PROGRAM & ABSTRACTS

67th Annual Meeting

AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE

Program: November 1-4, 1970
Tours: October 30-31 and November 1

CARILLON HOTEL
Oceanfront at 68th Street
Miami Beach, Florida

Concurrent with the
25th American Horticultural Congress
of the
American Horticultural Society
Deauville Hotel
Miami Beach, Florida
INDEX TO SESSIONS

MONDAY, NOVEMBER 2

Morning
8:30  (1) PLENARY SESSION - CasaNova Room, Deauville Hotel
9:30  (2) EIGHT CONCURRENT SESSIONS
      SYMPOSIUM: A Challenge to Research to Meet the Future Needs of Industry - Carillon Room
      (3) Collegiate Branch Forum: Student Papers - Dominion Room
      (4) Fruit: Growth and Development - Baroque Room
      (5) Fruit: Environment - Silver Chimes Room East
      (6) Vegetables: Breeding and Genetics - El Dorado Room
      (7) Vegetables: Nutrition - Empire Room
      (8) Woody Oramentals: Rhododendron Growth and Development - Imperial Room A
      (9) Floriculture: Chrysanthemum Growth and Development - Imperial Room B

Afternoon
1:00  (10) SEVEN CONCURRENT SESSIONS
      SYMPOSIUM: Fruit Abscission - Carillon Room
      (11) SYMPOSIUM: Baccalaureate and Non-Baccalaureate Programs in Horticultural Education - Silver Chimes Room East
      (12) Fruit: Growth and Development - Baroque Room
      (13) Postharvest Horticulture: Vegetables - Empire Room
      (14) Vegetables: Growth Regulators - El Dorado Room
      (15) Woody Oramentals: Growth Regulation - Imperial Room A
      (16) Floriculture: Rose Growth and Development - Imperial Room B

Evening
7:30  (17) SYMPOSIUM: Fruit Breeding - Empire Room

Tuesday (Cont’d.)

Afternoon
1:00  (25) SEVEN CONCURRENT SESSIONS
      SYMPOSIUM: The Technology and Feasibility of Bulk Storage and Processing in Fruit and Vegetable Industries - Burgundy Room
      (26) Fruit: Nutrition II - Baroque Room
      (27) Fruit: Physiology - Silver Chimes Room East
      (28) Vegetables: Nutrition - El Dorado Room
      (29) Vegetables: Breeding and Genetics - Empire Room
      (30) Ornamental Plants: Selection and Breeding - Imperial Room A
      (31) Floriculture: Growth and Development - Imperial Room B
      3:30  (32) SEVEN CONCURRENT SESSIONS
      SYMPOSIUM: Vegetable Seed Quality - Carillon Room
      (33) SYMPOSIUM: Baccalaureate and Non-Baccalaureate Programs in Horticultural Education - Silver Chimes Room East
      (34) Fruit: Breeding and Genetics - Silver Chimes Room East
      (35) Vegetables: Physiology - El Dorado Room
      (36) Vegetables: Culture - Empire Room
      (37) Postharvest Physiology: Ornamental Plants - Imperial Room A
      (38) Environmental Techniques of Standardization and Optimization - Imperial Room B
      4:00  (39) SIX CONCURRENT SESSIONS
      SYMPOSIUM: Soil Testing and Plant Analysis in Agriculture - Carillon Room
      (40) Postharvest Horticulture: Fruit - Baroque Room
      (41) Fruit: Cultural Practices - Silver Chimes Room East
      (42) Marketing: Fruits, Vegetables and Ornamentals - Empire Room
      (43) Hericides: Fruits, Vegetables and Ornamentals - Imperial Room A
      (44) Vegetables: Environment - El Dorado Room
      (45) Floriculture: Cultivars - Imperial Room B

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GENERAL INFORMATION

Registration, Information, and the Placement Service will be located in the lobby of the Carillon Hotel. The ASHS Office will be in the Hotel Silver Chimes Conference Room. Registration and housing information and tour applications were included in the June issue of HortScience. Additional applications may be secured from the ASHS, P.O.Box 109, St. Joseph, Michigan 49085.

