50 Orchard Park Apartments A-3
51 Physical Plant D-3
52 Physics Building D-6
53 Pierce Hall B-1
54 Police D-2
55 Poultry Husbandry B-7
56 Radiobiology Annex B-3
57 Radiobiology Laboratory D-1
58 Recreation Swimming Pool A-2
59 Regan Hall A-7
60 Roadhouse Hall D-8
61 Robbins Hall C-6
62 Ryerson Hall A-7
63 Segundo Dining Commons A-6
64 Silo Fountain C-4
65 Solano Park Apartments D-8
66 South Hall C-8
67 Sproul Hall D-8
68 Storer Hall B-5
69 Struve Hall A-8
70 Temporary Buildings (5–6) C-6
71 Temporary Buildings (13–16) A-6
72 Temporary Buildings (29–35) D-1
73 Temporary Buildings (98–115) C-5
74 Temporary Buildings (116–124) D-9
75 Tercero Dining Commons B-1
76 Thille Hall B-1
77 Titus Hall A-7
78 Toomey Field B-11
79 University House C-8
80 Veihmeyer Hall B-8
81 Voorhies Hall C-9
82 Walker Engineering Building C-6
83 Wickson Hall B-7
84 Wyatt Pavilion Theatre P-7
85 Wyatt Snack Bar D-7
86 Young Hall C-9

ley or to Marketer. In numerous comparisons, susceptible plants produced the longest fruit; heterozygous resistant plants, shorter fruit; and homozygous resistant plants the shortest. In a typical comparison, length : width ratios were 4.70, 4.42, and 4.06, respectively. No homozygous resistant progenies with fruit length equal to Ashley or Marketer were found, although selection for length has given improvement. With mosaic resistant slicers as recurrent parents, there has been less difference in fruit length between scab resistant and susceptible plants.

10:15 Development of Downy Mildew Resistant Broccoli, Cabbage, and Collards. 142

Barnes, William C., Clemson Univ., Charleston, South Carolina.

P.I. 189028 broccoli and P.I. 261774 cabbage were used in developing lines of broccoli, cabbage, and collard with resistance to downy mildew. Resistance to downy mildew in the adult plant stage has been good until senescence when it breaks down, however in the plant bed or juvenile stage resistance has been only fair. Resistance appears to be controlled largely by one dominant gene. Lines selected for resistance, cold tolerance and desirable horticultural characters are sufficiently uniform for yield trials to begin.

10:30 Inheritance of Resistance in Tomato (*Lycopersicon spp.*) to the Anthracnose Pathogen *Colletotrichum coccodes*. 143

Robbins, M. LeRon, and **Fred F. Angell**, Univ. of Maryland, College Park.

The search for anthracnose resistance in a source with desirable horticultural characters involved screening 24 tomato varieties and lines. Varieties and lines were differentially susceptible, but none were resistant enough to be used as resistant parents in a breeding program. Therefore, resistant P.I. lines were hybridized with the cultivars Roma and Heinz 1350. Six genetic populations (P_1, P_2, F_1, F_2, B_1P_1, and B_1P_2) of each cross were grown and fruits inoculated. In the inoculation technique used, a spore suspension droplet was placed onto a fruit from a hypodermic syringe, and the fruit skin underneath the droplet was then pricked with the hypodermic needle. Disease development occurred at room temperature without the necessity of controlled humidity. Results indicated that resistance is quantitatively inherited and is partially dominant to susceptibility.

10:45 Recess

11:00 Longevity of Tomato Plants in Diseased Fields as Affected by Breeding. 144

Gilbert, James C., Jack S. Tanaka, and **J. T. Chinn**, Univ. of Hawaii, Honolulu.

The accumulation of genes for disease resistance in tomato lines in Hawaii has apparently been assisted by hybrid vigor in extending the life of multiple resistant F_1 hybrids. Ten years use of such hybrids including the annual trials of the Southern Tomato Exchange program, has provided evidence of consistently longer survival and production in disease infested fields.

11:45 Corn Earworm Damage to Ears with Starchy (Su_1) Versus (su_1) Kernels on Genetically Uniform Mother Plants. 145

Cameron, J. W., L. D. Anderson, and **H. H. Shorey**, Univ. of California, Riverside.

Earworm damage to ears of sweet corn hybrids hand-pollinated to produce contrasting starchy and sugary kernel types with uniform mother-plant husk characters, was determined in 11 replicated trials in 1965, '66, and '67. Ears were either hand infested at once with young larvae and rated at fresh market harvest 18 days later, or infested 10 days after pollination and rated at hard dough stage 20 days later. By F tests, there was significant difference in damage to the 2 kernel types in 4 trials and non-significance in 7 trials. Overall, sugary ears showed only a slight trend toward greater damage. Evidently carbohydrate balance is not a major factor in earworm resistance at these stages; husk tightness, as shown in earlier studies, remains an important proven resistance factor.

11:30 Selecting Tomatoes for Resistance to Spider Mites. 146

Stoner, Allan K., USDA, Beltsville, Maryland.

Tomato plants possessing a high level of resistance to the spider mite (*Tetranychus cinnabarinus* (Boisduval)) (colony supplied by Floyd F. Smith) can be identified in segregating populations by selecting those with the greatest concentration of glandular hairs on their leaves. The glandular hairs may be counted with a stereoscopic microscope, or estimated with the naked eye when the plants are 6 to 8 weeks old. In 18 of 21 F_2 populations studied, plants selected for their high concentration of glandular hairs had higher levels of resistance to mites (as determined by oviposition rate) than did plants selected for having few hairs. The average number of eggs laid per female mite ranged from 6.2 to 50.5% less on the plants selected for a high concentration of hairs than on those with few hairs. Selection with the naked eye was as effective as actual glandular hair counts for identification of resistant segregates.

11:45 Variation in Response to Iron Nutrition Among Some Corn Inbreds. 147

Maynard, Donald N., and **Sylvanus Odurukwe**, Univ. of Massachusetts, Amherst.

A group of corn inbreds was screened for susceptibility to iron chlorosis. The inbreds were classified as susceptible-responsive, susceptible-not responsive, and resistant to iron deficiency chlorosis and were represented by Wf9, Oh40B, and Ma21547, respectively. These inbreds were used in subsequent experiments to study the response to iron sources, iron concentration, temperature, and interacting ions (Mn, K, Mg, and PO_4). Growth, iron chlorosis expression, iron accumulation, iron: interacting ion ratios, and the development of iron toxicity symptoms were all affected by the above variable treatments. However, the initial iron response classification remained constant regardless of variations in nutritional or environmental regime.

(21) ORNAMENTALS: WATER RELATIONS AND KEEPING QUALITY

Engineering 1062

Presiding: Anton M. Kofranek, Univ. of California, Davis.

9:30 Antitranspirants for Horticultural Crops. 148

Davenport, David C., Paul E. Martin, and **Robert M. Hagan**, Univ. of California, Davis.

Antitranspirants may alleviate water deficits, which adversely affect plant growth, by 1) forming a film over the foliage, 2) reducing stomatal apertures, or 3) increasing leaf reflectance. These materials may reduce irrigation requirements, extend environmental adaptability, improve yield and quality of produce, and possibly facilitate mechanical harvest operations. Data reported include dendrometer and relative turgidity measurements on almond trees sprayed with plastic antitranspirants which reduced transpiration, increased the water balance of the tree, and reduced afternoon shrinkage of the trunk by 50%. However, daily trunk growth was somewhat reduced. Phenylmercuric acetate (PMA) lowered transpiration rates of irrigated Oleander plants by over 30%. This could reduce the high costs of irrigation of highway ornamentals in arid regions. Other possible uses of antitranspirants on horticultural crops are summarized.

9:45 Observations on Radiant Energy Exchange and Water Loss from Carnations in a Glass Covered Greenhouse. 149

Hanan, Joe J., Colorado State Univ., Fort Collins.

Measurements of total radiation inside and outside the greenhouse, reflected and net radiation inside, above carnations grown in an inert substrate showed that radiant energy transmitted into the greenhouse, and the albedo of the crop, may be considered as constants during the period the measurements were taken. High linear correlations were found between evapotranspiration, net radiation and vapor pressure gradient. No attempt was made to complete evaluation of the transfer coefficient — i.e. resistance to water vapor movement of the vegetation and of the free air. Under certain conditions, a high input of sensible heat to evaporate water was found to occur which resulted in evapotranspiration exceeding net radiant energy input.

10:00 Endogenous Factors Associated with Keeping Quality in Poinsettia. 150

Gilbart, David A., and **Kenneth C. Sink**, Michigan State Univ., East Lansing.

Several cultivars of Poinsettia, *Euphorbia pulcherrima* Willd. ex Klotzsch, chosen to encompass a broad range of keeping times as expressed by leaf and bract abscission, were studied with respect to their post maturation respiratory pattern, sugar and starch level, protein and soluble non-protein nitrogen content, peroxidase activity and ethylene evolution. Correlation was made between ageing or abscission of leaves or bracts and a decreased respiration rate, a lower level of sugar and carbohydrate storage material, a decreased protein and non-protein nitrogen content and an increase in peroxidase activity. Ethylene was not evolved in significant amounts and does not appear to control abscission. The basic control of leaf and bract drop in poinsettia and varietal differences may be explained through changes in the level of endogenous auxin as controlled by peroxidase.

10:15 Impairment of Water Uptake Through Cut Stems. 151

Smith, Daniel E., Univ. of California, Davis.

Data are given relative to decrease in capacity of a cut stem vs. an intact stem. Data likewise indicate that air blocks are more serious for stems with long, wide, uninterrupted xylem elements. Likewise data are given which indicates that species vary widely in sensitivity to bacterial plugging of the vessels.

10:30 Recess

10:45 The Effect of Hydrogen Ion on Transpiration. 152

Farhoomand, M. B., L. A. Peterson, and **T. C. Hall**, Univ. of Wisconsin, Madison.

The transpiration rate in *Nicotiana tabacum* with roots immersed in a solution at pH 3.0 was significantly lower than that for plants with their roots in solutions at pH 4.0 or at pH 6.5. Since wilting occurred in the pH 3.0 treated plants, it was apparent that an insufficient quantity of water was available to the leaves to compensate for transpiration losses and to maintain turgor. This disruption in the internal water balance of the plants was attributed to the physiological distortion of the root tissues. The plants subjected to a pH 4.0 treatment, however, maintained turgor and transpired at rates comparable to the plants in pH 6.5. It is suggested that as far as the transpiration process is concerned, pH 4.0 is within the physiological range for the tobacco plant.

11:00 The Characterization of Water Potential in *Chrysanthemum morifolium* During Non-Stress and Stress Conditions. 153

Spomer, Louis A., and **R. W. Langhans**, Cornell Univ., Ithaca, New York.

Although water is quantitatively and qualitatively the most important nutrient required for plant growth, almost nothing is known about the state of water in the various plant tissues during non-stress and stress conditions. The activity of water in plants depends on its thermodynamic state or water potential. Two methods of measuring plant water potential, the thermocouple psychrometer method and the dye method, were used to characterize the state of water in five varieties of *Chrysanthemum morifolium* during non-stress and stress conditions. Preliminary observations relating the state of water in plants to the physiological effects of water stress are discussed.

11:15 A Comparison of Two Methods of Measuring Plant Water Potential in *Chrysanthemum morifolium*. 154

Spomer, Louis A., and **R. W. Langhans**, Cornell Univ., Ithaca, New York.

The physiological activity of water in plants depends on its thermodynamic state or water potential. The characterization of water potential in plants is an essential preliminary step to any study of plant water relations. Not much is known about plant water potential in various tissues under different conditions. This lack of knowledge is partly due to the difficulty of the measurement of plant water potentials. In this paper two methods of measuring plant water potential in *Chrysanthemum morifolium*, the thermocouple psychrometer method (difficult) and the dye method (relatively easy), are compared. The advantages and disadvantages of both methods for floricultural research are discussed.

(22) HORTICULTURAL EDUCATION

Chemistry 166

Presiding: O. A. Batcheller, California State Polytechnic College, Pomona.

9:30 The Value of Student Projects in Horticultural Education. 155

Karle, Harry P., and **O. Martin Braun**, Fresno State College, Fresno, California.

As more students with an urban background enroll in agriculture, the value of student project program becomes more apparent. Since the inception of this program, more than 350 students have undertaken projects in various areas of horticulture. A student may rent 1 to 5 acres of fruit trees, grapevines, or land for vegetables and then performs all the seasonal cultural operations under the supervision of his professor. In the case of tree fruits, a student begins with pruning and completes the project after the crop is sold and a detailed record book is accepted. After the sale of the product and all the expenses are paid the student shares in the profit. The average return to the student has been more than would have been received for work on an hourly basis. All students are encouraged to incorporate at least one experiment in their project. Examples of past experiments are; pruning trials, spray thinning, irrigation studies, harvesting aids, storage trials and fertilizer trials. We believe the project program is a most valuable adjunct to horticulture education.

9:40 The Value of Horticultural Research Training at the

Undergraduate Level. 156

Robbins, M. LeRon, Iowa State Univ., Ames.

Undergraduate students interested in horticultural research careers can benefit greatly from research training while undergraduates. A student may get research training by doing a research project or by working part time and summers for his horticulture department, or summers for other horticulture departments or experiment stations. The Collegiate Branch paper sessions of our Society and of the Southern Section have created research interest among undergraduates. A student entering one of these contests receives, from staff members of his department, instruction in the scientific method. He also learns how to write and orally present a scientific paper. This talk will tell what working for horticulture departments and doing research projects has meant to my peers and me.

10:00 An Analysis of the Inputs for Horticultural Research in 1967. 157

Harris, C. I., and **David R. Walker,** USDA, Washington, D. C.

The 1967 expenditures and numbers of scientist-man-years on state and federal research projects have been studied in an attempt to summarize the effort devoted to research on fruit crops, vegetable crops, and ornamentals. In the total programs of the State Agricultural Experiment Stations and the United States Department of Agriculture there were $57 million alloted to projects with more than 1800 scientist-man-years devoted to research related to horticultural crops. Of the total scientist-man-years, 274 were devoted to citrus and subtropical fruits, 541 to deciduous and small fruits and tree nuts, 141 to potatoes, 581 to vegetables other than potatoes, and 266 to ornamentals and turf. Research programs at the State Agricultural Experiment Stations accounted for approximately 70% of the total.

10:15 A Ten Year Projection for Horticulture Research. 158

Walker, David R., and **C. I. Harris,** USDA, Washington, D. C..

A long range study, made by experiment station directors and members of the Department of Agriculture, projected the number of research scientist man years they anticipate should be involved in specific agriculture areas in 5 and 10 years from now. Remote sensing research is slated for a 70 percent increase. The majority of agricultural crop research is projected for less than a 100% increase with some less than 40 percent. Weather modification is projected for a 244 percent increase. Specific research areas such as production efficiency, improving consumer acceptability, crop protection and mechanization of the various horticulture commodities have also been studied. Government funds will likely be provided, to some extent, on the basis of this study.

10:30 Two Methods of Popularizing Results of Horticultural Research. 159

Watson, Donald P., and **Richard A. Hamilton,** Univ. of Hawaii, Honolulu.

Techniques of popularizing the significance of "The Relationship of Nodal Structure to Training Macadamia Trees" by R. A. Hamilton, W. B. Storey and E. T. Fukunaga, 1963, Proc. Amer. Soc. Hort. Sci. 61:317-323, for consumers through the media of newspaper releases and television programs include; searching for and selecting a paper of consequence; thorough understanding of authors research and interpretation; postulating the features of consumer identification, inclusion of explanation of scientific result, impact upon consumers. Newspaper approach features: headline selection, explanation on loss of crop if research results had not been practiced, importance of results, monetary return in relation to cost of research. Television approach includes: dramatization of use of product, contingence of its existence upon university research, the research personalities and their discovery, other uses of the product.

10:45 Horticultural Education in Turkish Universities. 160

Bienz, Darrel R., Washington State Univ., Pullman.

Three Turkish universities are presently offering a curriculum which leads to the equivalent of a BS (agr.) Degree with a major in horticulture and a fourth is being established. At Ege University, which is typical, 200 of the 2000 students enrolled in the 5-year agricultural curriculum have expressed an interest in horticulture. These students study general science during the first year, agriculture during the second, third and ½ of the fourth years, and horticulture during the fifth year. During the spring semester and following summer, fourth-year students gain practical experience on the nearby university farm. Contrasts between the Turkish system and the American system of horticultural training, as well as adjustment problems which Turkish students experienced when they pursue graduate work in the United States, will be discussed.

TUESDAY AFTERNOON

(23) FRUIT: GROWTH REGULATORS AND BIOCHEMISTRY

Engineering 1062

Presiding: George C. Martin, Univ. of California, Davis.

1:15 Effect of Ethylene on Growth and Maturation of the Fig (*Ficus carica* L.) Fruit. 161

Maxie, E. C., and **J. C. Crane,** Univ. of California, Davis.

Ethylene (C_2H_4) at a concentration of 5 ppm inhibited the growth of fig fruits during Period I (cell division stage) but stimulated growth and maturation markedly during Periods II and III (cell enlargement stages). The rapid growth during Period II was dependent on exogenously supplied or endogenously induced C_2H_4. Individually treated fig fruits were powerful sinks, while treatment of individual leaves subtending a fruit had no effect on fruit growth. Fruits treated with C_2H_4 during the first half of Period II did not develop typical flavor, as did fruits treated in the last half or during Period III. The role of 2,4,5-T in stimulating growth and maturation by fig fruits is indirect, via induced C_2H_4 production. Ethylene is proposed as a regulator that initiates growth Period III and eventual maturation of fig fruits.

1:30 Fruiting Response of the Highbush Blueberry to Applied Gibberellic Acid Under Field Conditions. 162

Eck, Paul, and **Charles Mainland,** Rutgers Univ., New Brunswick, New Jersey.

Gibberellic acid (GA) at 0, 50, 100, 250, 375 and 500 ppm was applied to the highbush blueberry (var. Coville) at bloom for two consecutive seasons in the field. Duplicate treatment of the 500 GA level in 1966 and of the 250, 375 and 500 ppm GA levels in 1967 were caged to exclude pollinating insects. Percentage fruit set was increased by all GA treatments in 1966. In 1967, yields were increased by the 100, 500 and 500 caged treatments. GA treated plants produced berries that were smaller and later ripening than pollinated fruit. No difference in mold incidence and percentage weight loss in storage were apparent between treated fruit and the control. Only fruit from caged plants receiving 500 ppm GA had sucrose percentage and refractive index values less than those of the control berries. The GA treatments did not reduce the number of flower buds formed in 1966 or 1967.