Mail and telegrams should be addressed to ASHS Meeting, Carillon Hotel, Oceanfront at 68th Street, Miami Beach, Florida 33141. Phone (305) 865-7561.

REGISTRATION INFORMATION

Hotel room reservations and tour reservations must be made in advance. All other registration will be conducted upon your arrival at the Carillon Hotel. Except for tours, no funds for registration or ticket purchases should be sent in advance. Registration will be $12.00; for students, $3.00.

HOUSING

Housing will be available in the Carillon Hotel with possible overflow in the adjacent Deauville Hotel. Reservations must be made directly with the Carillon before October 10, 1970. Confirmation of room reservations will be sent from the Hotel. Since the Hotel will charge the single room rate for a double room any night it is occupied by only one person, try to arrange for a roommate whose arrival and departure dates coincide with yours. If a member is traveling alone but wishes to share a double room, the Hotel will attempt to match requests according to arrival and departure times.

There will be a limited number of single rooms available. After the quota of single rooms has been allocated, single occupants of double rooms will be charged the double room rate. Special rates for young children may be obtained from the Hotel. Baby-sitting service can also be arranged.

Food service is available in the Hotel dining rooms. The Modified American Meal Plan (MAP), which includes breakfast and dinner, is recommended. Room rates on the MAP are $16.00 single occupancy and $12.00 double occupancy per person daily. Rates on the European Plan (no meals) are $4.00 less than MAP plan. These special convention rates are also available two days preceding and following the ASHS meetings.

TRAILER AND CAMPING INFORMATION

Facilities for trailers, campers, and tenting will be available in National, State, and County parks, an Indiana Reservation, private campgrounds, and trailer parks during the time of the ASHS meetings. The following five campgrounds are located within ten miles of the meeting site and will be the most convenient for easy access.

Cloverleaf Trailer Park 16320 N. W. 2nd Avenue
Miami Beach, Florida 33169

Ocean Breeze 11150 Biscayne Blvd.
Miami, Florida 33161

Tamiami Trailer Park 3038 S. W. 8th Street
Miami, Florida 33135

Kobe’s Trailer Court 11900 N. E. 16th Avenue
Miami, Florida 33161

Biscayne Breeze 11380 Biscayne Blvd.
Miami, Florida 33161

Electricity, water, and sewer hookups, showers, and restroom facilities are available at all of the listed locations, and sites are $3.50–$4.50 a night. Reservations are recommended.

It should be noted that the above campgrounds and trailer parks are all located in urban areas. For those willing to commute longer distances, campgrounds are available in rural areas and parks within a radius of 30-40 miles of the meeting site. A further listing of campgrounds available in the southeastern Florida area may be obtained by writing to J. C. Raulston, 5007 - 60th Street, East, Bradenton, Florida 33505.

Visitors will find hundreds of excellent parks and campgrounds available throughout Florida for overnight stopping points while traveling to and from Miami.

CONCURRENT MEETINGS

The Florida State Horticultural Society and the Tropical Region of ASHS are meeting at the Carillon Hotel, October 27-29. All horticulturists will be welcome at these meetings. Registration details are given in the February 1970 issue of HortScience, p. 61.

The American Horticultural Society will meet concurrently with ASHS at Miami Beach. Headquarters for the AHS will be in the Deauville Hotel. Portions of the program will be jointly sponsored and registration for one Society will be honored for most events occurring in the other Society. Exhibits will be handled by the AHS and placed in the Deauville Hotel.

TRANSPORTATION

Air transportation into Miami International Airport is provided by a number of airlines. Good train service into Miami is also available by Seaboard Coast Line. Limousine and taxi service are available for transportation from the airport or train station to the Carillon Hotel. Travelers arriving by automobile should go directly to the Hotel, where ample parking is available.

RECREATIONAL ACTIVITIES

Swimming is available in the Atlantic Ocean and the Hotel swimming pool. Air and water temperatures at Miami are usually ideal for swimming in early November. Golfing is also available for all Hotel guests.

Many recreational activities and points of interest in south and central Florida are less than a day’s drive from Miami. A number of resort areas are located along the Atlantic and Gulf Coasts, and a variety of fishing exists in both coastal and inland waters. October and November are excellent months to visit Florida since the weather is usually pleasant and tourist facilities are not crowded.

LADIES’ AND FAMILY PROGRAM

An information desk and hospitality room will be provided along with planned activities. Ladies may also take advantage of a number of interesting attractions and local tours in the Miami area.

ASHS TOURS

Several pre-convention tours are planned. A general 2-day tour will leave the Carillon early Friday morning (October 30) and return Saturday evening. In addition, you may choose one of the three 1-day tours on Sunday, November 1, covering areas of interest in south Florida. Tour reservations must be made before September 30. Tour reservation forms were included in the June 1970 issue of HortScience, p. 188-189. Refunds will be made on cancellations received in writing before October 10, 1970.

General Tour October 30-31 $16.00

Features: Everglades water control and conservation; vegetable and sugar cane area southeast of Lake Okeechobee; citrus production, harvesting, packing, and processing along the central...
Florida ridge; the Citrus Experiment Station; Cypress Gardens; Indian River citrus; flower and vegetable production and marketing along the southeast coast. Approximately 500 miles.

Cost includes transportation and some meals. Other meals and lodging are additional. Reservations for Friday night’s lodging will be made for you ($6.00 per person in double or $10.00 single). You will not need to check out of the Carillon during the tour but your room may be reassigned for Friday night and your luggage stored.

Gardens Tour November 1 $7.50

Features: Fairchild Tropical Garden; USDA Plant Introduction Station; Vosters Nurseries; Fantastic Gardens. Lunch is included.

Subtropical Fruit and Vegetable Tour November 1 $7.50

Features: Sub-Tropical Experiment Station; preparation of and production on the rock soils of the Homestead area; lime, avocado, mango, and vegetable production; USDA Plant Introduction Station. Lunch is included.

Everglades National Park Tour November 1 $9.00

Features: Unique plants and animals of the Florida Everglades; Orchid Jungle. Lunch is included.

HORTICULTURE IN FLORIDA

On behalf of Florida’s horticultural interests, the 1970 ASHS Local Arrangements Committee extends a cordial welcome to all horticulturists visiting Florida this year. Visitors will find many drastic changes in the State since the Society last met in Florida, in 1954. However, Horticulture has lost little of its dominating importance in the agriculture of the State.

Cash receipts from the sale of the horticultural crops listed in Table 1 amounted to $706,244,000 in 1968-69. This was about 75% of the total receipts from the sale of all crops in Florida in 1968. Florida ranked fifth among all states in the value of crops produced. Few, if any, states are as heavily dependent on horticultural crops.

Florida’s success as a horticultural state can ultimately be traced back to a single factor: relatively mild winter temperatures. It would not have been possible to develop a large subtropical fruits industry, or develop a large winter vegetable and flower production, without this one factor. The population necessary to carry on this vast horticultural enterprise would not have been attracted to the state and the profitable markets existing in north-eastern and mid-western areas could not have been exploited.

January temperatures average in the low 50’s in north Florida and in the high 60’s in south Florida. Most of peninsular Florida will have 300 or more days without killing frost, but only the Florida Keys are without record of killing frost. The mild temperatures make citrus production possible throughout the southern three-quarters of the peninsula. Conversely, 300 or more chilling hours below 45° in the northern half of the peninsula and in north Florida make possible the production of many deciduous fruit and nut crops.

Rainfall averages about 53 inches annually, and is concentrated in the summer months. However, its distribution is very irregular and all high-value horticultural crops profit from supplemental irrigation. The relatively dry weather in winter is generally beneficial to vegetable crops, giving growers better control of soil moisture levels. However, the irregular rainfall distribution introduces a constant uncertainty into the production problems facing growers.

Most Florida soils are very sandy, highly leached, and very infertile. Even the muck soils of the Zellwood and Everglades districts were very “infertile” until discovery of the role of minor elements in plant nutrition. Soil infertility was largely overcome in the 1930’s and the use of minor elements was firmly established in Florida horticultural practices by 1945.