1:45 The Effect of Gibberellic Acid on the Highbush Blueberry (*Vaccinium corymbosum*). 163

Hooks, R. F., and **A. L. Kenworthy,** Michigan State Univ., East Lansing.

Gibberellic acid was applied two weeks after full bloom to the Jersey variety of highbush blueberry in order to facilitate mechanical harvesting. The following effects of gibberellic acid (GA_3) were collected over a two year period: 1) fruit was delayed in maturity and/or senescence, 2) at the first harvest a higher percent of unripe fruit and a higher titratable acidity was obtained, but later harvests were the same as the control, 3) no effect on weight per fruit, firmness or soluble solids were observed, 4) a lower percent of extraneous material was removed due to mechanical harvesting and cleaning, 5) rate of fruit growth was affected. GA_3 could be applied two weeks after full bloom and a higher percent of the ripe fruit could be removed at one harvest by mechanical harvesting.

2:00 Auxin and Gibberellin-Like Activity in Blueberry Flowers and Fruit. 164

Mainland, Charles M., and **Paul Eck,** Rutgers Univ., New Brunswick, New Jersey.

Auxin and gibberellin-like activity was measured in Coville and Jersey variety highbush blueberry flowers at bloom, and in fruit developing either from pollination or treatment with 500 ppm GA_3. Fruit samples were collected at weekly intervals for bioassay using the *Avena* coleoptile and lettuce hypocotyl tests. Both endogenous auxin levels and levels of GA-like material in Jersey flowers were higher than in Covill flowers. A large increase in extractable auxin followed the GA_3 treatment in both varieties. The increase in extractable auxin coincided with the more rapid initial growth rate characteristic of GA-treated fruit. Auxin activity coincided with growth rate much better than did the GA-like activity. By six weeks after GA_3 treatment, the level of GA-like activity in the fruit had decreased to a level no higher than the level found in pollinated fruit.

2:15 Seasonal Changes of Lycopene-Carotene Content and Fruit Quality of the Hudson Red Grapefruit. 165

Merdith, Filmore I., George H. Redman, and **Francis P. Griffiths,** USDA, Weslaco, Texas.

The seasonal changes of lycopene, carotene, Brix, and acid in the endocarp of the Hudson red grapefruit and Red Blush grapefruit were determined. Lycopene content in the flesh of the Red Blush grapefruit reached a maximum on September 19 while in the Hudson a maximum lycopene content was found October 10. Lycopene declined in the Red Blush through the remainder of the experiment while in the Hudson, lycopene declined until December 12, remained constant until February 27, and then slowly declined. Through the growing season carotene increased in the flesh of the Red Blush to a higher level than in the Hudson, Brix and acid content were higher in the Hudson than in the Red Blush throughout the fruit growth period.

2:30 Recess

2:45 Distribution of Soluble Components and Quality Factors in the Edible Portion of Citrus Fruit. 166

Ting, S. V., Univ. of Florida, Lake Alfred.

A study of the chemical characteristics of the juice of different portions of the edible part of various citrus fruits indicated a gradient variation from the outer portion of the carpel toward the center. The titratable acidity was the lowest in the outer portion and the highest at the center, while the gradient of the soluble solids was just the opposite. The ratios of these two factors varied more than two fold between the extremes. The effect of maturity, fruit size, and variety on these gradients were also compared. Vitamin C, reducing, and nonreducing sugar contents of different parts of the fruit were also found to vary significantly, but no marked trend existed in the amino acid and carotenoid content of the juice.

3:00 Effect of Growth-Regulators on Translocation and Distribution of Amino Acids, Organic Acids, and Sugars in Muscat of Alexandria Grapes. 167

Shindy, Wasfy W., Walter M. Kliewer, and **Robert J. Weaver,** Univ. of California, Davis.

The apical portion of Muscat of Alexandria shoots were treated with gibberellic acid (GA_3) at 100 ppm, a cytokinin 6 (benzylamino)-9-(2-tetrahydropyranyl)-9H-purine at 1000 ppm, 4-chlorophenoxyacetic acid (4-CPA) at 25 ppm, 2-chloroethyltrimethyl ammonium chloride (CCC) at 2000 ppm, and benzothiozole-2-oxyacetic acid (BOA) at 20 ppm. Four days later $C^{14}O_2$ was applied to the most recently mature leaf on the shoot and after 24 hours the amount of C^{14} in the amino acid, organic acid, and sugar fractions in different parts of the shoot were determined. GA_3 and cytokinin increased the amount C^{14} compounds translocated, and altered the distribution of these compounds in the shoot. The rate of translocation and the distribution of the labeled compound were influenced differently by the growth-regulators. CCC, BOA, and 4-CPA decreased the amount of translocation of labeled amino acids, organic acids, and sugars to various parts of the shoot.

3:15 Influence of Growth Regulators on the Concentration of Protein and Nucleic Acids in Grape Flowers. 168

Soleimani, Abbas, W. M. Kliewer, and **R. J. Weaver,** Univ. of California, Davis.

Black Corinth vines at full bloom were sprayed with 100 ppm gibberelic acid (GA_3), 150 ppm 4-chloro-phenoxyacetic acid (4-CPA) and 1000 ppm benzyladenine (BA). Flower samples were collected 0, 1, 6, 12, 48, and 96 hours after treatment with the various growth regulators and analyzed for protein and nucleic acids. Both GA_3 and BA almost immediately (after 1 hour) increased the concentration of protein, RNA and DNA in the flower parts, which continued to increase and reached a maximum concentration 24 hours after the initial application of the regulators. Benzyladenine in contrast to the other growth substances, did not significantly increase the protein and nucleic acids of the flower parts. The level of protein, RNA, and DNA in the untreated and treated flowers were approximately the same 48 and 96 hours after the initial treatment.

3:30 Influence of Preharvest Applications of Malathion on Anthocyanin Development in *Vaccinium macrocarpon* (var. Early Black). 169

Devlin, Robert M., Bert M. Zuckerman, and **I. E. Demoranville,** Univ. of Massachusetts, East Wareham.

This study demonstrates that malathion increases color in cranberries and does so without affecting size or yield. Dosage and time of application were also evaluated. Foliar sprays of 800, 1600, and 2400 ppm malathion were applied 3, 2, and 1 week before harvest, each treatment being replicated 6 times. No significant difference in size and yield was observed. Quantitative analyses for anthocyanins showed that all treatments caused a significant increase in color. Application of 800 ppm malathion 3, 2, and 1 week before harvest raised the level of anthocyanins 32, 27, and 14%. When applied at 1600 ppm 3, 2, and 1 week before harvest, anthocyanin levels were raised 32, 33, and 17%. Finally, application of 2400 ppm malathion 3, 2, and 1 week before harvest raised the level of anthocyanins 48, 35, and 21%. It was concluded that malathion applied 2 weeks before harvest at 1600 ppm would give good color enhancement with only a minimum risk of damage.

3:45 Factors Affecting the Extraction and Subsequent MAK Chromatography of Nucleic Acids from Apple Twigs. 170

Li, P. H., and **C. J. Weiser,** Univ. of Minnesota, St. Paul.

MAK is a useful technuque for studying nucleic acids (NA) which has not previously been adopted to the study of woody species. NA from 1-year-old apple twigs were succesfully separated into sRNA, DNA, 1.rRNA, and h rRNAA. Nine factors involved in the extraction were varied and evaluated. The optimum conditions for maximum yield of NA were as follows: Twigs were freeze-dried and ground in a mill (40-mesh). 5g powder was added to 50 ml of .01M tris, pH7.6, .06M KCl, .01M $MgCl_2$; 2 ml bentonite; 2g dupanol; and 50 ml of phenol and the slurry was homogenized for 5 1-min intervals carrying at ambient temperature. After centrifugation, NA were removed and washed once with 40 ml phenol plus 2 ml bentonite for 10 min at 4°C. NA were precipitated with 95% ethanol (Potassium acetate should not be used to aid ppt). NA were dissolved in 20 ml of .05 phosphate buffer, pH6.7, and dialyzed against same buffer before transferring the sample to the MAK column.

4:10 ASHS BUSINESS MEETING
Neil W. Stuart, President, Presiding.
Chemistry 194

(24) FRUIT: PROPAGATION
Engineering 1120

Presiding: Dale E. Kester, Univ. of California, Davis.

1:15 Endogenous Growth Substances in *Juglans regia* Seed During Stratification. 171

Martin, George C., M. Iona R. Mason, and **Harold I. Forde,** Univ. of California, Davis.

Commonly *J. regia* seed is stratified in moist conditions for 8 weeks at or around 35°F to complete the chilling requirement. Before chilling, the seeds will not germinate. As the stratification period advances, increased germination occurs and by 8 weeks one can expect 90-95% germination. Methanol extracts of kernels taken at various phases of stratification were partitioned into neutral and weakly acidic, and acidic fractions for analysis. After separation on paper chromatography in isopropanol; ammonia and water (8:1:1 v/v/v) extracts were bioassayed by the wheat coleoptile test. No activity was found in the neutral and weakly acidic fraction while very active growth inhibition at Rf 0.6-0.7 was found in the acid fraction. This growth retardation of wheat coleoptile subsides rapidly after 3 weeks in stratification. Though the growth inhibitor zone is similar in Rf to abscisic acid spectrophotometric analysis did not corroborate that finding.

1:30 Rooting Cofactors and Inhibitors in Softwood Cuttings of Apple. 172

Lopecki, Janusz, and **Frank G. Dennis, Jr.,** Agric. Exp. Station, Geneva, New York.

The levels of rooting cofactors and inhibitors were measured in softwood cuttings of 3 apple rootstocks (MM 106, MM 109, and EM IX) at 4 times from June through August. Bioassay of chromatographed extracts of bases with mung beans showed a decrease in the level of promoters (cofactors) and an increase in the inhibitor level with time. This was accompanied by a decrease in the rooting ability of the cuttings. The reverse situtation was found in apices and leaves: the promoter level was higher and the inhibitor level lower in August than in June and July. Extracts from the bases of cuttings treated with auxin (IBA) and held for 1 week under mist contained more cofactor activity than extracts from untreated bases in June and July and less activity in August.

1:45 Aseptic Culture of Axillary Buds of the Apple (*Pyrus malus* L.). 173

Dutcher, Roger D., Cornell Univ., Ithaca, New York.

A culture system was devised which allowed apparently normal growth of axillary buds of the apple *in vitro*. A modified Murashegi medium, using 6% sucrose and high minor element and vitamin levels produced up to 12 cm. of shoot growth. Moderately high light intensities, under long-day conditions, favored growth. Various growth-regulating substances such as indoleacetic acid or gibberellic acid either inhibited or had no effect on growth. Attempts to induce rooting of the cultures, including chemical and light-dark treatments, were unsuccessful.

2:00 Effect of Low Temperature and Growth Regulators on Germination of Seeds of Tokay Grapes. 174

Yeou-Der, Kang, Robert J. Weaver, and **Robert M. Pool,** Univ. of California, Davis.

The low-temperature requirement for germination of 'Tokay' grape seeds was studied. As little as 3 days of 0°C induced termination of rest in some seeds; optimum germination occurred after 63 days at 0°C. Neither long-term nor short-term soaking with cold water, nor short-term soaking with warm water, substituted for cold. Benzyladenine up to 8000 ppm did not obviate the cold requirement. At 8000 ppm, the potassium salt of gibberellic acid (GA) completely replaced the cold requirement; at 10 ppm it terminated rest in some of the seeds. When scarified seeds were used, optimum GA concentration for germination was 10 ppm.

2:15 Promotion of Germination by Warm Periods During Stratification of Cherry and Plum Pits. 175

Dennis, Frank G., Agric. Exp. Station, Geneva, New York.

Moist cherry and plum pits held at 20° C for 3 weeks prior to stratification at 2° C gave higher rates of germination than similar pits held continuously at 2°. Germination was promoted only in seeds with intact endocarps. Within the first 6 weeks of stratification, 3 weeks at 20° were effective whether preceding, following, or alternating with 3 weeks at 2°. Further experiments indicated that promotion of germination was caused by increased activity of microorganisms during the warm period, leading to a weakening of the endocarp.

2:30 The Effect of Cherry Stock-Scion Combination and Mechanical Constriction on the Distribution of Starch in the Stem. 176

Yu, Kyung S., and **Robert Carlson,** Michigan State Univ., East Lansing.

Graft incompatibility often occur when sweet cherries are grafted on Mahaleb and less frequently when on Mazzard. A study in the cause and effect was initiated. Two cherry varieties, Napoleon and Montmorency, were grafted on Mazzard and Mahaleb rootstock. Two inches above the graft union either an aluminum band or a score was placed on the trunk. Bark samples were taken above and below the graft union, the band and the score for starch analysis tests. The variation in starch content at the specified loci was determined and described.

2:45 Recess

3:00 Studies With Blueberry Rootstocks. 177

Galletta, Gene J., and **Almon St. Fish, Jr.,** North Carolina State Univ., Raleigh.

The highbush blueberry (*Vaccinium corymbosum L.*) has been successfully grafted onto selections of the blueberry species *V. ashei* (rabbiteye), *V. amoenum and V. arboreum.* The rabbiteye blueberry proved the superior rootstock. Rabbiteye blueberries are more tolerant to variations in soil type, organic matter content, pH, moisture and soil

borne disease than highbrush blueberries. Spring whip, cleft or side grafting, or summer T-budding were the most successful methods employed. The rabbiteye is an invigorating rootstock, enhancing scion growth and productivity and showing no incompatibility after 5 to 7 years in the field. Understock sprouting is controlled by summer pinching, dormant suckering, or selection of "'non-sprouting" stock clones. Practical uses foreseen include extension of blueberry production to different soils, replanting of "poor spots" in commericial fields, and replanting fields for the second or third time.

3:15 Pear Rootstock Studies. 178

Lombard, Porter B., and **M. N. Westwood,** Oregon State Univ., Corvallis.

Several pear varieties on several different rootstocks were studied with respect to growth control, yield efficiency and mineral uptake. Although differences were found in each factor, there was no apparent correlation between the three major factors, when rootstocks of different species and genera were used.

3:30 Sprouting From the Base of Dwarf Apple Trees. 179

Rauch, Fred D., J. P. Mahlstede, and **W. E. Loomis,** Mississippi State Univ., State College.

Studies using dwarf apple trees of Starkrimson/Clark Dwarf/Bedford showed that the number of suckers produced per tree was directly correlated with the length of the interstock. Excavation of the roots revealed that the major portion of these sprouts originate within 2 inches of the soil surface but they do originate up to a depth of twelve inches below the surface. Treatments of unworked Garnet seedling with NAA, either as lanolin paste application to girdled stems or as root-soaks, resulted in inhibition of adventitious shoot formation. When TIBA was used in these treatments, shoot initiation was increased. It was concluded that sprouting is correlated with low hormone levels in the tissues.

3:45 Pruning Severity Studies with Vigorous Grafted Grapevines. 180

Lider, Lloyd A., A. N. Kasimatis, and **W. M. Kliewer,** Univ. of California, Davis.

For three years a study of the effects of pruning severity was conducted in a non-irrigated California vineyard. Two small-clustered, cane-pruned wine varieties, Chardonay and Gamay Beaujolais grafted upon two phylloxera resistant rootstocks, Rupestris St. George and Ganzin 1 (AxR#1) were used. Three levels of pruning severity based on pruning weights were set at 5, 10, and 15 nodes per pound of dormant prunings. Pruning severity directly affected both the rate of fruit maturation and the pruning weights the following year. It inversely affected fruit yields. The vine response to level of pruning was markedly affected by rootstock and was noted in cluster size differences and degree of bud fruitfulness.

4:10 ASHS BUSINESS MEETING
Neil W. Stuart, President, Presiding.
Chemistry 194

(25) VEGETABLE CROPS: NUTRITION AND WATER RELATIONS
Engineering 2129

Presiding: John C. Lingle, Shell Development Co., Modesto, California

1:15 Tomato Responses to Potash on a Vermiculitic Clay Soil. 181

Miller, Knudt J., J. D. Downes, and **R. E. Lucas,** Michigan State Univ., East Lansing.

Soil test exchangeable K increased 12.63 lbs/A with each 100 lb increment of actual K applied from 0 to 500 lbs/A. Approximately 87% K fixation in the field was substantiated in laboratory tests for this Genesee sandy clay loam soil. For each 100 lbs K applied, total yield of H1350 fresh market transplant tomatoes increased 1370 lbs/A and direct seeded H1350 processing tomato yields increased 3.77 tons of No. 1 fruit per acre. Maximum yields were not obtained. The primary response to K application was noted in increasing fruit quality with less cracking and reduced incidence of grey wall.

1:30 Plant Nutrient Levels and Subsequent Yield of Greenhouse Tomatoes as Influenced by Various Nitrogen Sources in Cornell Peat-lite Mix A. 182

Quebedeaux, Bruno, and **Raymond Sheldrake, Jr.,** Cornell Univ., Ithaca, New York.

Mineral nutrient levels in Cornell peat-lite Mix A and in dried leaf petioles of greenhouse tomato plants as affected by nitrogen sources were determined. NH_4^+ - N nutrition increased total N, P, and K^+ uptake while NO_3^- - N nutrition increased Mg^{++} and Ca^{++} uptake. NH_4^+ - N nutrition induced wilting on excessively warm days and affected the water balance of the plant. The effect of nitrogen sources on yield were not significant in both the spring and fall crops. Fruit number, weight and size tended to show minor differences with respect to nitrogen sources.

1:45 Fertilizer-Plant Population Studies for Once-Over Tomato Harvest. 183

Austin, Max E., and **E. Mapp Dunton,** Virginia Polytechnic Inst., Blacksburg.

Attempts were made in Blacksburg and Painter, Va. to influence the growth and fruiting of ES 24 tomato variety by varying soil fertility and plant spacing. Growth rate and yield of marketable fruit were not influenced in Blacksburg by broadcasting 1000 lbs/A 5-10-10 nor supplementing the broadcast rate with 40 and 80 lbs N nor by doubling the plant population from 5800 plants/A using single or dual rows. The average yield was about 18 T/A. At Painter, fertilizer increased tomato yields. When broadcast, the earliest maximum yield was obtained 34 days after cessation of stem enlargement. Sidedressing additional N delayed the earliest yield 2 weeks but did not increase the yield. The average yield was about 11 T/A. Time from the date the stem stopped enlarging to the earliest once-over maximum yield of marketable fruit varied: at Blacksburg it was 60 days whereas at Painter it varied from 34 to 49 days.