Florida growers face numerous hazards, including major freezes at intervals of approximately 10 years; hurricanes at irregular intervals, often attended by flooding; and frequent periods of deficient rainfall. The warm temperatures and high humidity and generally frequent rains are favorable for development of insects, mites, diseases, and weeds.

Research has been a necessity and well supported under these conditions. Figure 1 shows the major crop research stations. A survey of current expenditures for horticultural research (Harris and Walker, HortScience (4): 285-287) shows Florida second among all states. Extension programs are conducted in 66 of the 67 counties of the State, and county programs are supplemented with multi-county specialists and a strong group of area and State extension specialists. All area specialists are located at branch experiment stations.

Horticultural teaching is concentrated at the University of Florida in Gainesville, which provides one of the largest teaching programs in any of the southern and southeastern states.

Some facts about specific horticultural crops are provided in Table 1. Citrus is the largest horticultural crop in Florida. Citrus groves are seen continuously on the 100 mile drive between Leesburg and Sebring (US27 from Leesburg to Haines City, then US27A from Haines City to Sebring). Florida’s total production in 1968-69 was about 8 million tons, enough to provide approximately 80 pounds of citrus fruit to every person in the United States. Most of the crop goes to the processor, with the largest single product being frozen orange concentrate. Over 92 million gallons of frozen orange concentrate were produced from 69% of the orange crop. About 32% of the grapefruit crop was processed. Well over half of the production of most other kinds of citrus fruit is marketed fresh.

Major subtropical fruits are avocados, in which Florida produces about one-quarter of the United States’ total, and mangoes, in which virtually the entire U. S. production comes from southern Florida. Small crops of guava, lychee,
Table 1. Some Facts about Horticultural Crops in Florida, 1968–69 Season

<table>
<thead>
<tr>
<th>Crop</th>
<th>Acreage</th>
<th>Production</th>
<th>Value (at Farm)</th>
<th>Harvest Season</th>
<th>Producing Area (See Fig. 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Citrus:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oranges</td>
<td>713,400</td>
<td>129.7 million boxes</td>
<td>$237,518,000</td>
<td>October 15–July 30</td>
<td>2–10 incl.</td>
</tr>
<tr>
<td>Tempeles</td>
<td>24,593</td>
<td>4.5 million boxes</td>
<td>9,791,000</td>
<td>Dec. 1–March 15</td>
<td>4,5,6,7,8</td>
</tr>
<tr>
<td>Tangerines</td>
<td>21,097</td>
<td>3.4 million boxes</td>
<td>7,762,000</td>
<td>Oct. 15–Feb. 28</td>
<td>2,3,4,5,6,7</td>
</tr>
<tr>
<td>Tangelos</td>
<td>24,253</td>
<td>1.8 million boxes</td>
<td>4,311,000</td>
<td>Oct. 1–Feb. 15</td>
<td>2,4,5,6,7,8</td>
</tr>
<tr>
<td>Murcots</td>
<td>10,647</td>
<td>1.1 million boxes</td>
<td>2,556,000</td>
<td>Jan. 15–April 15</td>
<td>2,4,5,6,7</td>
</tr>
<tr>
<td>Lemons</td>
<td>8,659</td>
<td>1.0 million boxes</td>
<td>1,375,000</td>
<td>June 15–Dec. 15</td>
<td>5,6,10</td>
</tr>
<tr>
<td>Limes</td>
<td>3,985</td>
<td>0.7 million boxes</td>
<td>2,014,000</td>
<td>June 1–March 30</td>
<td>5,10</td>
</tr>
<tr>
<td>Miscellaneous Citrus</td>
<td>4,732</td>
<td></td>
<td>5,910,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avocado</td>
<td>5,325</td>
<td>12,600 tons</td>
<td>2,986,000</td>
<td>Aug. 1–Jan. 30</td>
<td>10</td>
</tr>
<tr>
<td>Mango</td>
<td>1,525</td>
<td>194,000 bushels</td>
<td></td>
<td>May 15–Sept. 30</td>
<td>10</td>
</tr>
<tr>
<td>Peach and Nectarine</td>
<td>5,600</td>
<td></td>
<td></td>
<td>April 15–June 15</td>
<td>2,5,6,1</td>
</tr>
<tr>
<td>Tung</td>
<td>17,378</td>
<td>12,000 tons</td>
<td>780,000</td>
<td>Nov. and Dec.</td>
<td>1</td>
</tr>
<tr>
<td>Pecan</td>
<td>35,602</td>
<td>5,000,000 pounds</td>
<td>1,850,000</td>
<td>Oct.–Dec.</td>
<td></td>
</tr>
<tr>
<td><strong>Vegetables, Melons, and Strawberries:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomatoes</td>
<td>47,500</td>
<td>6,755,000 cwt.</td>
<td>81,916,000</td>
<td>Oct. 15–June 20</td>
<td>10,8,5,7</td>
</tr>
<tr>
<td>Sweet Corn</td>
<td>56,600</td>
<td>4,379,000 cwt.</td>
<td>26,726,000</td>
<td>Oct. 15–July 10</td>
<td>9,10,4,1</td>
</tr>
<tr>
<td>Celery</td>
<td>11,800</td>
<td>4,540,000 cwt.</td>
<td>25,034,000</td>
<td>Nov. 1–July 10</td>
<td>9,4</td>
</tr>
<tr>
<td>Potatoes</td>
<td>40,400</td>
<td>7,264,000 cwt.</td>
<td>22,487,000</td>
<td>Dec. 15–June 30</td>
<td>3,10,8</td>
</tr>
<tr>
<td>Peppers</td>
<td>16,700</td>
<td>1,590,000 cwt.</td>
<td>21,050,000</td>
<td>Oct. 20–June 30</td>
<td>8,10,4</td>
</tr>
<tr>
<td>Snap Beans</td>
<td>41,700</td>
<td>1,448,000 cwt.</td>
<td>17,774,000</td>
<td>Oct. 15–June 15</td>
<td>10,9</td>
</tr>
<tr>
<td>Watermelons</td>
<td>53,500</td>
<td>6,955,000 cwt.</td>
<td>17,388,000</td>
<td>March 20–July 15</td>
<td>1,2,8,5,6</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>17,000</td>
<td>1,456,000 cwt.</td>
<td>12,218,000</td>
<td>Sept. 20–June 15</td>
<td>8,5,10,4</td>
</tr>
<tr>
<td>Cabbage</td>
<td>17,600</td>
<td>4,048,000 cwt.</td>
<td>11,486,000</td>
<td>Nov. 1–May 31</td>
<td>2,3,4,10</td>
</tr>
<tr>
<td>Strawberries</td>
<td>1,600</td>
<td>160,000 cwt.</td>
<td>5,213,000</td>
<td>Dec. 15–May 15</td>
<td>5,10,2</td>
</tr>
<tr>
<td>Miscellaneous Vegetables</td>
<td>71,010</td>
<td></td>
<td>41,290,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ferns (Plumosus and Leatherleaf)</strong></td>
<td>1,750</td>
<td>8,700,000</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flowers:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gladiolus Flowers</td>
<td>8,364</td>
<td>17,905,000 dozens</td>
<td>12,713,000</td>
<td>Oct. 1–June 30</td>
<td>5,8,10,7</td>
</tr>
<tr>
<td>Chrysanthemums</td>
<td>1,950</td>
<td>620,987 cartons</td>
<td>12,913,000</td>
<td>Oct. 1–June 30</td>
<td>10,7,5,8</td>
</tr>
<tr>
<td><strong>Bulb Crops:</strong></td>
<td>1,730</td>
<td>4,100,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Foliage Plants:</strong></td>
<td>605</td>
<td>14,357,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nursery Stock:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woody Ornamentals</td>
<td>11,028</td>
<td>29,800,000</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Deciduous and Subtropical</td>
<td>707</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citrus</td>
<td>2,491</td>
<td>4,076,000 trees</td>
<td>4,280,000</td>
<td>2–10 incl.</td>
<td></td>
</tr>
<tr>
<td>Turfgrass Sod</td>
<td>17,000</td>
<td>12,000,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous Ornamental Crops</td>
<td>817</td>
<td>16,300,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>1,418,531</td>
<td>706,244,000</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

papaya, and sapodilla are produced in this area also.