2:00 Lettuce and Cabbage Yields and Economic Returns in Relation to Lime, N and P On A Tropical Red Latosol. 184

Downes, J. D., C. W. Francis, J. N. Landers, E. Lobato, and **C. G. Araujo,** Michigan State Univ., East Lansing.

White Boston lettuce yields were increased from 5891 Kg/ha with 4 tons of calcitic lime to 6419 Kg/ha with 8 tons of lime. Increasing the N applied from 100 to 200 Kg/ha did not consistently increase yields. Broadcast treble superphosphate to give 0, 150, 300 and 450 Kg P_2O_5/ha increased plant survival, yields, head size and quality. The best preliminary estimating equation was: $Ye=1646+912.43\ P_2O_5$ where yields and P_2O_5 are in Kg/ha. Maximum net returns were estimated at 200 Kg P_2O_5. Marion Market cabbage yields were not increased

by liming beyond 4 tons/ha, but increasing N from 100 to 200 Kg/ha consistently increased yields an average 1.44 T/ha. The best preliminary estimating equation relating cabbage yields to P_2O_5 was: Ye=12.33+5.9155 log P_2O_5 where Ye is in Tons/ha and P_2O_5 in Kg/ha.

2:15 Nutrient Interrelationships on Yield, Nitrate, and Oxalic Acid Content of Spinach. 185

Regan, William S., V. N. Lambeth, J. R. Brown, and **G. G. Blevins,** Univ. of Missouri, Columbia.

A field experiment which included 24 combinations of Ca, P, K, and N was conducted to study nutrient interrelationships on yield, nitrate, and oxalic acid content of Viking spinach. Fertilizer supplements of 4900 lbs Ca/A, 88 lbs P/A, and 83 lbs K/A enhanced spinach yields whereas increasing N in the range of 100-300 lbs/A caused reductions in yield. Interactions of Ca x P, Ca x K, P x K and K x N were also significant with respect to yield. Nitrate-nitrogen accumulation in the leaves was increased by K and N applications, and was decreased by liming on low-P soil. Oxalic acid content was lowered by P fertilization and increased by K addition, except at the 100 lbs/A N level. Low P-high K-high N imbalance increased nitrates and oxalic acid and reduced yields.

2:30 Relation of N, P, and K Content of Leaves Sampled at Intervals and Locations on the Plant to Yield of Seven Vegetable Crops. 186

Howlett, Freeman S., Ohio Agric. Res. and Development Center, Wooster.

Utilizing the central composite rotatable design involving application of 5 increments of N, P or K to onion, celery, pepper, cabbage, melon, and greenhouse tomato over a 3-year period, correlation coefficients of these elements with yield have been ascertained. The most mature leaves have usually been sampled at intervals during growth. Composition of leaves from various locations on the plant have likewise been compared. The correlation coefficients between the elements and yield have shown much similarity at successive sampling dates, and even on leaves taken from the same location at wide time intervals. The results have been very satisfactory in checking the validity of the presently used Critical Level (Minimum Requirement) of the element in leaves sampled at various intervals and locations.

2:45 Recess

3:00 Growth and Nutrient Absorption in Carrot. 187

Zink, F. W., Univ. of California, Davis.

Development, mineral composition of tops and roots, and nutrient absorption of Long Imperator Carrots growing in the field are reported. Root fresh and dry weight increased slowly during early growth. When approximately half of the total growing period had passed less than 5% of the ultimate fresh and dry weight of roots had been produced. Plants produced in excess of 47% of their fresh root weight in the 28 days before harvest. At harvest the tops had removed an average in lb/acre, of: N, 74; P, 6; K, 80; Na, 41; Ca, 90; and Mg, 16. At harvest the roots had removed an average in lb/acre, of: N, 73; P, 17; K, 123; Na, 46; Ca, 28; and Mg, 8.

3:15 The Effect of Fruit Development on Root Growth and Water Relations in Tomato Plants. 188

Oyer, Edwin B., Cornell Univ., Ithaca, New York.

Michigan-Ohio hybrid tomatoes were grown in solution culture with two main treatments imposed: normal fruit set and development vs. deflowering by removing the clusters before anthesis. Data on the amount of solution taken up, number and diameter of fruits per plant and root volume were recorded at daily or weekly intervals. Fruit volume was determined by water displaced by fruits of similar

diameters. A decline in the rate of root growth in fruiting plants was more closely associated with the rapid increase in fruit volume than with increasing fruit numbers per plant. Total root volume of fruiting plants was about one half that of the non-fruiting plants. The fruiting plants took up 30 additional liters of solution per plant during the period of fruit development than the non-fruiting plants during the same period. The fruit volume produced per plant was approximately 3 liters resulting in a ratio of solution taken up to fruit volume produced of 10 to 1.

3:30 Controlling the Irrigation of Tomatoes and Other Vegetable Crops by Refractometer. 189

Pratt, Arthur J., and **Leslie Farkas,** Cornell Univ., Ithaca, New York.

Work was started at Cornell in 1958 testing the need for irrigation with a refractometer by determining the per cent of soluble solids in the leaves of many vegetable crops and some weeds. The refractometer readings increased as the need for water increased. It was highest on the youngest leaves, highest on leaves fully exposed to the sun, highest on plants most heavily fertilized, and higher at midday than in the morning. The best way found to overcome these variations unrelated to the water supply was to hand water 3 to 4 selected plants the evening before and compare the refractometer readings of those taken at 9 to 10 A.M. with those of nearby unwatered plants. The difference between these readings was called a water-deficiency index. Controlling irrigation by refractometer worked best on tomatoes. Opaque juice was easier to read with certain refractometers than others.

3:45 Tomato Maturity as Influenced by Irrigation Frequency and the Rate of Nitrogen Fertilization. 190

Raleigh, George, Arthur J. Pratt, and **Leslie Farkas,** Cornell Univ., Ithaca, New York.

Three levels of irrigation and three levels of nitrogen fertilization were compared in a five-year experiment on tomatoes at Ithaca, N.Y. Contrary to many experiments, irrigation did not delay maturity as much as heavy nitrogen fertilization. In some years there was a highly significant interaction between the rates of irrigation and nitrogen fertilization. Irrigation control by refractometer checking of the total soluble solids in the tomato leaves was compared with basing the irrigation on soil moisture blocks. With tomatoes, the refractometer proved simplest and most reliable when a water deficiency index was determined by comparing the soluble solids of a few hand-watered test plants with those not watered.

4:10 ASHS BUSINESS MEETING
Neil W. Stuart, President, Presiding.
Chemistry 194

WANT A PLACE TO CHAT?

TRY

Chemistry 176

Engineering 1134

(26) SYMPOSIUM: HORTICULTURAL PLANT BREEDING II

Chemistry 194

Presiding: Henry M. Cathey, USDA Plant Industry Station, Beltsville, Maryland.

1:30 **Breeding Research on Early Yield in Tomato.** 191
Kooistra, E., Institute of Horticultural Plant Breeding, Wageningen, Holland.

1:55 **Reciprocal Benefits of Coordinated Research in Physiological Genetics and Plant Breeding.** 192
Gabelman, W. H., Univ. of Wisconsin, Madison.

2:20 **Collecting Wild Fruits in the USSR.** 193
Brooks, Howard J., U. S. Plant Industry Station, Beltsville, Maryland.

2:45 **Gene Resources and Fruit Research in the Soviet Bloc Countries.** 194
Weaver, G. M., Canada Department of Agriculture Res. Station, Harrow, Ontario.

3:10 **Current Developments in the Breeding of Woody Plants.** 195
Egolf, D. R., U. S. National Arboretum, USDA, Washington, D. C.

3:35 **Current Developments in the Breeding of F-1 Hybrid Annuals.** 196
Goldsmith, G. A., Goldsmith Seeds, Inc., Gilroy, California.

4:00 **Adjourn**

4:10 **ASHS BUSINESS MEETING**
Neil W. Stuart, President, Presiding.
Chemistry 194

NOTICE

All papers presented at the Symposium on Horticultural Plant Breeding, Sessions I and II, will be published as a special insert in a forthcoming issue of *HortScience*.

(27) SYMPOSIUM: NATURE, MECHANISMS AND CONTROL OF RIPENING

Sponsored by: Postharvest Horticulture Section, ASHS.

Presiding: D. V. Fisher, Chairman, Postharvest Horticulture Section, ASHS, Canada Department of Agriculture, Summerland, British Columbia.

1:30 **The Role of Ripening in the Affairs of Man.** 197
Petterson, Max E., Washington State Univ., Pullman.

2:05 **The Anatomy of Ripening.** 198
Spurr, Arthur R., Univ. of California, Davis.

2:30 **The Physiology and Biochemistry of Ripening.** 199
Dostal, Herbert C., Purdue Univ., Lafayette, Indiana.

2:55 **Recess**

3:10 **Environmental Control of Ripening.** 200
Smock, Robert M., Cornell Univ., Ithaca, New York.

3:35 **Metabolic Control of Ripening.** 201
Looney, Norman E., Canada Dept. of Agric., Summerland, British Columbia.

4:00 **Adjourn**

4:10 **ASHS BUSINESS MEETING**
Neil W. Stuart, President, Presiding.
Chemistry 194

CHEMICAL PRUNING OF ORNAMENTALS
Luncheon and Informal Discussion
Wednesday 11:50 a.m. - 1:40 p.m.
Moderator: Roy A. Larson,
North Carolina State University
Raleigh
Tercero - Red Room
(Take food tray into Red Room - No reservations)

(28) ORNAMENTALS: PHYSIOLOGY
Engineering 1066

Presiding: Roy A. Larson, North Carolina State Univ., Raleigh.

1:45 Benefits of Carbon Dioxide Enrichment and Direct Seeding Of F_1 Hybrid Annuals Under Controlled Environments. 202

Krizek, Donald T., William A. Bailey, and **Herschel H. Klueter,** USDA, Beltsville, Maryland.

The advantages of using controlled environments for accelerating the growth and development of young seedlings have been reported previously. The present study demonstrated that even greater benefits can be obtained by germinating seeds directly under controlled environments. F_1 hybrid annuals (ageratum, marigold, and petunia) grown for 17 days from seed in the growth chamber at 400 ppm CO_2, 85/75°F day/night temperature, 65% RH, 2500 ft.-c. light and 16-hour photo-period, and then moved to the greenhouse, were much larger and flowered much sooner than those grown initially in the greenhouse for 10 days or those maintained continuously in the greenhouse. Increasing the CO_2 level to 2000 ppm resulted in further increases in vegetative growth, especially of the lateral buds and even more precocious floral development. Sequential photographs will be shown to illustrate the marked carry-over effects of controlled-environment treatment.

2:00 Photosynthate Contribution of Growing Rose Shoots. 203

Kohl, Harry C., and **Daniel Edward Smith,** Univ. of California, Davis.

Using C^{14} as a tracer, it was learned that shoots of greenhouse roses are parasitic until very late in their life history.

2:15 The Response of Several Flower Crops to Foliar Sprays of an Ethylene Producing Compound. 204

Shanks, James B., Univ. of Maryland, College Park.

An experimental compound from Amchem Products, Inc. (Amchem 66-329) was reported by Leopold (BioScience 17:22) to produce ethylene in plants when applied as a foliar spray. Applications were made at intervals during the 1967 growing season to hydrangeas, gardenias, and azaleas and to certain other crops as poinsettias, carnations, chrysanthemums, and snapdragons at more specific stages of growth. A typical effect on all plants has been dwarfing or retarding of growth and in mature plants of promoting leaf abscission. Hydrangeas defoliated in October were dwarfed in growth in the greenhouse following cold storage. Lateral branching was induced in azaleas, particularly when used in conjunction with suboptimal concentrations of fatty acid esters for chemical pinching. Delayed flower formation was noted in chrysanthemums, hydrangeas, and azaleas. Snapdragons were emasculated by an application immediately prior to flowering.

2:30 Inhibition of Axillary Bud Growth of *Chrysanthemum morifolium* with Fatty Acid Esters. 205

Lert, Peter J., and **Anton M. Kofranek,** Univ. of California, San Jose, Davis.

Axillary shoots normally present on the lower portion of stems of *Chrysanthemum morifolium* grown for cut flowers, damage flowers and increase labor during harvesting and marketing operations of the commercial crop. The lower two-thirds of chrysanthemum plants (cultivars 'Albatross' and 'Fred Shoesmith') were sprayed with a commercially supplied formulation of alkyl esters of short-chain fatty acids and surfactant, at concentrations of 2%, 3% and 5% active ingredient. Applications were made 2 weeks before disbudding, at time of disbudding, and one week after disbudding. All treatments effectively inhibited the development of axillary buds on the lower portions of treated stems.

2:45 The Effects of Succinic Acid 2, 2-dimethyl Hydrazide on Stem and Leaf Tissues of *Chrysanthemum morifolium* "Bright Golden Anne." 206

Mitlehner, Alfred W., UNIROYAL Chemical, Bethany, Connecticut.

Succinic acid 2,-2-dimethylhydrazide (SDMH) treatments caused almost identical per cent reductions in the length and fresh weight of *Chrysanthemum morifolium*, cultivar "Bright Golden Anne" stem tissues. Per cent reductions in stem dry weight were usually greater than reductions in fresh weight. Histological sections indicated that SDMH treatments caused reductions in both cell numbers and sizes. The amount of xylem and the sclerification of pith tissues was decreased in treated plants. There was an apparent increase in the number of chloroplasts and starch grains in cortical epidermal cells of treated plants. Shoot apices of treated and untreated plants were similar. Leaves from treated plants were generally larger in size, fresh weight, dry weight and thickness than similar leaves from untreated plants. There was a significant increase in the thickness of the spongy mesophyll layer due to SDMH treatments.

3:00 Recess

3:15 Plant Protein Isozymes Associated with Environmental Change. 207

McCown, B. H., T. C. Hall, and **G. E. Beck,** Univ. of Wisconsin, Madison.

Three *Dianthus* cultivars were grown under long photoperiods in greenhouses and then subjected to various regimes of photoperiod and temperature in controlled-environment chambers. The stem protein components were isolated and separated by acrylamide gel electrophoresis. Seven enzyme components (peroxidase, esterase, acid phosphatase, and four dehydrogenases) were analyzed for each regime. Reproducible changes in the isozyme patterns were observed. One band, associated with a peroxidase complex of special characteristics, was induced under short photoperiods and/or low temperatures. This band could be readily induced in the two cold-hardy cultivars but not in the cold-sensitive cultivar. A second peroxidase band was induced in all three cultivars. Concomitant changes were also observed in the esterase and acid phosphatase banding, however these patterns were apparent in all three cultivars. Similar changes in isozyme patterns have been observed under overwintering conditions in the field.

3:30 Stomate Density in Relation to Winter Hardiness of Select Varieties of *Ilex opaca* Ait. 208

Knecht, George N., and **Elwin R. Orton, Jr.,** Rutgers Univ., New Brunswick, New Jersey.

Stomate density was determined for eleven varieties of *Ilex opaca* Ait. which had been subjectively ranked as either very hardy, hardy, semi-hardy, or non-hardy on the basis of field observations recorded over a 5-year period. Variance analysis revealed that the number of stomates for the varieties rated very hardy was significantly lower than that of the varieties rated non-hardy. Stomate counts for the varieties in the intermediate hardiness classes all fell within the range delimited by the counts of the very hardy and non-hardy varieties. Additional studies are being conducted to determine the reliability of utilizing stomate density as an index of winter hardiness.

3:45 Factors Influencing Cold Hardiness of *Taxus cuspitata* Roots. 209

Mityga, Henry G., and **F. O. Lanphear,** Purdue Univ., Lafayette, Indiana.

Various environmental and chemical effects were studied on the cold hardiness of *Taxus cuspidate* (Japanese Yew) roots using the refined TTC test. The rate extent of hardening was obtained using natural and controlled hardening conditions of 40°F and 8-hour photoperiod. Under controlled conditions, the foliage was hardy to -20°F while mature roots were usually hardy to 0°F. Under no circumstances were environmental conditions able to harden the young roots, which were killed at 22°-24°F. Preliminary studies using 100 ppm Alar applied over a 4-week period, increased the hardiness of the young roots 33°F, which was comparable to the mature roots. The influence of differential root and top temperatures on the hardiness of mature roots was investigated. Temperatures of either 70°F or 40°F, or combinations, were used. An increase of hardiness occurred with low root temperatures even when the tops of the plants were at high temperatures. If girdled, the roots failed to harden regardless of the environmental conditions. These results suggest that substrates from the top of the plant are necessary to induce hardiness.

4:10 ASHS BUSINESS MEETING
Neil W. Stuart, President, Presiding.
Chemistry 194

TUESDAY EVENING

ANNUAL BANQUET
AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE

Tuesday, August 20
Freeborn Hall (28)
University of California, Davis

6:30 p.m. Social Hour (All ages)
7:30 p.m. Dinner

WEDNESDAY MORNING

8:30 CONCURRENT GENERAL SESSIONS

(29) CONCEPT OF YIELD IN HORTICULTURE
Chemistry 179

Presiding: Dillon S. Brown, Univ. of California, Davis.

Photosynthesis and other physiological processes in relation to growth, development, and yield, and progress in dynamic simulations of plant growth. 210

Robert S. Loomis, Associate Professor, Dept. of Agronomy, Univ. of California, Davis.

(30) CELL AND ORGAN CULTURE IN HORTICULTURAL RESEARCH
Engineering 2129

Presiding: Wesley P. Hackett, Univ. of California, Davis.

Examples of research applications in plant propagotion, breeding, synthesis of secondary plant products, etc. 211

Toshio Murashige, Associate Professor, Dept. of Horticultural Science, Univ. of California, Riverside.

(31) MECHANIZATION IN AGRICULTURE
Chemistry 194

Presiding: William L. Sims, Univ. of California, Davis.

The interdisciplinary approach to the solution of engineering and horticultural problems in mechanizing production and harvesting. 212

Roy Bainer, Dean, College of Engineering, Univ. of California, Davis.

(32) SYMPOSIUM: MECHANIZED GROWING AND HARVESTING OF FRUIT AND VEGETABLE CROPS
Chemistry 194

Presiding: William L. Sims, Extension Vegetable Crops Specialist, Univ. of California, Davis.

9:30 Fruit Crops in the East. 213
Larson, Robert P., Michigan State Univ., East Lansing.

9:55 Fruit Crops in the West. 214
Fridley, Robert B., Univ. of California, Davis.

10:20 Recess

10:35 Vegetable Crops in the East. 215
Warren, G. F., Purdue Univ., Lafayette, Indiana.

11:00 Vegetable Crops in the West. 216
Lorenz, Oscar A., Univ. of California, Davis.

11:35 Processing Considerations: Mechanization Influence on Processing of Fruits and Vegetables. 217
Allewett, William Jr., Tri-Valley Growers, San Francisco, California.

12:00 Discussion

12:30 Adjourn

(33) FRUIT: MORPHOLOGY
Chemistry 166

Presiding: Roy K. Simons, Univ. of Illinois, Urbana.

9:30 The Morphological and Anatomical Characteristics of Watercore in Apples. 218

Simons, Roy K., Univ. of Illinois, Urbana.

Comparisons have been made between susceptible and non-susceptible cultivars, illustrating morphological and anatomical differences in the vascular tissue, which are factors directly contributing to watercore. The following tissues of the fruit show a definite influence on watercore: point of divergence of toral and carpellary bundles; differential size of core line; 5-sepallary and 5-petallary with dorsal and carpellary bundles; cell proliferation; senescence of vascular tissue in the affected areas; and abnormal vascular tissue development with initiation of new parenchyma cells contiguous to the bundles. The non-susceptible cultivar produced uniform cell development between ventral and dorsal carpellary bundles with no cell proliferation. Illustrated by photomicrographs.

9:45 Some Aspects of the Ultrastructure of Apple Skin as Revealed by Electron Microscopy. 219

Dayton, Daniel F., Univ. of Illinois, Urbana.

Most common plant organelles except dicotyosomes exist in the cells of mature apple skin. The cell is principally occupied by a large central vacuole surrounded by a typical unit membrane, or a void previously containing such. The organelles appear imbedded in a gel holding them in place even after disintegration of the vacuolar membrane. Many chloroplasts, having lost their stroma, become aggregations of starch, persisting much longer than starch occurring elsewhere in the cell. Hence the skin as a whole is a significant starch storing tissue. Secondary thickening of epidermal cell walls is only ¼-⅓ of that produced by hypodermal cells (500-600 m*u* vs. 1700 m*u*), shows less structure and stains more lightly. Many plasmadesma connect adjacent cells in the same layer but are rarely found between layers. Most plasmadesma appear inactive at maturity.

10:00 Variation in the Color Attributes of 30 Apple Varieties. 220

Lott, Richard V., Univ. of Illinois, Urbana.

Spectrophotometric measurements of the skin and flesh colors of the immature, mature, and ripened fruits of 30 apple varieties, and the conversion of the data from the resulting spectral curves to Munsell notations showed the following limits for each of the 3 color attributes: (1) Skin—*hue* 9.8 RP in Black Winesap to 5.0 GY in Golden Delicious or a difference of 35.2 hue units, *value* 2.4 in Black Winesap to 9.0 in Yellow Transparent, and *chroma* 1.4 in Black Winesap to 11.4 in Williams; (2) Flesh—*hue* 1.5 Y in Golden Delicious to 3.1 GY in Yellow Transparent or a range of 11.6 hue units, *value* 7.6 in Yellow Transparent and Duchess to 9.1 in Red June, Yellow Transparent, and Red Fameuse, and *chroma* 1.3 in Red Fameuse to 5.9 in Winesap. Spectral curves illustrating these differences will be presented.

10:15 Foliar Penetration of Naphthaleneacetic Acid. 221

Green, Duane, W., and **Martin J. Bukovac**, Michigan State Univ., East Lansing.

Factors affecting foliar absorption of naphthaleneacetic acid (NAA) were established using excised leaf discs from pear (*Pyrus communis* L.) and bean (*Phaseolus vulgaris* L.). Small glass tubes were sealed to the leaf discs with a film of petroleum jelly, radioactive NAA added to the tubes and then covered and placed in Petri dishes lined with moist paper. Uptake of NAA was linear with time and concentration. NAA uptake was favored at pH values below the pK (4.2). The Q_{10} for penetration between 2 and 27°C was 4.0. Penetration appeared not to be light dependent. Leaves which developed in an environment of high light and high temperature absorbed less NAA than leaves which developed in low light-low temperature conditions. Data collected by radiautography and radioanalysis suggested that penetration into the leaf was not uniform. Less than 2 percent of the NAA absorbed was decarboxylated.

10:30 Penetration of Naphthaleneacetic Acid and Naphthaleneacetamide Through Isolated Pear Leaf Cuticle. 222

Norris, Robert F., and **Martin J. Bukovac**, Michigan State Univ., East Lansing.

Isolation of pear leaf cuticle (*Pyrus communis* L *cv* Bartlett) from the underlying tissues, by enzymatic means, has permitted critical studies on the mechanisms of penetration of naphthaleneacetic acid (NAA) and naphthaleneacetamide (NAAm) through this natural barrier. No physical changes were detected in the cuticle as a result of enzymatic isolation. The penetration of NAA was pH dependent whereas NAAm penetration was not. This difference is related to the degree of dissociation. The response to pH decreased as the carrier solution dried out, and this loss was considered to be a function of concentration. Variation in humidity on drying time resulted in marked differences in penetration. The implications of temperature variations on biological response are significant in the light of changes in cuticular penetration manifested by temperature change; the Q_{10} between 15 and 25°C is 5.6. Consistently lower rates of penetration of NAAm than NAA were observed.

(34) ORNAMENTALS: BREEDING AND PROPAGATION

Engineering 1062

Presiding: Kenneth C. Sink, Michigan State Univ., East Lansing.

9:30 Blindness or Flower Bud Abortion in Petunia. 223

Hamilton, Bruce A., and **Stephen A. Garrison**, Rutgers Univ., New Brunswick, New Jersey.

Blindness is a flower bud abnormality characterized by an aborted corolla, pistil, and stamen; calyx development appears normal. Blindness was experimentally induced by subjecting the plants to low light intensity conditions and through mist treatment of cutting. Of the four lines subjected to low light intensity, the two lines that were reportedly resistant to blindness bloomed earlier, had more normal flowers per branch and had fewer blind flowers than the two susceptible lines. Whole plants and cuttings of one resistant line and one susceptible line were treated with mist. None of the whole plants developed blind flowers. Three buds (5-10 mm. in length) aborted in cuttings from the resistant line; 15 buds (1-6 mm. in length) aborted in cuttings from the susceptible line. The better resistant line and the two susceptible lines will be used in genetic studies of this disorder.

9:45 Genome and Karyotype Relationships in the Genus *Dendrobium* (Orchidaceae). 224

Wilfret, Gary J., Univ. of Hawaii, Honolulu.

Dendrobium is one of the largest genera in the family Orchidaceae, comprising approximately a thousand species, many of which are cultivated. The genus is subdivided into numerous sections. Investigation of chromosome numbers showed that most species have $2n = 38$ or 40 chromosomes. Similarities and differences in chromosome size and morphology of various species were observed and recorded. Numerous intrasectional and intersectional crosses were attempted in order to establish sexual compatibilities. Observations on meiosis generally revealed good pairing among intrasectional hybrids and poor pairing among intersectional hybrids. Karyotype, cross compatibility and meiotic behavior were correlated with species relationships.

10:00 Use of High Speed Centrifugation to Obtain Extracts From Cuttings Treated by Terminal Applications of 3-indoleacetic Acid (IAA-2-14C). 225

McGuire, John J., Luke S. Albert, and **V. G. Shutak**, Univ. of Rhode Island, Kingston.

A method for extracting indoles from stem segments of woody cuttings of *Ilex crenata* 'Convexa' by refrigerated high speed centrifugation has been developed. Effective extraction was obtained when segments were immersed in a solution of 40% ethanol and exposed to a force of 2750 X g. for at least two hours. Quantitative determinations of IAA-2-14C measured by liquid scintillation counts of the extracts revealed that this method depicted changes in levels of the isotope in different segments of the stem as a result of different treatments. Changes in levels of auxin in the segment was also portrayed by differences in rooting responses. Centrifuged extracts were separated into two phases. Most of the isotope was contained in the smaller lower phase. Proportionate levels of the two phases changed in cutting segments over time. The isotope was not present in the lower phase at the time of rooting.

10:15 Studies on Root Initiation in Aseptically Cultured Shoot Apices and Leaf Petioles of Juvenile and Adult *Hedera helix*. 226

Hackett, Wesley P., Sue Tirsell, and **R. J. Smith,** Univ. of California, Davis.

It was found that rooting of juvenile apices and leaf petioles in high intensity light (400-500 ft-c) is very limited at indoleacetic acid (IAA) concentrations from 1 to 50 mg/1 in the medium. When IAA is used at 10 mg/1, catechol or pyrogallol at 5 x 10^{-5} M increases rooting 5-10 fold. Optimal rooting with NAA occurs with 5-10 mg/1 in the medium and is approximately equivalent to IAA (10 mg/1) plus catechol (5 x 10^{-5} M). In low intensity light (25 ft-c) IAA is nearly as effective as IAA + catechol in high light. Rooting of adult apices or petioles in high intensity light is essentially zero using IAA, NAA, or combinations of IAA and catechol. In low intensity light, rooting occurs with 10 mg/1 IAA and may be promoted to some degree by catechol in combination with IAA. Methanolic extracts of adult and juvenile shoot tisssue and some zones of paper chromatograms of these extracts promote rooting of juvenile shoot apices but not adult apices when IAA is used at 10 mg/1.

10:30 Recess

10:45 Stimulation and Retardation of Adventitious Root Formation by Application of B-Nine and Cycocel. 227

Read, Paul E., and **Vernon C. Hoysler,** Univ. of Minnesota, St. Paul.

Geranium cuttings dipped momentarily in solutions of several concentrations of B-Nine produced significantly greater weight and numbers of adventitious roots than did untreated cuttings. Concentrations of 1000 ppm, 2500 ppm and 5000 ppm were effective, with 2500 ppm optimum. Conversely, similar treatments of Cycocel caused a marked depression of adventitious root production. As rate of Cycocel was increased, production of adventitious roots diminished, suggesting corroboration of research proposing Cycocel's behavior as being that of an "anti-auxin".

11:00 Rooting of Narrowleaf Evergreen Cuttings as Influenced by Various Hormone Treatments. 228

Irving, R. M., and **W. O. Johnson,** Oklahoma State Univ., Stillwater.

Cuttings from *Juniperus horizontalis* 'Plumosa' and *Juniperus chinensis* 'Hetz Glauca' plants were taken in October and treated with several rooting hormones either in solution or in a talc preparation. In general, dip solutions of rooting hormones induced greater rooting than preparations in talc. Indole-butyric acid (IBA) applied in solution at 2000 ppm induced greater rooting than Hormodin #1, 2, 3, or any combination of IBA and indole-acetic acid (IAA) at 2000 ppm, indicating that no synergistic effect was obtained with the species tested. Two hard-to-root species, *Juniperus scopulorum* 'Blue Haven' and *Thuja orientalis,* rooted to a considerable degree when treated with a 'concentrated dip mixture' containing IBA, IAA, pyruvic acid, catechol, kinetin, and boron. Hormodin #1 and 2 gave no increase in rooting while only slight increases in rooting percentages were obtained with Hormodin #3.

11:15 Nutrient Mist in Propagation. 229

Wott, J. A., and **H. B. Tukey, Jr.,** Cornell Univ., Ithaca, New York.

Softwood cuttings were rooted under intermittent water mist and nutrient mist containing a soluble fertilizer (23-19-17) at rates of 2 to 8 oz per 100 gal of water. Most cuttings absorbed greater amounts of N when the concentration of N in the mist was increased. P and K absorption increased in the 2- and 4-oz treatments only. Rooting percentage and root quality were better under the 4- and 6-oz treatments. Other species responded better when low concentrations of

nutrients were applied in the mist. As the length of application time of nutrient mist was increased on chrysanthemum cuttings, there was an increase in both number of roots per cutting and nutrient content. Timing of nutrient applications and size of the cuttings influenced the response to nutrient mist. Uptake of P was traced, using ^{32}P applied both to the rooting medium and through the mist.

11:30 Shading of *Rhododendron* Stock Plants to Study Flowering and Leaf Rootability. 230

Johnson, Charles R., and **A. N. Roberts,** Oregon State Univ., Corvallis.

Shading stock plants of 'Pink Pearl' and 2 age-groups of 'Roseum Elegans' was used to study the influence of 4 light intensities on flowering and leaf rootability. Unshaded plants produced mostly flowering shoots whose top leaves rooted best, thus verifying that leaves expanded during flower initiation are larger and root poorer than smaller terminal ones. Minimum shading (25%) of older stock plants resulted in primarily flowering shoots with large leaves and low rootability, while leaf rootability in young, non-flowering plants of 'Roseum Elegans' was enhanced. Heavy shading (90%) produced non-flowering shoots having large leaves and lesser rootability than unshaded flowering shoots with 'Pink Pearl' but greater rootability with easier to root 'Roseum Elegans.' The association of poor rooting with large leaves is only valid on flowering shoots and differences in leaf rootability of shaded old and young stock plants can be explained on the basis of flowering.

11:50 CHEMICAL PRUNING OF ORNAMENTALS
Red Room, Tercero Dining Commons (74)

Moderator: Roy A. Larson, North Carolina State Univ., Raleigh.

(Take food tray into Red Room. No reservations)

WEDNESDAY AFTERNOON

(35) POSTHARVEST HORTICULTURE: METABOLISM AND GROWTH REGULATORS
Chemistry 166

Presiding: Donald H. Dewey, Michigan State Univ., East Lansing.

1:30 Changes in Content and Molecular Forms of Malic Enzyme During Development of Pome Fruits. 231

Klein, Isaac, and **D. R. Dilley,** Michigan State Univ., East Lansing.

Extraction of malic enzyme from acetone dried powder prepared from Wealthy and McIntosh apples at successive developmental stages revealed that the specific activity of the enzyme increased markedly during the phase of initial growth of the fruit, and again during ripening. Malic enzyme was located on disc and slab acrylamide gel, after electrophoresis, by the tetrazolium dye method. Four to six uniformly spaced bands exhibiting malic enzyme activity were detected after prolonged incubation. Only one, and occasionally two, of the bands contained sufficient quantity of enzyme that could be detected by a general protein stain. No qualitative change in the molecular form of the enzyme was apparent during ontogeny of the fruit. Electrophoretic separation of proteins from Bartlett pears infiltrated with C^{14}-phenylalanine showed high incorporation of the label to malic enzyme early during ripening of the fruit.

1:45 Biochemical Changes During the Development of Cork Spot of 'York Imperial' Apples. 232

Faust, Miklos, and **C. B. Shear,** USDA, Beltsville, Maryland.

Biochemical changes occurring during the development of cork spot of 'York Imperial' apples were investigated. At the first visible sign of the disorder the rate of ethylene production increases in the affected tissue. Respiration also increases; acetate rather than glucose is the major respiratory substrate. Protein synthesis, pectin synthesis, and movement of inorganic ions into the affected tissue follow. At the final stage of development, the tissue becomes brown and appears as a firm brown spot in the flesh of the apple. The abnormal changes during development of the disorder are considered common to diseases and injuries and not specific for cork spot. We believe that the disorganization of lipoprotein membranes may be the initial change leading to the development of cork spot.

2:00 Toxicity of Fermentation Products Accumulating in Watercored 'Delicious' Apples. 233

Bramlage, William J., and **Richard E. Bir,** Univ. of Massachusetts, Amherst.

Watercored 'Richared Delicious' apples contained many-fold increases of ethanol, acetaldehyde, and ethyl acetate over non-watercored apples. All 3 substances were shown to be toxic to apples. Lowest atmospheric concentrations producing injury were $2x10^{-3}$ mole/l of ethyl acetate or $12x10^{-4}$ mole/l of acetaldehyde; both substances produced external lesions on fruit within 1 day at room temperature. Prolonged exposure to ethanol at $4x10^{-3}$ mole/l resulted in internal browning of apples. Exposure of fruit to combinations of these substances resulted in injury from as little as $8x10^{-4}$ mole/l of acetaldehyde plus $4x10^{-4}$ mole/l of ethyl acetate. Thus their toxicity to apples is complementary. Ethanol was not complementary in inducing injury. These findings support the hypothesis that watercore directly leads to internal breakdown of 'Delicious' apples by promoting the formation of toxic metabolic products.

2:15 Residual Diphenylamine as Affected by Contamination and Aging of Solutions and by Method of Application for Apple Control 234

Wilson, L. G., and **D. H. Dewey,** Michigan State Univ., East Lansing.

A colorimetric field test procedure for estimating the diphenylamine content of solutions employed for treating apples for storage scald control was developed using a vanadium pentoxide reagent. Treating solutions held for periods up to 4 weeks in duration showed concentrations of DPA gradually decreased to levels slightly above one-half the original content. The addition of organic matter to the solutions slightly reduced the amount of detectable DPA. Residue analyses by electron capture gas chromatographic methods for apple fruits were made to ascertain the effect of applying DPA solutions under hydrostatic pressure up to 4 psi.

2:30 Laboratory Studies on the Effects of Chemicals on the Coloration of Apples. 235

Smock, Robert M., Cornell Univ., Ithaca, New York.

Post-harvest screening of compounds that might influence coloration of apples was done in the laboratory. A number of carbonates such as glycol carbonate and carbonate buffers increased anthocyanin development. It is speculated that CO_2 from these compounds stimulated coloration. Certain compounds that were phytotoxic, such as Malathion, increased color. Other compounds such as chloro-IPC, quercetin, and quercitrin decreased coloration. A list of compounds that had no effect on color are presented. Rutin, quercein-3-rutinocide, increased color development but the response was variable from lot to lot.

2:45 The Regulatory Effect of Gibberellic Acid and Cytokinins on Fruit Maturation and Ripening. 236

Abdel-Gawad, Hesham A., and **Roger J. Romani,** Univ. of California, Davis.

The studies included pre-harvest spray treatments of apricots and post-harvest dipping of apricots, peaches, and pears. Various concentrations of GA, benzyladenine, or SD-8339, combinations, spraying dates and dipping periods were included in studies conducted during two fruit seasons, 1965 and 1966. Post-harvest treatments affected certain physiological processes in apricots, but had little or no effect on pears where tissue slice studies suggested inadequate penetrability. Pre-harvest spraying caused a retardation in apricot maturation.The effect was also carried over to the post-harvest period as evidenced by a lowered respiratory rate, retarded climacteric, and delayed color change. The physiological implications of these results and probable horticultural significance will be discussed.

3:00 Recess

3:15 Effects of Succinic Acid 2, 2-dimethyl Hydrazide (Alar) on Apples. 237

Mattus, George E., Virginia Polytechnic Inst., Blacksburg.