Deciduous fruit crops are produced in the northern one-third of the peninsula and in north Florida. The development of new varieties of peaches and nectarines has made possible the initiation of a peach industry to supply the fresh fruit market in April and May. Pecan production is substantial and very promising for the future.

Production of vegetables, melons, and strawberries is aimed particularly at the fresh market, and a much smaller volume of these crops is processed. Planting of some crops begins in August, and a succession of crops is planted in the same or in a series of locations. This supplies a great portion of the demand for fresh vegetables in the eastern part of the United States until production is initiated in more northerly areas in the spring and summer. For some crops such as sweet corn, Florida produces virtually the entire U. S. winter supply.

Tomatoes are the most important vegetable crop
produced in Florida. Tomatoes for mature green harvest represented approximately 87% of the acreage. Vine-ripe production is under increasingly heavy competition from foreign imports and is in a declining condition. Florida dominates the shipment of snap beans, with a volume more than five times that of the next ranking state. The State Farmers’ Market at Pompano is the largest shipping point for snap beans in the United States, if not in the world. Florida also dominates the winter market supply of bell peppers, radishes, cucumbers, and cabbage. One farm on the organic soil in the Belle Glade area grows and harvests annually more celery than the State of Michigan.

Cut flowers are produced on both west and east coasts of the peninsula. Florida leads the nation in production of pompom chrysanthemums, and gladioli; is second in potted chrysanthemums; and third in standard chrysanthemums. Florida also is the leading grower of foliage plants, with over 26 million square feet in production. Value of Florida foliage sales was about 54% of the national total. Growers in the Apopka area accounted for more than two-thirds of the State value of foliage plant sales. Most of the balance was produced in southeast Florida from Palm Beach through Dade County.

Bulb crops in Table 1 include 800 acres of gladiolus for corms, and 700 acres of caladiums. Miscellaneous ornamental crops include 120 acres of chrysanthemums for rooted cuttings.

Nursery stock occupied over 14,000 acres. The large-scale nursery production of woody ornamentals of north Florida is distributed throughout the United States and into foreign countries including Mexico. Loss of citrus trees in groves due to normal causes would require production of over 2 million new citrus trees each year.

Production of turfgrass sod is a large and growing item in Florida horticulture. Acreage in parks, lawns, highway shoulders and rights-of-way, and not least of all in the hundreds of Florida golf courses, has created a large demand for this crop. Sod is harvested in all except the coldest months of the year.

Horticulturists attending the 1970 meeting may wish to see at first hand some of the developments mentioned very briefly above. Visitors are invited to contact the research stations listed with Figure 1 for appointments or for additional information about points of interest.

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**Fig. 1.** Principal Research Stations in Florida.

A. **IFAS Big Bend Horticultural Laboratory,**
   P. O. Box 539,
   Monticello, Florida 32344.
   Contact: Dr. H. W. Young

B1. **IFAS Food Science Department,**
    Food Science Laboratory,
    University of Florida,
    Gainesville, Florida 32601
    Contact: Dr. Ray A. Dennison

B2. **IFAS Fruit Crops Department,**
    1185 McCarty Hall,
    University of Florida,
    Gainesville, Florida 32601
    Contact: Dr. A. H. Krezdorn

B3. **IFAS Ornamental Horticulture Department,**
    107 Rolfs Hall, University of Florida,
    Gainesville, Florida 32601
    Contact: Dr. Tom J. Sheehan

B4. **IFAS Vegetable Crops Department,**
    303 Newell Hall, University of Florida
    Gainesville, Florida 32601
    Contact: Dr. George A. Marlowe
C. IFAS Potato Investigations Laboratory,
P. O. Box 728,
Hastings, Florida 32045
Contact: Dr. D. R. Hensel