Alar was applied on several apple cultivars as a spring spray in 1964 and 1965 and as a summer spray in 1965, 1966, and 1967. Shoot length and fruit size were reduced by a spring spray but not by a summer spray applied within 2 months of harvest. Less fruit dropped from Alar-sprayed trees, particularly for Delicious and Stayman. Fruits sprayed with Alar were firmer at harvest. Firmness differences between Alar and check fruit were least in a severe drought year. In 3 dry seasons, apple soluble solids and ground color were not materially influenced by Alar. Red color was increased by Alar. In most seasons Alar had a minor effect on storage disorders. Although Alar-sprayed fruit was usually firmer after storage, firmness differences between Alar and check fruit were less following storage than at harvest.

3:30 Stimulation of Tomato Ripening by Amchem 66-329. 238

Garrison, Stephen A., Rutgers Univ., New Brunswick, New Jersey.

Green tomato fruits were detached 25, 30, 35, and 40 days after pollination, and injected with the growth regulator Amchem 66-329 at rates of 0, 100, 200, 400, 800, or 1600 μg per fruit. All fruits were ripened at 75°F with 12 hours of artificial light. Water controls (μg 66-329) ripened 49-51 days after pollination. Fruits injected 25 and 30 days after pollination with 800-1600 μg 66-329 per fruit ripened 9-10 days before controls. Fruit injected 35 days after pollination with 800-1600 mg 66-329 per fruit ripened 5 days before the controls whereas 66-329 had little effect on the time to incipient coloring when fruits were injected 40 days after pollination. Green fruits injected with high concentrations of 66-329 emitted ethylene at higher rates than control fruits.

3:45 The Effect of Amchem 66-329 on Degreening and Respiration of 'Valencia' Oranges. 239

Obervacher, M. F., Univ. of Florida, Lake Alfred.

The new, coded, growth regulator AmChem 66-329 was capable of accelerating the degreening and increasing the respiration of 'Valencia' oranges. Degreening of fruits treated with AmChem 66-329 and placed in the light at 85°F was comparable to that obtained in commercial-type degreening rooms. Degreening was somewhat slower in the dark at the same temperature. Both of these processes are stimulated by ethylene and ethylene evolution was noted. Initial applications of AmChem 66-329 were made through the stem, but later trials proved that the material was effective when the fruits were dipped in solutions of the compound.

4:00 Metabolic Comparisons of MH-Treated and Untreated Onion Bulbs. 240

Pendergrass, Ann, and **Francis M. Isenberg,** Cornell Univ., Ithaca, New York.

The mode of action of maleic hydrazide (MH) was studied by comparisons of several respiratory reactions and nucleic acid contents between tissue of MH-treated and untreated resting, dormant, and regrowing onion bulbs. Results from gross respiration of intact bulbs, concentrations of Krebs cycle intermediates, and activity measurements of specific dehydrogenases indicated that in onion bulbs, MH does not appear to depress respiration, specifically succinated dehydrogenase. Comparisons of inner shoot nucleic acid concentrations were made to determine whether in MH treatment as in the case of certain substituted uracils which enhance RNA production and depress DNA. Localized recovery of $14_{C\text{-}MH}$ and shoot apex autoradiographs may indicate that MH slows differentiation of the flower structure by association with and repression of the nucleic acid replication process.

4:15 Analysis of Onion Sugars and Organic Acids by Gas Chromatography. 241

Pendergrass, Ann, and **Francis M. Isenberg,** Cornell Univ., Ithaca, New York.

In a study of dormancy and differentiation in stored onions, bulbs which had been field-sprayed with maleic hydrazide (MH) were compared with non-treated bulbs for the amounts and kinds of sugars and organic acids present in each. Outer storage scale leaves and inner growing points were studied separately during the course of storage. An extraction and analysis procedure of possible use for other plant materials was developed. The sugars and organic acids were analyzed as TMS ether derivatives by a programmed temperature gas chromatograph attached to a digital integration system for quantitation. Regardless of treatment, bulbs were found to accumulate maleic acid rather than succinic as would be expected if MH inhibits succinate dehydrogenase. Sugars were found to decrease in scale leaves during storage, particularly with the breaking of shoot dormancy.

4:30 Studies of Snap Pod Polysaccharides and Their Relation to Texture. 242

Wiley, Robert C., and **Mansur Tavakoli,** Univ. of Maryland, College Park.

Texture of the pod is an increasingly important characteristic of snap bean quality. Changes prior to canning or freezing primarily include toughening of the tissue and loss of fleshiness around the seed, with fibrousness being a less important problem. This work evaluates the types and quantities of polysaccharides in both the Blue Lake and non-Blue Lake varieties. The pectines and hemicelluloses measured as their monomeric trimethylsilyl derivatives are correlated with shear readings of the pods. Polyuronides, glucans, galactans, and xylans are the most important polysaccharides related to texture. The gas chromatograms fingerprinted the varieties studied.

(36) VEGETABLE CROPS: PHYSIOLOGY AND PHYSIOLOGICAL AND PATHOLOGICAL DISORDERS

Engineering 2129

Presiding: Stanley K. Ries, Michigan State Univ., East Lansing.

1:30 The Effect of Night Temperature on Fruit Set of Peppers. 243

Wells, Otho S., and **William O. Drinkwater,** Rutgers Univ., New Brunswick, New Jersey.

Experiments were conducted in controlled environment chambers to study the effect of night temperature on fruit setting in the pepper. Two varieties, Delaware Belle and Pennwonder, were studied under four different night temperatures (50°, 60°, 70°, and 80° F) while day temperature was maintained at 78° F. The greatest number of flowers per plant formed at 60° and 70°F night temperature. The greatest number of fruits and the highest per cent fruit set was found at night temperatures of 50° and 60°F. In the morphological distribution of flowers and fruits on a plant, the maximum number of flowers occurred at nodes 6 and 7 while the maximum number of fruits occurred at nodes 3 and 4. Per cent fruit set was highest at nodes 1 and 3 at all four night temperatures. Per cent fruit set was higher at all nodes at 50° and 60°F than at 70° and 80°F.

1:45 The Effect of Flower Age, Time of Day, and Variety on Pollen Germination of Onion, *Allium cepa* l. 244

Mann, Lorraine P., and **George W. Woodbury,** Univ. of Idaho, Moscow.

Low seed yield in the hybrid onion seed industry has become a major problem in the past few years. Since pollen viability is a prerequisite to fertilization and seed set, this study was conducted to investigate the influence of various factors on the germination of onion pollen. Pollen of two different pollen parents, B12115C and B2215C, was collected at 9:00 a.m. and 2:30 p.m. from flowers of three ages—approximately 1, 3, and 6 days after anthesis. The pollen was germinated in hanging drops of a sucrose-gelatine medium including boric acid and calcium. The results showed a linear relationship between pollen age and pollen germination. The ability to germinate declined rapidly after the first day and approached zero by the sixth day. No significant difference in germination existed between pollen collected in the morning versus pollen collected in the afternoon. The percentage of pollen germination from B12115C was significantly higher than the percentage from B2215C.

2:00 Carbohydrate Changes in the Shoot Tip of Cauliflower During Vernalization. 245

Sadik, Sidki, and **J. L. Ozbun,** Cornell Univ., Ithaca, New York.

Studies on the chemical changes in the shoot tip of cauliflower during 2 weeks of vernalization at 42° F and with a light intensity of 500 ft.c. reaches its highest level in the early stages of vernalization and from there on the level is constant. Plants which are prevented from accumulating sugars and starch during the cold treatment or are depleted of them following the cold treatment, do not flower.

2:15 The Metabolism of Arginine in Germinating Pumpkin Seedlings. 246

Splittstoesser, Walter E., Univ. of Illinois, Urbana.

The distribution and metabolism of arginine was studied by injecting arginine-U-^{14}C into pumpkin cotyledons. At most, 20% of the administered arginine was transported from the cotyledons to the axis tissues. Arginine was extensively metabolized to citric acid cycle intermediates and other amino acids in both cotyledons and axis tissues. Arginine was incorporated into protein in both axis cotyledons with synthesis and turnover occurring at a rapid rate in the cotyledons. Arginase activity indicates that the enzymatic machinery for arginine metabolism was present in the cotyledons.

2:30 Carotenes, Xanthophylls, and Color in Carrot Varieties and Lines As Affected by Growing Temperatures. 247

Bradley, George A., and **Billy B. Rhodes,** Univ. of Arkansas, Fayetteville.

Seventy-two carrot lines from diverse sources made most of their root growth in two soil temperature ranges: 70-80° and 45-55°F. Canned and frozen samples were characterized for color, total carote-

noids, alpha-, beta- and total-carotenes, and xanthophylls. In warm temperatures, all varieties showed higher total carotenoids, higher xanthophyll content and a much higher ratio of alpha to beta-carotene than in cool temperatures. There was no variety-temperature interaction affecting these components. In most varieties canned slice color was closely correlated with beta-carotene content and the beta/alpha carotene ratio. In Waltham Hi-Color and a few other lines the color was better than expected from these characteristics. These showed smaller amounts of xanthophylls and beta-carotene and more alpha, and total carotenes in relation to total carotenoids.

2:45 The Effects of Kinetin in Overcoming High-Temperature Inhibition of Lettuce Seed Germination. 248

Smith, Orrin E., William Yen, and **James M. Lyons,** Univ. of California, Riverside.

Dipping lettuce seeds for 3 minutes in 100 mg/liter kinetin solution induced 67% germination at 35°C compared to 0% germination of control seeds treated with water. Physical manipulations of the seeds such as freezing and thawing, vacuum infiltration and ultrasonic sound increased germination at 30°, but failed to increase the effectiveness of kinetin. It is suggested that a role of kinetin may be to effect a "trigger" action in early stages of germination.

3:00 Recess

3:15 Vascular Anatomy of Tomato Fruit Selected for High and Low Expression of Blotchy Ripening. 249

Fogleman, Max E., L. C. Pierce, and **J. L. Weigle,** Univ. of Kentucky, Lexington.

Microscopic examination of normal and blotchy tissue revealed disorganization and breakdown of the parenchyma cells adjacent to the vascular bundles in affected areas. Vascular bundles in blotchy areas were larger than those in normal tissue and displayed prominent lateral branching, occurring nearer the stem and in blotchy tissues. Fruits from progenies of selections for low and high expression of blotchy ripening were examined the following year to see if these anatomical characteristics could be found. Histology was studied at 7, 14, and 21 days after anthesis and at the mature green stage. Fruits from progenies of selections low in blotchy tissue had a larger number of vascular bundles that were small but well distributed. Fruits from progenies of selections for severe blotchy ripening had fewer vascular bundles that were large and erratic in distribution. No differences in expansion of the parenchyma cells could be detected at three weeks. At the mature green stage parenchyma cells in the progeny of low blotchy selections were well expanded just under the epidermis, but not in blotchy selections.

3:30 Lettuce Tipburn and Nitrogen Metabolism. 250

Ries, S. K., L. Baker and **S. Ashkar,** Michigan State Univ., East Lansing.

Nitrogen metabolism of leaf lettuce was compared between samples from greenhouses containing tipburn and no tipburn. Plants showing tipburn were also compared with plants not having tipburn in the same house. The levels of most nitrogen constituents were altered. The most striking differences were in amino acid levels, which were higher both on a fresh weight and a dry weight basis in tipburned lettuce. Most significant was the increase in asparagine content from an almost undetectable amount in the non-tipburned lettuce to more than 2% of the dry weight in the tipburned samples. It is postulated that environmental factors cause an alteration in nitrogen metabolism resulting in the production of toxic quantities of amino acids, such as asparagine, which cause tipbrun.

3:45 Artificial Light Induced Leaf Lesions in a Diploid Solanum Accession. 251

Nilsen, Karl N., and **Darrel R. Bienz,** Washington State Univ., Pullman.

Until recently, use of a fluorescent plus incandescent illuminated growth chamber for the growing of a diploid *Solanum* accession (PI 5279.15)

has not been possible due to the appearance of elevated chlorotic intervenal areas (lesions) on the upper surface of the leaves. These lesions first appear on the young, rapidly-expanding leaves, finally developing into distinct necrotic spots as the leaves mature. Plant vigor is reduced, being ultimately expressed as a reduction in final size, blossom, and tuber yield. Results of studies involving the examination of the ultraviolet absorption characteristics of plastic materials used to separate lamps from plants has shown that those materials which absorb the fluorescent lamp emissions between 300 and 320 millimicrons wavelength will cause the appearance of lesions, whereas plastic materials such as polyethylene or polyvinyl chloride which permit transmission of the 300 to 320 millimicron near ultraviolet also permit the growing of lesion-free, vigorous, normal plants.

4:00 Lettuce Growth and Tipburn Incidence Under Controlled Humidity. 252

Bottenberg, George E., and **T. W. Tibbitts,** Univ. of Wisconsin, Madison.

Meikonigon, a cultivar of bibb lettuce, was grown in peat soil from seeding at 70° F, 2000 ft.c and with CO_2 above 300 ppm under 4 humidity treatments: (1) 90% RH-16 hr light and 8 hr dark, (2) 90% RH-16 hr light and 50% RH-8 hr dark, (3) 50% RH-16 hr light and 90% RH-8 hr dark, (4) 50% RH-16 hr light and 8 hr dark. Both leaf size of plants and rate of leaf development were approximately 25% greater under continuous 90% RH than under continuous 50% RH. The growth of the plants with RH alternations was intermediate. Tipburn incidence was accelerated with increased humidity, occurring at 25.0, 27.7, 31.1, and 34.7 days respectively under the different treatments. There was no acceleration of tipburn by the abrupt light-dark changes in the humidity environment.

4:15 Tobacco Mosaic Virus Strains in Greenhouse Tomatoes. 253

Jensen, Merle H., B. L. Pollack, and **Eugene H. Varney,** Rutgers Univ., New Brunswick, New Jersey.

Differential hosts and serological techniques were used to group 14 isolates of tobacco mosaic virus (TMV), collected from tomato plants, into either the 'tomato or tobacco' strain of TMV. Two of these isolates, one of each strain, were simultaneously inoculated to tobacco, *N. tabacum* 'Samsun' and tomato plants, *L. esculentum* 'Mich.-Ohio' at 2 concentrations in 3 combinations. Also, each strain was inoculated separately to tobacco and tomato plants. In tomato, the tobacco and tomato strains multiplied normally when alone but if both were inoculated together regardless of the concentration of either, the tobacco strain was suppressed and the tomato strain became dominant. The opposite was true in tobacco plants. Although virus-free tomatoes could be infected with the tobacco strain of TMV found in smoking tobacco, the almost universal presence of the tomato strain of TMV found in greenhouse tomatoes indicates other sources of inoculum are most important.

(37) FRUIT: GROWTH RETARDANTS

Chemistry 179

Presiding: Edward L. Proebsting, Jr., Irrigation Exp. Station, Prosser, Washington.

1:45 *In Vivo* and *In Vitro* Reactions of 1, 1-dimethylamino Succinamic Acid (B-9, Alar) and Related Substances. 254

Sachs, Roy M., and **Kay Ryugo,** Univ. of California, Davis.

In vivo studies with labeled Alar (B-995) and 1,1 dimethylhydrazine (UDMH) showed that the latter, while penetrating the leaves more readily than the former, was not as effective an inhibitor of pea and

bean stem elongation nor a promoter of flowering in fuchsia on a mole per mole basis. Occasional hydrolysis of Alar was experienced but the evidence indicates that it may have occurred spontaneously on the leaf surface. *In vitro* trials with UDMH and betahydroxyethylhydrazine (BOH) revealed that they coupled readily with aldehydes. Incubation of dimazine- and succinate-labeled Alar with acetone leaf powder of cherry resulted in 2 catabolites whose R_f values did not coincide with that of UDMH. While the biological activity of these breakdown products have not been tested, after an 18 hour incubation period they may constitute as much as 15% of the Alar added. These findings strongly suggest that the mode of action of Alar is not primarily by its hydrolysis to UDMH which in turn inhibits diamine oxidase from converting tryptamine to indoleacealdehyde as postulated by Reed and Moore.

2:00 Absorption and Translocation of C^{14} Labeled N-dimthylamino Succinamic Acid by Young Tung Trees (*Aleurites fordii* Hemsl.). 255

Overcash, J. P., M. W. Kilby, and **Norman Mitlin,** Mississippi State Univ., State College.

Known quantities of the C^{14} radioisotope were applied to the lower epidermis of 4 full grown leaves per plant on young actively growing tung trees in containers which were kept in growth chambers at 80°F. Plant tissues were subsequently sampled, processed, and counted with a Packard Tri-Carb Liquid Syntillation, automatic recording, spectrophotommeter. After one hour the material had been absorbed by the lamina and translocated to the petiole. After 24 hours the radioactivity indicated that the chemical was present in all plant tissues, including the roots. The maximum amount on an mg per gram of fresh weight basis occurred after four days for most of the 14 sampling positions on the trees. The chemical solution was dry on the lamina in less than an hour yet absorption continued for several days.

2:15 Some Effects of a Growth Retardant on Shoot Meristems of Apple. 256

Wilde, Mary, and **L. J. Edgerton,** Cornell Univ., Ithaca, New York.

Uniform, actively growing apple seedlings, 10 to 15 cm high, were sprayed with N-dimethyl amino succinamic acid (Alar). The apical portion of treated and control seedlings was collected at the following intervals after treatment: 3, 27 hours; 3, 6, 8, 14 days; 5 weeks. Sections through the apex were prepared, stained, and examined microscopically for mitotic figures. As compared with controls, the frequency of mitotic figures in the stem apex of treated plants progressively decreased through three days; at 6, 8, and 14 days the number of figures progressively increased but did not reach the frequency found in untreated seedlings at 14 days. A similar but less marked decrease in mitotic activity occurred in young leaf primordia. In the rib meristems frequency of mitosis was unchanged at three hours but then declined and virtually ceased until the 14th day when a few more figures were visible. Five-week-old seedlings were examined for histological abnormalities associated with extreme shortening of internodes in the sprayed seedlings.

2:30 The Influence of N-dimethylamino Succinamic Acid (Alar) on Growth of the Sweet Cherry, *Prunus avium*. 257

Chaplin, Michael H., and **A. L. Kenworthy,** Michigan State Univ., East Lansing.

Sweet cherry trees of the Windsor and Schmidt cultivars were sprayed with 1000, 2000, 4000, and 8000 ppm N-dimethyl amino succinamic acid (Alar) 2 weeks after full bloom. A reduction in the force required to remove the fruit from its pedicel was observed on Alar-treated trees. The soluble solids content and titratable acidity of the Alar treated fruit was significantly higher than that of the untreated fruits. Alar promoted red color development in the fruit early in the growing season. Fruit size was reduced by 8000 ppm Alar in the Windsor cultivar. There were no differences in the respiratory activity of the Alar-treated fruit and that of the untreated fruit. Vegetative growth was also influenced. Shoot length, number of buds per shoot, and shoot internode length were significantly reduced by Alar application.

2:45 The Effects of Alar on Red Tart Cherries (*Prunus cereasus*). 258

Unrath, C. R., and **A. L. Kenworthy,** Michigan State Univ., East Lansing.

Results of a three-year study using Alar on red tart cherries show that Alar is effective in influencing both vegetative growth and fruit development. Alar applied at 2000 and 4000 ppm two weeks after full bloom: 1) Reduced the force required to separate the fruit from its pedicel, 2) increased fruit firmness, 3) increased fruit color early in the harvest season and 4) increased uniformity of fruit size by reducing the rate of "normal" fruit enlargement which occurs with delayed harvest. Alar did not affect soluble solids. Alar treated fruit, harvested mechanically, was firmer than untreated fruit that was hand picked. Trees treated with Alar matured fruit 5-7 days earlier and bloomed 2-3 days earlier the following year. Alar reduced shoot growth by decreasing internode length but had little effect on total bud production. Alar caused an increase in fruit bud initiation.

3:00 Effects of N-dimethylamino Succinamic Acid (Alar) on Yield, Size, Maturation, and Quality of Peaches with Reference to Its Use in Adapting Fruit for Mechanical Harvesting. 259

Gambrell, Carl E., Jr., E. T. Sims, Jr., and **W. H. Rhodes,** Clemson Univ., Columbia, South Carolina.

The growth regulator N-dimethyl amino succinamic acid (Alar) was applied as post-bloom sprays to several varieties of peaches from 1964-1967. There were no significant differences in fruit yield, size or shape when compared to either hand thinned or non-thinned checks. When compared to the 2 checks, Alar consistently accelerated maturation by approximately 5 days as well as reduced the number of pickings required from an average of 5 to 2. Quality of fruit from trees receiving post-bloom sprays of Alar was generally equal to or better at maturity than fruit from hand thinned or non-thinned checks as indicated by pure color, undercolor, overcolor, soluble solids, pH, total titratable acidity, and the soluble solids-acids ratio. Alar, when applied near pit-hardening, caused effects which could be beneficial in adapting fruit to mechanical harvesting.

3:15 Recess

3:30 Vegetative and Reproductive Responses of Highbush Blueberry to Succinic Acid 2, 2-dimethylhydrazide (Alar). 260

Hapitan, Jose C., Jr., and **Vladimir G. Shutak,** Univ. of Rhode Island, Kingston.

Single spray applications of succinic acid 2,2 dimethylhydrazide (Alar) at 5000 ppm on July 18 or August 22 significantly inhibited vegetative growth of highbush blueberry cultivars 'Collins' and 'Bluecrop'. Inhibition was significantly greater in plants which received repeated spray application in July and August. Spray treatments also increased number of flower buds per unit length of total new shoot growth, delayed blossom opening and increased number of flowers in the third and fourth buds but failed to increase the number of flowers in the second bud. Alar delayed ripening of the berries but did not significantly affect the average size of berries.

3:45 The Effect of Alar (N-dimethylamino Succinamic Acid) on Yield and Quality Attributes of Concord Grapes. 261

Cahoon, Garth A., and **C. W. Donoho, Jr.,** Ohio Agric. and Dev. Center, Wooster.

In the spring of 1967 mature vines in 3 Concord grape vineyards were sprayed with Alar at concentrations of 500 and 1000 ppm at first and peak bloom. The principle effect was to increase cluster weight and

yield by increasing the number of berries set per cluster. However, as cluster weight increased, weight of individual berries decreased. Soluble solids and total acids were used as an index of maturity and quality. Soluble solids tended to be lower on treated than on untreated vines, while total acid content was not significantly effected. Yields were influenced by both the time and concentration of material applied. The most effective treatment was Alar applied at 1000 ppm at first bloom.

4:00 Post-year Responses of Concord Grape Vines Treated With N-dimethylamino Succinamic Acid. 262

Tukey, Loren D., Pennsylvania State Univ., University Park.

The performance of Concord grape vines treated the previous year with N-dimethyl amino succinamic acid (DMAS) was evaluated by determining the amount of 1-year prunings and grape production. DMAS had been applied as an aqueous foliar spray to vines growing in the field in 1965 and to similar but different vines in 1966. DMAS had been applied at full-bloom or earlier to increase berry set. Concentrations ranged from 750 to 2250 ppm. In the year of treatment, a significant reduction had been obtained in the length of canes and the amount of 1-year prunings. Thus, in balanced pruning, fewer buds had been left on the treated vines. Analysis of the data obtained at the completion of the second growing season, 1966 and 1967 respectively, indicated that there were no significant differences between previously treated vines and non-treated vines. Consequently, even though a reduction in vine vigor had been obtained in the year of DMAS treatment, subsequent fruit production and vegetative development was unaffected. Further, vine vigor appeared to be related more closely to that previous to treatment than to that as a result of a foliar application of DMAS.

4:45 Vegetative and Fruiting Responses of Pecan (*Carya illinoensis* Koch) to Heading Back and N-dimethylamino Succinamic Acid. 263

Storey, J. Benton, George Madden, and **Gilberto Garza F.**, Texas A&M Univ., College Station.

Heading back and Alar were used at 3 to 2 levels respectively in all possible combinations on a replicated two year test involving 288 eighteen-year-old pecan trees. Alar decreased vegetative growth measured by trunk diameter and shoot growth, nut maturity, grade, specific gravity, percent filling, percent kernel, nut size, and value per pound. Alar increased shuck disease, shade density, leaf color, and yield. Heading back decreased vegetative growth, shuck disease, and yield. Heading back increased grade, specific gravity, percent kernel, nut size, percent fill, shade density, and leaf color. The heaviest heading back treatment reduced income per acre on Barton trees from $1000.24 to $833.84 whereas Alar increased yield on the heaviest pruned Barton trees from $833.84 to $1079.99. Thus there is evidence that since Alar and heading back have essentially reverse effects on pecan trees that the two can be used in combination to provide the desired response of maintaining a small, regular-bearing tree.

(38) VEGETABLE CROPS: BREEDING
Engineering 1120

Presiding: Homer T. Erickson, Purdue Univ., Lafayette, Indiana.

1:45 Breeding Tropically-adapted Vegetable Corn Hybrids and Varieties. 264

Brewbaker, James L., Rockefeller Foundation, Bangkok, Thailand.

Fresh corn in the tropics is largely inferior, derived as it is from tough flint or glutinous genotypes, or from sweet corns of unacceptable

quality or daylength tolerance. Disease and daylength conspire to make US hybrids almost consistently disappointing in the tropic latitudes. About 500 sweet corn (*su*) single cross hybrids have been bred in Hawaii involving tropical germplasm, and evaluated in Hawaii and Thailand. Similarly, 20 tropically adapted sweet synthetics and about 100 lines of glutinous (wx), high-sucrose (*ae/wx, bt,* or sh_2), and high-lysine (o_2 and fl_2 on *su* or *wx*) genotypes were produced and given at least preliminary yield and quality evaluations. Several of these have been released to growers. Mainland and Hawaiian sweet inbreds are being converted to fl_2 and 0_2 with an eye on protein deficiencies in the tropics, to *Ht* (blight resistance) and to photoperiod adaptability, while varietal improvement for tenderness among *ae wx, su, o_2 wx* and other populations is in progress.

2:00 Descriptive Study of Sweet Corn Inbreds and Its Possible Relation to Combining Ability Performance. 265

Campbell, William M., and **David W. Davis,** Univ. of Minnesota, St. Paul.

A descriptive study was undertaken to formulate a predictive basis in morphology for combining ability performance of eleven sweet corn inbreds of *zea mays* which have a known combining ability. Morphological characters indicative of teosinte and *Tripsacum* introgression were selected. Gross morphological aspects (leaf width and length; tassel shape and structure; internode length; ear position, length, and diameter differed significantly across these inbreds. From longitudinal sections of mature cobs the inbreds differed significantly in the following internal characters of the pistillate spikelet: rachis width and length, and rachilla length and angle of inclination. This work is being extended through 1) electrophoretic study of soluble seed proteins and 2) measurement of combining ability performance of the F_1 diallel of the inbreds

2:15 The Inheritance of Seed Coat Rupture in Snap Beans *Phaseolus vulgaris* L. 266

Dickson, M. H., New York State Agric. Exp. Station, Geneva.

Seed coat rupture, also described as 'fish face,' is a common seed problem in snap beans. Lines from the cross of Tendercrop and Streamliner were classified as high, 18% or more; medium, 3-18%, and low, 3% or less, seed with ruptured seed coats. Crosses of HxL gave F_2 segregation pattern of 1:2:1 for H:M:L classes. F_3 data verified the F_2 data explaining variations from the expected results in other crosses. The data suggested seed coat rupture is due to a single incompletely dominant gene with 25-50% penetrance. It is not linked with seed color, pod shape or size or maternal factors.

2:30 Breeding for Early Yield in Glasshouse Tomatoes. 267

Kooistra, E., Inst. of Hort. Plant Breeding, Wageningen, Netherlands.

For early production of tomatoes in the Netherlands the amount of light in the winter months is the limiting factor. The low rate of assimilation not only limits growth but also makes for an unfavorable distribution of the available assimilates, impeding good truss development. Selection for early yield is therefore directed toward obtaining material which allows the available light to be used to best advantage and reduces the possibility of disturbing the equilibrium between vegetative growth and generative development. With respect to the usual cultural method, progress was made with selection for good growth combined with a good truss development in poor light. For a modified cultural method, e.g. the single truss method, weak growth may open up prospects. Finally, it has been demonstrated that the incorporation of a rapid fruit development also favors an early yield.

2:45 The Nature of Reduced Fecundity and Male Sterility in a Strain of Watermelon. 268

Fuqua, Mack C., Texas A&M Univ., Lubbock.

Studies were conducted to determine the nature of reduced fecundity and male sterility in watermelon strain U-256 by determining the percentage of viable pollen produced by the acetocarmine stain technique. studying cytologically the process leading to pollen abortion, studying anatomically pollen germination and growth on the stigma and through the conductive tissue in the pistillate flower, and studying cytologically the process leading to ovule abortion. Pollen produced by the normal variants was 93.75% viable and no viable pollen was found to be produced by the sterile variant. The mechanism of pollen abortion was found to be due to the absence of meiosis in the pollen mother cells with subsequent degeneration. Pollen germination and pollen tube growth was normal on the pistillate flower of the male sterile variant. The mechanism leading to ovule abortion was due to the absence of meiosis in the megaspore mother cell.

3:00 Recess

3:15 Anatomical Aspects of Petaloidy in Carrots (*Daucus carota* L. var. *sativa*). 269

Eisa, Hamdy M., and **Donald H. Wallace**, Cornell Univ., Ithaca, New York.

Petaloidy is the transformation of stamens to petal-like structures, resulting in male sterility. Petaloidy was found in wild carrots in 1953, and since then it has been used in carrot breeding programs. Different degrees of petaloidy exist, depending on the extent of transformation in the filament and the anther. Serial sections of normal and petaloid flowers reveal that anticlinal cell division of the epidermal cell layer early in floral primordia development is associated with petaloidy. In occasional cases where the anthers are not completely transformed, pollen mother cells form and the anthers contain shrivelled pollen grains. In such instances of incomplete transformation there is an inverse relationship between the degree of petaloidy and pollen grain development.

3:30 Embryo Variability Among the Seed Lots of Triploid Watermelon. 270

Eigsti, Orie J., Chicago State College, Chicago.

Size and weight of triploid embryos varies greatly from a microscopic mass of cells to the huge well-developed embryos. There is no external seed coat character to indicate how large or small the embryo may be within a given seed. However, machines that separate seed lots by specific gravity do make excellent means to detect the large embryos which produce the most vigorous seedlings. A serious consequence of the smaller embryo group is their sensitivity to excess water at the time of sprouting. That portion of triploids with a light specific gravity may have a viability of 90%, yet only yield 20% or less in a field stand. It is also noted that such embryo size variability is not found among the diploid or tetraploid.

3:45 Genetic Control of Flowering and Frost Tolerance in Inbred Lines of Broccoli. 271

Bouwkamp, John C., and **Shigemi Honma**, Michigan State Univ., East Lansing.

Two inbred lines of broccoli were compared for frost tolerance and tendency to flower after controlled vernalization. Data suggested that one of the lines required long days and cool temperatures for flower induction while the other required cool temperatures only. Results obtained suggest that the gene controlling long day requirements also appear to control frost resistance or that the two genes may be closely linked. The frost tolerance is measured by the ability to live after freezing rather than simply a super-cooling effect.

4:00 Feasibility of Breeding High Protein Potatoes. 272

Hoff, J. E., H. T. Erickson, and **C. M. Jones**, Purdue Univ., Lafayette, Indiana.

Analysis of *Solanum tuberosum* breeding lines and *Solanum* species indicates a range of variability for both crude and true protein sufficient to permit breeding for either character. Investigations of effects of moisture and heat stress indicate that these may be significant factors in changing protein content. Analyses of various sized tubers showed that small tubers tend to have higher levels of protein. Amino acid analyses of several breeding lines are presented. True protein tended to decrease during sprouting while the crude protein changed relatively little.

(39) FRUIT AND VEGETABLE CROPS: MECHANICAL HARVESTING.

Chemistry 194

Presiding: William Hollis, National Canners Association, Washington, D. C.

2:00 The Influence of Various Cultural Practices on the Yield-Quality Pattern of Simulated Machine Harvested Cantaloupes. 273

Marlowe, George A., Jr., Donald M. May, and **Burton J. Hoyle**, Univ. of California, Davis.

The influence of population density, nitrogen level, moisture regime and date of harvest on the yield-quality pattern of cantaloupes was studied for its machine harvest aspects. Conventional or accumulative harvests yielded 2.39 total and 2.19 marketable melons per plant, whereas, the destructive or once-over method yielded 2.21 total and 0.89 marketable. On the high moisture plots, low N was better than high at the 6 and 12 inch spacing with no difference at 18 inches. On the dry plots, low N gave higher yield than N at all three spacings. Dry plots were significantly better than the high water plots. The influence of spacing was greater than the nitrogen or irrigation effect.

2:15 Mechanical Harvest Muskmelons. 274

Foster, R. E., and **B. L. Harriott**, Univ. of Arizona, Mesa.

An experimental cantaloupe selective harvester component was used to test three University of Arizona lines and three commercial cultivars. Breeding strains, developed for mechanical harvesting, differ from standard forms in vine growth, fruit abscission, and fruit shape. In each of two latin-square plantings all strains were grown at three spacings. All twelve harvests of each test were made by the machine. Two distinct actions were recognized: removal of fruit from the vine, and movement of loose fruit to a "pick-up" position. Harvested fruit was recorded as immature, mature and marketable, or overmature. Two University of Arizona lines yielded the most fruit and the highest percentage of marketable fruit. The most fruit was moved to the pick up position from one of these. Spacings affected total yield but not the percentage of mature fruit picked. In movement of loose fruit, variety X spacings interactions probably reflected vine development.

2:30 Field Seeding Tomatoes at High Plant Population for Processing. 275

Nicklow, Clark W., and **William J. Woolsey**, Michigan State Univ., East Lansing.

Tomato yields resulting from simulated machine harvest in southeastern Michigan were significantly influenced by plant population. Twelve varieties, early, midseason and late, responded to significantly greater

early yields when seeded at a 12" x 6" spacing (12 inches between rows and 6 inches between plants in the row or 87,120 plants per acre) in contrast to spacings of 36" x 12" (14,520 plants per acre). Greater than 30 tons per acre were produced from plants at the high plant population. Peak yields of a few mid-season, large-vined varieties occurred when the plants were spaced 12" x 12" (43,560 plants per acre). Growers in the mid-west are urged to use field seeding for September harvest and transplants for August harvest.

2:45 Size of Plant Important in Mechanical Clipping of Pickling Cucumbers. 276

Sims, William L., and **Brent L. Gledhill,** Univ. of California, Davis.

Plant size at time of mechanical clipping or topping of pickling cucumbers grown for mechanical harvesting is very important. Pickling cucumber plants of the variety SMR-58 have been mechanically clipped in both greenhouse and field studies. Treatments have been as follows: (A) five-inch plants clipped to three inches, (B) nine-inch plants clipped to four inches, (C) twelve-inch plants clipped to six inches, (D) sixteen-inch plants clipped to nine inches, (E) check (non-clipped). The number of nodes remaining after clipping had an effect on the number of single, double, and triple branches (laterals) produced. Clipping also reduced the size of the plant at time of once-over harvesting. Treatments C and D left 3 and 4 nodes respectively and produced a greater number of double and triple laterals. Yield was also the highest in treatment C.

3:00 Recess

3:15 Harvest Indices for Once-over Harvested Pickling Cucumbers. 277

Miller, C. H. and **G. R. Hughes,** North Carolina State Univ., Raleigh.

Experiments were conducted on both spring and fall crops to more clearly define the relationship between the various marketable grades of pickling cucumbers from the standpoint of production and value. Plant populations of 105,000 per acre were established in the spring and 70,000 in the fall with gynoecious varieties. The plots designated for the first harvest were picked when a few fruits of the No. 2 size (17/16 to 24/16 in. dia.) were present. Plots designated for subsequent harvests were picked at 2- to 3-day intervals for a total of 8. Maximum value ($461) was achieved in the fifth harvest of the spring planting when 4, 6, 58 and 31 percent of the cucumber grades 1 through 5 (max. 2 ½ in. dia.) were present. At that time, 88.9 percent of the plants were bearing fruit and had an average of 1.19 fruits per plant. Similar results were recorded in the fall planting, although growth was slower because of cooler weather.

3:30 Pickling Cucumber Spacing and Variety Studies Aimed at Machine Harvest. 278

Nicklow, Clark W., and **William J. Woolsey,** Michigan State Univ., East Lansing.

Yields from a new MSU line, MSU 6515-3, were compared at the following plant populations: 5" x 5" (251,000 plants per acre), 7" x 7" (127,000), 9" x 9" (77,500) and 18" x 4½" (77,500) under high and medium levels of irrigation. For both a two harvest system and a single harvest system, the plants that were spaced 5" x 5" resulted in yields that were significantly greater in dollar value per acre (greater than $700 per acre or in excess of 600 bushels) than plants spaced 18" x 4½" or at the 9" x 9" spacing. The dollar value of cucumbers harvested increased linearly as plant population increased. Pickling cucumber varieties vary significantly in their ability to produce high yields at a high plant population. Some varieties have the ability to produce high yields using the one-harvest system whereas others appear to produce higher yields only if they are harvested using the two-harvest system in order to remove the crown set.

3:45 Some Factors Associated With Mechanical Harvesting of Sweet Cherries. 279

Larsen, Paul R., and **John Thienes,** Michigan State Univ., East Lansing.

Mechanical harvesting studies conducted in northern Michigan sweet cherry orchards in 1967 indicated: (1) Fruit removal of the Napoleon variety for brining was 87% or above during a two-week harvesting period. (2) There was no significant difference in fruit removal percentages between various types of fruiting branches, but willowy-type hangers had the lowest average percent removal and they impeded harvesting time and efficiency. (3) There was no apparent difference in brining quality of fruit caught high in a tree versus fruit allowed to fall through a tree into the standard catching unit. (4) Machine-harvested fruit had a high percent of attached stems, compared to hand-picked fruit. (5) Quality of machine-harvested fruit dropped significantly as fruit became mature. 1968 studies included different pruning systems to improve harvesting efficiency. Preliminary results, including percent fruit removal, percent attached stems, fruit quality, and handling procedures, will be discussed.

4:00 Physical and Anatomical Characteristics of Blemishes of Sour Cherries (*Prunus cerasus* L.) Resulting From Mechanical Harvesting, Handling, and Soak Before Processing. 280

Arnold, Calvin E., and **Arthur E. Mitchell,** Michigan State Univ., East Lansing.

Mechanical harvesting of sour cherries resulted in an increase in visible blemishes and a reduction in firmness of flesh. Certain bruises were latent, some masked by red pigment. When graded at harvest, 10% of the cherries had visible bruises. After bleaching in SO_2, the number increased to 28%. Bruises consisted of crushed surface tissue 3 to 4 cells in depth, and sheared and crushed cells within the cortex 6 to 8 cells beneath the epidermis. After soaking for 3 hours, the average durometer reading, indicating flesh firmness, was 45 gm. as compared to 37 gm. before soaking. Increase in firmness corresponded to thickened cortical cell walls. After soaking for an additional 21 hours at the processing plant, all cherries exhibited excessive scald. When sectioned, epidermal and subepidermal cells were dense with a brownish cast, when compared to nonscalded cells.

(40) FLORICULTURE: PHYSIOLOGY AND MORPHOLOGY

Engineering 1062

Presiding: Henry M. Cathey, USDA Plant Industry Station, Beltsville, Maryland.

2:00 The Effect of Long Photoperiods on Flower Development of *Chrysanthemum morifolium*. 281

Ben-Jaacov, Jaacov, and **Robert W. Langhans,** Cornell Univ., Ithaca, New York.

Application of long days to *Chrysanthemum morifolium* plants, after initial flower induction by short days, will be discussed. The effect of the long day treatment is dependent on the time of its application, with regard to the development stage of the flower bud. Early (before florets induction is completed) application of long days causes an increase in the number of florets initiated. Late (after florets induction is completed) application of long days causes the elongation of the florets. This elongation is caused by increased cell division. The application of this light manipulation to improve flowering of *Chrysanthemum morifolium* will be discussed. The behavior of several varieties will be demonstrated.

2:15 Effect of Photoperiod on Flower Initiation, Development, Leaf Formation, and Stem Elongation of *Dianthus Caryophyllus.* 282

Cheng, Le-Hong, and **R. W. Langhans,** Cornell Univ., Ithaca, New York.

Histological sections were made of carnation apexes to study the changes that occurred during flower initiation and development. Increasing the photoperiod hastened flower initiation, but slowed development. Stem elongation and leaf formation studies were made on plants grown under various photoperiods. The longer the photoperiod, during the vegetative state, the greater the stem elongation rate. Photoperiod, however, had no effect on the rate of leaf formation. Photoperiod, also had no effect on stem elongation rate after flower intiation. The rate of stem elongation was very large after flower initiation.

2:30 Effect of Supplemental Light on Flowering Response of Carnation in the Greenhouse. 283

Elstrodt, Charles J., and **James B. Shanks,** Univ. of Maryland, College Park.

A 2-year study was conducted on 2 varieties of carnation. Plantings were made June 1, July 1, and Aug. 1, and pinched 3 weeks later. Natural photoperiods were compared with 3 incandescent light interruptions of the dark period. Results indicate that additional light produced earlier flowering, more uniform development, and fewer nodes on flowering shoots.

2:45 Flower Initiation of Carnations as Effected by Temperature and Photoperiod Following Pinching. 284

Shanks, James B., and **Charles Elstrodt,** Univ. of Maryland, College Park.

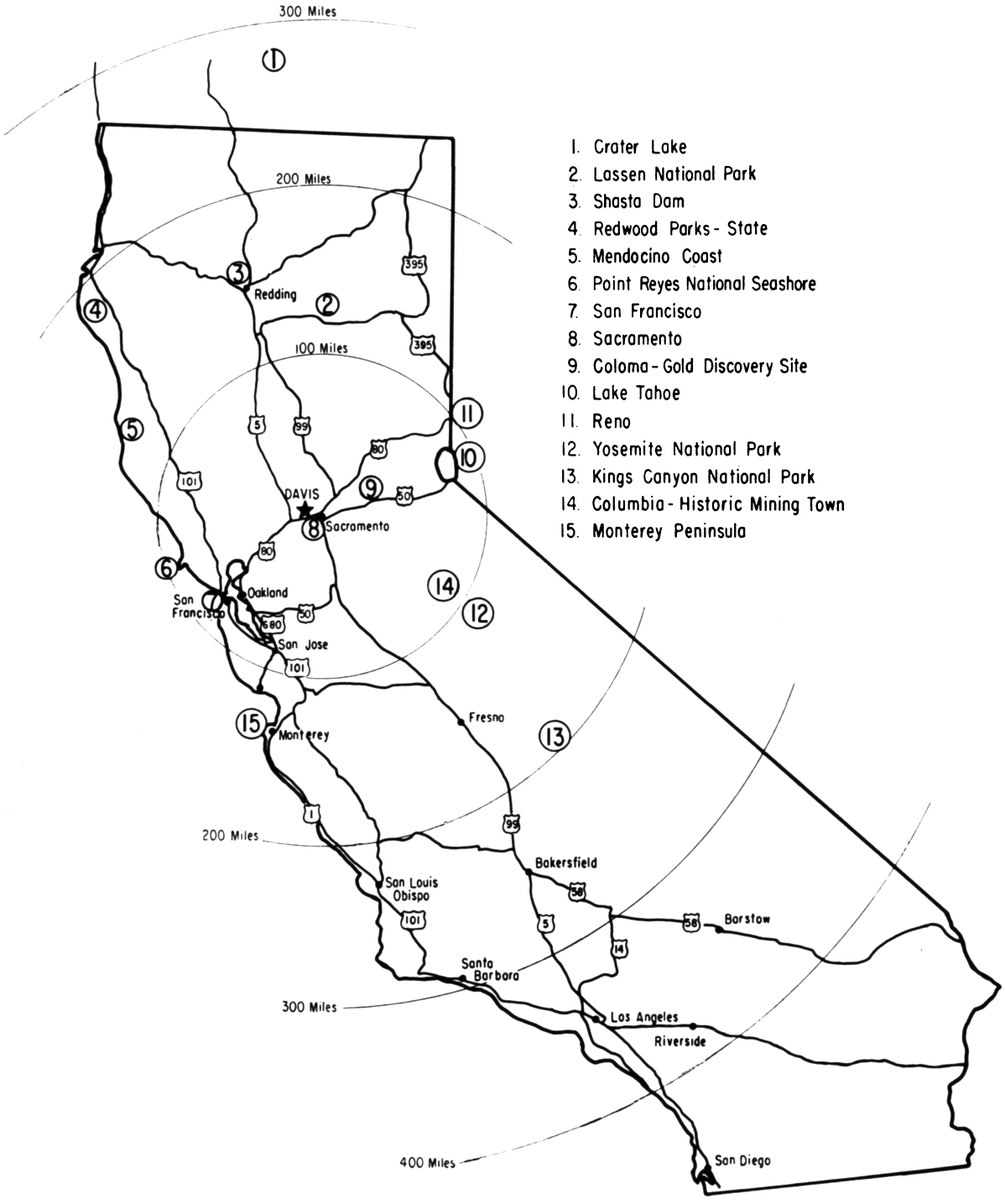
Two carnation varieties received 4 combinations of 55 and 65°F temperatures and 8 and 24 hour photoperiods for 2 or 4 weeks before or at weekly intervals following pinching. Node counts indicated that earlier flowering was promoted by long days during the fourth through sixth weeks following pinching. Temperature had no primary effect.

3:00 Responses of Some Ornamental Plants to Synthetic Abscisic Acid. 285

Cathey, Henry M., USDA Agric. Res. Service, Beltsville, Maryland.

Weekly applications of RS-abscisic acid (ABA) to carnation plants grown on long days delayed the flowering as much as those grown on 8-hr days. Plants grown on 8-hr days and treated with ABA initiated and developed flowers 10 to 12 weeks later than those grown on 8-hr days. When ABA treatments were discontinued the plants resumed immediately their normal growth characteristics. ABA applications every other day delayed the flowering of petunia while cornflower was nonresponsive at all dosages tested. The flowering of short-day plants, chrysanthemum and marigold, was unaffected by daily applications of ABA. ABA suppressed the growth of the long-day plants Japanese maple and dogwood grown on long days. The plants formed resting meristems similar to those observed on plants grown on 8-hr days. ABA was not active in promoting leaf abscision of any of the species tested.

Additional copies of this Program-Abstracts Insert will be available for $1.00 per copy at the registration desk during the meeting.



1. Crater Lake
2. Lassen National Park
3. Shasta Dam
4. Redwood Parks - State
5. Mendocino Coast
6. Point Reyes National Seashore
7. San Francisco
8. Sacramento
9. Coloma - Gold Discovery Site
10. Lake Tahoe
11. Reno
12. Yosemite National Park
13. Kings Canyon National Park
14. Columbia - Historic Mining Town
15. Monterey Peninsula

POINTS OF INTEREST

Sacramento

State Capitol, Sutter's Fort and Indian Museum, Crocker Art Gallery, William Land Park and Zoo (for families).

San Francisco

A cosmopolitan city! Ask at Information Desk or write to San Francisco Visitors Bureau, Fox Plaza, San Francisco 94102.

Coastal

Many beaches, Monterey Peninsula, Big Sur, Point Reyes National Seashore, Muir Woods, Redwood country (many parks), scenic coastal highway 1, early Spanish missions.

Sierra

Lake Tahoe-Donner Lake, Yosemite National Park, Sequoia National Park and King's Canyon, Calveras Big Trees, Coloma (gold discovery site), Columbia (early mining town restored as State park), Lassen National Park.

More detailed information on things to see and do may be secured from the Family Information Desk, 550 Oxford Circle.

Those planning to camp en route to and from Davis may secure additional information from:

U. S. Forest Service, Information and Education Section,
630 Sansome Street,
San Francisco, California 94111

Department of Parks and Recreation, State of
California, P. O. Box 2390, Sacramento,
California 95811

Certain automobile associations also have excellent campsite lists.

CAMPUS DISPLAYS

In addition to the tour and department open houses, you may wish to visit displays of interest on the Campus.

SIERRA TO THE SEA WALKWAY (32)

A transect of 36 soils representative of those from the Sierra-Nevadas to the Pacific Ocean. This outdoor display is part of the landscape south of Hoagland Hall. The Department of Soils and Plant Nutrition has placed on the south wall of Hoagland Hall a pictorial representation of the physiographic features of this transect.

SCIENTIFIC ILLUSTRATION DISPLAYS (17)

Scientific illustrations of plants and insects are on display in the lobbies of the Chemistry Building. These are the handiwork of Mrs. Mary Foley Benson, senior scientific illustrator, of the Entomology Museum, University of California, Davis.

Some of the illustrations for scientific publications on mealybugs, weeds, allergy producing plants and crop and ornamental plants were selected for showing.

Mrs. Benson has published in journals of the Washington Academy of Sciences; Smithsonian Institute, U. S. Patent Office and the U. S. Department of Agriculture. Her work has been exhibited in the U. S. National Museum; Hunt Botanical Library at Carnegie Institute of Technology; Cleveland Museum of Art, and numerous other galleries.

UNIVERSITY LIBRARY EXHIBITS (41)

The history of agricultural mechanization, particularly of horticultural crops, is exhibited on the main floor of the University Library. The items featured in the display are from the Library's general collection and from the F. Hal Higgins Library of Agricultural Technology.

The exhibit cases in the Department of Special Collections on the 4th floor of the University Library feature materials from the University's Rare Book Collection including several rare herbals. Many of the items shown come from the Library of Count Egon Caesar Corti, the author of various works on Austrian history and the Hapsburgs. The Davis campus share of this collection contained works representative of the great botanical and horticultural works of the 18th and 19th centuries. These are particularly distinguished for their hand colored plates. Additional examples of these plates are also hung in the Department of Special Collections.

The University Library, now numbering more than half a million volumes, has a particularly strong collection in agriculture. In addition, the Library's Department of Special Collections houses the F. Hal Higgins Library of Agricultural Technology containing about 300,000 items on the history of agriculture and agricultural mechanization. This collection was accumulated over a period of thirty years by F. Hal Higgins, who has had a distinguished career as an agricultural journalist. The Higgins Collection provides an unusually full history of agricultural mechanization in the United States and, in addition, is particularly rich in pictures of old and new models of agricultural machinery and equipment. Among its many treasures are extensive files of agricultural machinery catalogs; complete and incomplete runs of house organs for many U. S. manufacturing companies; significant volumes of patent literature; manufacturers' manuals for all types of agricultural equipment; and the working collections of various significant persons involved in the field of agricultural engineering.

Members of the staff of the University Library have prepared these exhibits in honor of the annual meeting of the American Society for Horticultural Science. All visitors are cordially invited to visit both the Library and the exhibits.

THE CITY OF DAVIS has a population of about 20,000 with almost as many bicycles. Davis is the first city to have special bike lanes designated on certain streets. Davis is close to many of California's cultural, governmental, recreational and scenic areas. (See map on 105 and 106).

CHARTER MEMBERS of the AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE

Since its founding on September 9, 1903 at Boston, Massachusetts, with 27 Charter Members from 16 states of the USA and one from Canada, the "Society for Horticultural Science" has grown to a membership of almost 3,000 in the USA and 65 other countries. In 1916, the constitution was amended to change the name to "American Society for Horticultural Science", but the membership has continued to become more international in scope.

Thus, present-day members of the Society owe a debt of gratitude to Professor S. A. Beach and the 26 other charter members (listed below) who recognized that a scientific basis was necessary for continued progress in horticulture and, because scientific work being done in horticulture was not fully appreciated in scientific circles, founded the Society "to give dignity and definiteness of aim to scientific work in horticulture."

L. H. Bailey	(N. Y.)	O. M. Munson	(Me.)
S. A. Beach	(N. Y.)	W. Paddock	(Colo.)
F. H. Burnette	(La.)	G. H. Powell	(USDA)
V. A. Clark	(N. Y.)	H. L. Price	(Va.)
C. P. Close	(Del.)	P. H. Rolfs	(USDA)
L. C. Corbett	(USDA)	J. T. Stinson	(Mo.)
John Craig	(N. Y.)	W. Stuart	(Vt.)
Albert Dickens	(Kan.)	C. B. Smith	(USDA)
A. T. Erwin	(La.)	F. W. Taylor	(Mo.)
N. E. Hansen	(S. D.)	W. A. Taylor	(USDA)
U. P. Hedrick	(Mich.)	H. E. Van Deman	(USDA)
H. H. Hume	(N. C.)	F. A. Waugh	(Mass.)
H. C. Irish	(Mo.)	H. E. Weed	(Ill.)
W. T. Macoun	(Canada)		

PAST OFFICERS OF THE AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE

With any organization, the key to success lies in its membership — the leadership and foresight of its principal officers as well as its many members who serve on committees and other assignments. In this respect, the ASHS has been extremely fortunate in having had a large number of members who have given unselfishly of their time, their efforts, and their abilities.

It is appropriate here to recognize and pay tribute to the following members who have served with distinction as the Society's principal officers since its founding in 1903, with terms expiring in the year indicated. Particular encomium is due a few outstanding individuals such as S. A. Beach and L. H. Bailey for their foresight and determination in the founding and organization of the Society; to C. P. Close and H. B. Tukey, Sr. who each simultaneously served approximately 20 years as Editor and Secretary-Treasurer-Business Manager; and to F. S. Howlett, R. E. Marshall, H. M. Munger, and J. R. Magness for their extended periods of devoted service as indicated in the following lists.

President

*L. H. Bailey	1903-07	*A. F. Yeager	1951
*W. A. Taylor	1908-10	*Kenneth Post	1952
*S. A. Beach	1911	S. H. Yarnell	1953
*W. T. Macoun	1912	F. P. Cullinan	1954
*U. P. Hedrick	1913	*E. S. Haber	1955
*L. C. Corbett	1914	M. B. Davis	1956
*W. L. Howard	1915	L. D. Davis	1957
*M. A. Blake	1916	W. T. Pentzer	1958
*T. C. Johnson	1917	F. S. Howlett	1959
*C. A. McCue	1918	H. A. Rollins, Sr.	1960
*J. W. Crow	1919	V. T. Stoutemyer	1961
W. H. Alderman	1920	F. S. Jamison	1962
W. H. Chandler	1921	Walter Reuther	1963
*J. C. Blair	1922	R. E. Larson	1964
*J. H. Gourley	1923	*L. P. Batjer	1965
*M. J. Dorsey	1924	H. J. Carew	1966
H. C. Thompson	1925	H. M. Munger	1967
*E. C. Auchter	1926		
*E. J. Kraus	1927		
*C. P. Close	1928		
V. R. Gardner	1929		
A. T. Erwin	1930		
*T. H. McHatton	1931		
H. A. Jones	1932		
Laurenz Greene	1933		
J. R. Magness	1934		
*H. H. Zimmerley	1935		
Alex Laurie	1936		
A. J. Heinicke	1937		
*J. K. Shaw	1938		
V. R. Boswell	1939		
L. H. MacDaniels	1940		
*F. C. Bradford	1941		
J. C. Miller	1942 & 1943		
W. P. Tufts	1944		
*W. B. Mack	1945		
G. F. Potter	1946		
H. B. Tukey, Sr.	1947		
J. E. Knott	1948		
G. M. Darrow	1949		
*S. L. Emsweller	1950		

Secretary-Treasurer

*S. A. Beach	1903-04
*V. A. Clark	1905-07
*C. P. Close	1908-27
H. B. Tukey, Sr.	1928-46
F. S. Howlett	1947-57
*R. E. Marshall	1958-65

Editor of the Proceedings

*S. A. Beach	1903-07
*C. P. Close	1908-27
H. B. Tukey, Sr.	1928-50
H. M. Munger	1950-56
Damon Boynton	1956-59
J. R. Magness	1959-66
S. H. Yarnell	1966-present

Executive Director and Editor of HortScience

Cecil Blackwell 1965-present

*now deceased

FELLOWS OF THE AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE

Beginning in 1965, the Society elected its first class of Fellows as a means of recognizing and honoring its members who have made outstanding contributions to horticultural science and the profession in the area of teaching, research, or extension; through the exhibiting of leadership in horticultural business and industry pertinent to and compatible with the objectives of the Society; or by reason of noteworthy effort in advancing the goals of the Society through participation in its councils and administration.

Those elected Fellows of the Society in 1965, 1966, and 1967 are listed below. Those elected Fellows in 1968 will be honored during the annual banquet August 20 at the University of California, Davis.

W. H. Alderman	(1965)	J. E. Knott	(1965)
F. W. Allen	(1965)	Russell E. Larson	(1965)
*L. P. Batjer	(1966)	Alex Laurie	(1965)
V. R. Boswell	(1965)	J. W. Lesley	(1965)
H. John Carew	(1967)	L. H. MacDaniels	(1965)
Robert L. Carolus	(1966)	J. H. MacGillivray	(1966)
W. H. Chandler	(1965)	J. R. Magness	(1965)
E. P. Christopher	(1967)	*C. H. Mahoney	(1965)
H. L. Cochran	(1966)	*R. E. Marshall	(1965)
I. J. Condit	(1966)	Edward C. Maxie	(1967)
F. P. Cullinan	(1965)	J. C. Miller	(1965)
T. M. Currence	(1965)	A. E. Murneek	(1967)
George M. Darrow	(1965)	Oscar H. Pearson	(1965)
L. D. Davis	(1965)	W. T. Pentzer	(1965)
M. B. Davis	(1965)	G. F. Potter	(1965)
*M. J. Dorsey	(1965)	E. L. Proebsting, Sr.	(1966)
N. K. Ellis	(1965)	G. J. Raleigh	(1966)
*S. L. Emsweller	(1965)	Walter Reuther	(1965)
A. T. Erwin	(1965)	R. H. Roberts	(1966)
W. A. Frazier	(1966)	H. A. Rollins, Sr.	(1965)
M. E. Gardner	(1967)	A. Lloyd Ryall	(1966)
V. R. Gardner	(1965)	Robert M. Smock	(1967)
Lorenz Greene	(1965)	E. C. Stevenson	(1966)
Paul L. Harding	(1967)	V. T. Stoutemyer	(1965)
A. J. Heinicke, Sr.	(1965)	H. C. Thompson	(1965)
*A. H. Hendrickson	(1965)	Warren P. Tuffs	(1965)
Freeman S. Howlett	(1965)	H. B. Tukey, Sr.	(1965)
F. S. Jamison	(1965)	L. M. Ware	(1967)
Stanley Johnston	(1965)	H. O. Werner	(1965)
Henry A. Jones	(1965)	A. J. Winkler	(1966)
Wesley P. Judkins	(1967)	S. H. Yarnell	(1965)
W. D. Kimbrough	(1967)		

*now deceased

PREVIOUS RECIPIENTS OF ASHS AWARDS

The Society's Awards Program began in 1942 with establishment of "The Vaughan Research Award in Horticulture," sponsored by Leonard H. Vaughan of Vaughan's Seed Stores, Chicago, Illinois. Up to nine research awards are now presented each year, in cooperation with various donors, to the authors of outstanding research papers published in the previous year's volumes of the Society's *Proceedings*. There is also an award for distinguished teaching.

Recipients of the various awards each year are recommended by duly appointed screening committees for each award, with final selections being made by the Awards Committee consisting of the president of the Society and the four immediate past presidents of whom the senior in office serves as chairman.

In recognition of previous award recipients and donors, following is a list of the various awards, donors, and recipients each year through 1967. Those selected as recipients of awards for 1968 will be honored during the annual banquet August 20 at the University of California, Davis.

THE VAUGHAN RESEARCH AWARD IN HORTICULTURE

Established in 1942 through the generosity of Leonard H. Vaughan of Vaughan's Seed Stores, Chicago, Illinois, two awards of $500 each were offered each year: one in the field of Floriculture and one in Vegetable Crops. Preference was given to papers that presented new discoveries in these fields, showing promise of commercial importance or practical applications.

Recipients:

1943* — O. A. Lorenz and J. E. Knott (Vegetable Crops)
1944* — Henry A. Jones and Alfred E. Clarke (Vegetable Crops)
— L. F. Randolph and Leland G. Cox (Floriculture)

*indicates year the awards were presented; papers were published the previous year.

LEONARD H. VAUGHAN MEMORIAL RESEARCH AWARD

In 1944, following the death of Mr. Vaughan, the awards were established as a memorial to him by his company,

Additional copies of this Program-Abstracts Insert are available as separates, and may be ordered by mail at $1.25 per copy (including postage) either before or after the Annual Meeting from the Society's headquarters office: American Society for Horticultural Science, P. O. Box 109, St. Joseph, Michigan 49085, USA.

Vaughan's Seed Stores of Chicago, and the company continued to sponsor the awards on an annual basis until 1963. Criteria for selecting recipients remained the same.

Recipients:

Year	*Vegetable Crops*	*Floriculture*
1945	P. W. Zimmerman & A. E. Hitchcock	V. T. Stoutemyer
1946	Charles M. Rick	G. A. L. Mehlquist
1947	William H. Lachman	D. C. Kiplinger & Glen Fuller
1948	Oned Shifriss	S. L. Emsweller
1949	Russell E. Larson & Sherman Paur	S. L. Emsweller & Neil W. Stuart
1950*	W. A. Frazier & Robert K. Dennett	John G. Seeley
1951	M. L. Odland & C. J. Noll	O. W. Davidson & Sam Asen
1952	H. Kihara	C. W. Fischer, Jr. & J. R. Keller
1953	A. N. Reath & S. H. Wittwer	———
1954	R. W. Richardson, Jr. & T. M. Currence	James B. Shanks & Conrad B. Link
1955	C. M. Geraldson	B. Lennart Johnson
1956	H. C. Mohr, H. T. Blackhurst, & E. R. Jensen	A. A. Piringer, Jr. & Neil W. Stuart
1957	R. L. Sawyer & S. L. Dallyn	R. J. Downs & H. A. Borthwick
1958	Irvin L. Eaks & Leonard L. Morris	J. P. Nitsch
1959	Margaret M. Lesley & J. W. Lesley	Sam Asen & Neil W. Stuart
1960	H. C. Mohr & C. M. Watkins	Sam Asen, Neil W. Stuart, & H. W. Siegelman
1961	J. R. Wall & T. L. York	A. A. Piringer, Jr. & H. M. Cathey
1962	Kirti Singh & B. D. Thompson	H. M. Cathey & A. A. Piringer, Jr.
1963	M. L. Odland	Robert O. Miller

*In 1950, an award in the area of fruit crops was also presented to Julian C. Crane and Rene Blondeau.

THE CHARLES G. WOODBURY AWARD IN RAW PRODUCTS RESEARCH

and

THE NATIONAL CANNERS ASSOCIATION AWARD IN RAW PRODUCTS RESEARCH

Purpose of the award is to recognize outstanding basic or applied research on horticultural crops used for canning – particularly on the raw products of such crops as related to quality of the canned product. The Charles G. Woodbury Award was established in 1949 by Dr. Woodbury, former Director of the Raw Products Research Bureau of the National Canners Association, Washington, D. C. When the last of the fund established by Dr. Woodbury was used in 1940, the National Canners Association assumed sponsorship of the award on an annual basis in honor of Dr. Woodbury. The name of the award was changed in 1967, but the purpose remains the same.

Recipients:

1951 R. B. Guyer, Amihud Kramer, and L. E. Ide

1952 George B. Reynard

1953 Amihud Kramer

1954 F. W. Allen

1955 Otmar Silberstein

1956 E. M. Rahn

1957 C. T. Poole

1958 E. L. Proebsting, Jr., G. H. Carter, D. W. Ingalsbe, and A. M. Newbert

1959 J. N. Moore, A. A. Kattan, and J. W. Fleming

1960 H. T. Hartmann, Marion Simone, R. H. Vaughn, and E. C. Maxie

1961 Robert C. Wiley and Arthur H. Thompson

1962 Robert C. Wiley and G. E. Sternbridge

1963 Max W. Williams and Max E. Patterson

1964 Jack H. Kyle and Thomas E. Randall

1965 A. E. Thompson, R. L. Bower, and R. W. Helper

1966 L. L. Claypool, R. B. Fridley, and P. A. Adrian

1967* Dermot P. Coyne

*Name of the award was changed to "The National Canners Association Award in Raw Products Research."

THE JOSEPH HARVEY GOURLEY AWARD IN POMOLOGY

Established in 1950 by the *American Fruit Grower* magazine, Willoughby, Ohio, in honor of Professor J. H. Gourley, a past president of the Society and formerly head of the Department of Horticulture and Forestry at Ohio State University. The award is for the best paper in the broad general area of fruit crops, and has been presented annually since 1951.

Recipients:

1951 John W. Sites and Herman J. Reitz
1952 Leon Havis and Anna L. Gilkeson
1953 John Einset
1954 J. R. Shay, D. F. Dayton, and L. F. Hough
1955 E. L. Proebsting, Jr. and A. L. Kenworthy
1956 C. H. Hendershott and Lowell F. Bailey
1957 C. P. Harley, L. O. Regeimbal, and H. H. Moon
1958 L. P. Batjer, H. D. Billingsley, M. N. Westwood, and B. L. Rogers
1959 C. B. Shear
1960 E. C. Maxie, M. V. Bradley, B. J. Robinson, and A. A. Hewitt
1961 Dillon S. Brown
1962 H. T. Hartmann and Christopher Panetos
1963 J. N. Moore and L. F. Hough
1964 Esam M. Ahmed and L. E. Scott
1965 Don R. Heinicke
1966 Miklos Faust
1967 Peter B. Catlin and E. A. Olsson

THE ALEX LAURIE AWARD IN FLORICULTURE AND ORNAMENTAL HORTICULTURE

The award was established in 1952 by the Ohio State Floriculture Alumni Association, Columbus, Ohio, in honor of Professor Alex Laurie, a past president of the Society who retired from the Department of Horticulture at Ohio State University in 1952. The award is made annually for the best paper contributing to the advancement of knowledge in the areas of floriculture, ornamental, and landscape horticulture.

Recipients:

1953 H. W. Siegelman
1954 Charles A. Lewis
1955 Henry M. Cathey
1956 Garth A. Cahoon and Duane O. Crummett
1957 C. W. Dunham, C. L. Hamner, and Sam Asen
1958 No Recipient
1959 Clark D. Paris and W. J. Haney
1960 Joe J. Hanan
1961 Abraham H. Halevy
1962 Makoto Kawase
1963 Jasper N. Joiner and Thomas C. Smith
1964 A. H. Halevy, J. Shoub, Deborah Eakati, Ora Pleaner, and S. P. Monseline
1965 A. N. Roberts, L. T. Blaney, and O. C. Compton
1966 P. H. Li, C. J. Weiser, and R. van Huystee
1967 Makoto Kawase

THE DOW CHEMICAL COMPANY AWARD

Established in 1963 by the Contributions Committee of the Dow Chemical Company, Midland, Michigan, the award is for the best paper dealing with prolongation of life of harvested fruit and has been presented each year since 1964.

Recipients:

1964 Robert E. Hardenburg
1965 Pen Hsiang Li and Elmer Hansen
1966 C. W. Coggins, Jr., and L. N. Lewis
1967 Max W. Williams

THE KENNETH POST AWARD IN FLORICULTURE AND ORNAMENTAL HORTICULTURE

The award was established in 1964 for recognition of outstanding graduate student research in the area of floriculture, ornamental, and landscape horticulture. The award is sponsored by The Kenneth Post Foundation, Etna, New York, in memory of the late Kenneth Post, a past president of ASHS and professor at Cornell University.

Recipients:

1964 F. O. Lanphear
1965 Joe J. Hanan
1966 Harry K. Tayama and Robert O. Miller
1967 Leonard P. Stoltz and Charles E. Hess

THE ASGROW AWARD IN VEGETABLE CROPS

Established in 1964 and sponsored by the Asgrow Seed Company, New Haven, Connecticut, the award replaced the former Leonard H. Vaughan Memorial Research Award in Vegetable Crops. The Asgrow Award is presented annually for the best paper on genetic and biological factors affecting the production and handling of vegetable crops.

Recipients:

1964 Lee A. Hadwiger and Charles V. Hall
1965 A. R. Saghir, L. K. Mann, Richard A. Bernhard, and John V. Jacobsen
1966 A. E. Thompson
1967 Sidki Sadik and Philip A. Minges

THE NATIONAL APPLE INSTITUTE AWARD

Established in 1964 and sponsored by the National Apple Institute, Washington, D. C., the award is for the best paper relevant to improved marketing and utilization of apples and apple products.

Recipients:
1964 Milton Workman
1965 G. S. Birth and K. L. Olsen
1966 No Recipient
1967 Dillon S. Brown, J. R. Buchanan, and J. R. Hicks

THE STARK AWARD

Sponsored by Stark Brothers Nurseries and Orchards Company, Louisiana, Missouri, the award was established in 1964 for recognition of outstanding research papers relating to fruit tree decline. Criteria were broadened in 1966 to include papers dealing with methods of improving the general quality, performance, and longevity of fruit trees.

Recipients:
1964 Hudson T. Hartmann, William H. Griggs, and Carl J. Hansen
1965 No Recipient
1966 Robert F. Carlson
1967 Roy K. Simons

THE MARION W. MEADOWS AWARD IN VEGETABLE CROPS

The award was established in 1965 by friends and former associates of the late Marion W. Meadows, in his memory, for recognition of outstanding graduate student research in the area of vegetable crops. The award is sponsored by the Marion W. Meadows Memorial Award Committee, Cornell University, Ithaca, New York. Dr. Meadows earned distinction for his work with potatoes and agricultural chemicals at Cornell and with Agway, Inc.

Recipients:
1966 R. L. Engle, W. H. Gabelman, and R. R. Romanowski, Jr.
1967 Oyette L. Chambliss and Charles M. Jones

THE L. M. WARE AWARD FOR DISTINGUISHED TEACHING

The award was established on a national basis in 1963 by Professor L. M. Ware of Auburn University, Auburn, Alabama, to encourage and recognize excellence in the teaching of horticulture — judged on the basis of content and nature of courses taught, teaching methods, impression and influence on students, and service to the horticultural industry as a teacher. The award was presented for the first time on a national basis in 1964.

Recipients:
1964 Robert M. Smock
1965 Fred R. Brison
1966 D. C. Kiplinger
1967 Leslie Hafen

SUSTAINING MEMBERS of the AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE

The American Society for Horticultural Science serves as the professional organization for almost 3,000 horticulturists. Individual members at colleges and universities, at research stations, in industry, in the field of practice, and representatives of Sustaining Members join forces to promote the Society's objectives—the advancement of scientific research, education, and extension of knowledge in all branches of horticultural science and technology.

Many business firms and other organizations support the Society's objectives through payment of a **Sustaining Membership** fee each year, and through participation in the Society's activities by their designated representatives.

We hereby gratefully acknowledge the active support of the following Sustaining Members and their representatives (listed in parentheses) for calendar year 1968 (as of May 31, 1968):

Agrico Chemical Corp., Div. of Continental Oil Co. (L. J. Sullivan), Memphis, Tennessee

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American Cyanamid Co., Agr. Div. (F. L. Stark), Princeton, N.J.

AmChem Products, Inc. (B. H. Emerson), Ambler, Pa.

American Potash Institute (J. Fielding Reed), Atlanta, Ga.

Asgrow Seed Co. (John S. Rogers), Orange, Conn.

Geo. J. Ball, Inc. (G. Victor Ball), West Chicago, Ill.

Basic Vegetable Products, Inc. (J. E. Morgan), Vacaville, Calif.

W. Atlee Burpee Co. (David Burpee), Philadelphia, Pa.

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*California Tomato Research Institute, Inc. (George A. Johannessen), Stockton, Calif.

Chevron Chemical Co., Ortho Div. (Robert K. Thompson), Richmond, Calif.

Bruce Church, Inc. (David M. Williams), Salinas, Calif.

Crookham Co. (A. D. Taylor), Caldwell, Idaho

Dessert Seed Co. (A. M. Dessert), El Centro, Calif.

Di Giorgio Corp. (J. Max O'Neill), San Francisco, Calif.

**Eli Lilly & Co., Elanco Products Div. (F. W. McClelland), Greenfield, Ind.

*Fairview Orchards (Robert L. Button), Hancock, Md.

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Gerber Products Co. (Emmet L. Ridley), Fremont, Mich.

*Gilroy Foods, Inc. (Elmo W. Davis), Gilroy, Calif

Green Giant Co. (J. G. Martland), LeSueur, Minn.

The Grower-Shipper Vegetable Assn. (Jack E. Bias), Salinas, Calif.

*Hart Carter Co. (Charles DiCarlo), Peoria, Ill.

*Hepburn Orchards, Inc. (E. W. Hepburn), Hancock, Md.

H. J. Heinz Co., Agr. Dept. (Max D. Reeder), Pittsburgh, Pa.

Inter State Nurseries, Inc. (L. R. Sjulin), Hamburg, Iowa

**Massachusetts Hort. Society (Carlton B. Lees), Boston, Mass.

Northrup, King & Co. (Iver Jorgensen), Minneapolis, Minn.

**Robert B. Peters Co., Inc. (Robert B. Peters), Allentown, Pa.

*The Proctor & Gamble Co. (Harry S. Walker), Cincinnati, Ohio.

Stauffer Chemical Co. (C. O. Persing), Mountain View, Calif.

United States Rubber Co., Chemical Div. (H. Douglas Tate), Bethany, Conn.

*United States Testing Co., Inc. (W. T. Sample), Memphis, Tenn.

Washington State Apple Adv. Comm. (Joseph T. Brownlow), Wenatchee, Wash.

Washington State Fruit Comm. (Fred H. Westberg), Yakima, Wash.

Arthur Yates & Co. Pty. Ltd. (D. Blazey), Castle Hill, N.S.W., Australia

**Yoder Brothers, Inc. (William Skou), Barberton, Ohio

NOTE: Companies and organizations printed in **bold face type** have been Sustaining Members for 10 years or more.

** indicates Sustaining Members for 5 to 9 years.

*indicates new Sustaining Members for 1968.