D. IFAS Watermelon and Grape Investigations Laboratory,
P. O. Box 388,
Leesburg, Florida 32748
Contact: Dr. J. M. Crall

E. IFAS Central Florida Experiment Station,
P. O. Box 909,
Sanford, Florida 32771
Contact: Dr. J. F. Darby

F. IFAS Ridge Ornamental Laboratory,
Route 1, Box 980
Apopka, Florida 32703
Contact: Dr. Will E. Waters

G. USDA Horticultural Station,
2120 Camden Road,
Orlando, Florida 32803
Contact: Dr. W. C. Cooper

H. IFAS Citrus Experiment Station,
P. O. Box 1088,
Lake Alfred, Florida 33850.
Contact: Dr. Ivan Stewart

I. USDA Fruit and Vegetable Products Laboratory,
P. O. Box 1909,
Winter Haven, Florida 33880.
Contact: Dr. M. K. Veldhuis

J. IFAS and ESSA Weather Forecasting Service,
P. O. Box 1068,
Lakeland, Florida 33802.
Contact: Mr. Jim Georg

K. IFAS Gulf Coast Experiment Station,
P. O. Box 2125, Manatee Station,
Bradenton, Florida 33505.
Contact: Dr. James Strobel

L. IFAS Indian River Field Laboratory,
P. O. Box 248,
Fort Pierce, Florida 33450.
Contact: Dr. Mortimer Cohen

M. IFAS South Florida Field Laboratory,
P. O. Box 973,
Immokalee, Florida 33934.
Contact: Dr. Paul H. Everett

N. IFAS Everglades Experiment Station,
P. O. Drawer A,
Belle Glade, Florida 33430.
Contact: Dr. Dan W. Beardsley

O. IFAS Plantation Field Laboratory,
5305 S. W. 12th Street,
Fort Lauderdale, Florida 33314.
Contact: Dr. E. O. Burt

P. USDA Market Quality Research Division,
13601 Cutler Road,
Miami, Florida 33158.
Contact: Mr. Wm. F. Reeder

Q. IFAS Sub-Tropical Experiment Station,
18905 S. W. 280th Street,
Homestead, Florida 33030.
Contact: Dr. R. A. Conover

NOTICE - IMPORTANT
Members of ASHS who receive a copy of this Program & Abstracts Section by mail prior to the Annual Meeting are encouraged to bring it with them if they attend the meeting; otherwise, additional copies available at the meeting will cost $1.00 per copy.

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SPECIAL EVENTS AND PROGRAM HIGHLIGHTS

SOCIAL EVENTS, BREAKFASTS AND BANQUETS

Cocktail Party and Luau
A social hour will be offered in the Carillon South Lobby at 6:30 p.m. on Sunday, November 1. Admission will be by registration badge. This will be followed by a luau in the Silver Chimes Dining Room. There will be no extra charge for those on MAP meal plan. Others will pay the usual dinner check.

Committee Chairmen Breakfast
This event will occur at 7:00 a.m. on Monday, November 2, and Committee Chairmen will be advised of details in advance by President Elect Alvin L. Kenworthy.

Administrator’s Breakfast
This event is by invitation only and will occur at 7:00 a.m. on Tuesday, November 3.

Extension Horticulture Banquet
This event is scheduled for 7:00 p.m. Monday, November 2. Banquet tickets will be $6.50 each. Purchase tickets at the registration desk before noon Monday.

ASHS Banquet
The annual banquet will be Tuesday, November 3, at 6:30 p.m. in the Carillon Room. Tickets will be $8.00 each. Purchase tickets at the registration desk before 10:00 a.m. on Tuesday.

COLLEGIATE BRANCH ACTIVITIES

Sunday, November 1

8:30 p.m. COLLEGIATE BRANCH “BOOST YOUR UNIVERSITY” SLIDE SHOW will be presented at 8:30 p.m. in the Empire Room. This session is designed to allow students to share campus scenes and club activities from their own universities with fellow students from other universities.

Monday, November 2

10:00 a.m. COLLEGIATE BRANCH STUDENT PAPERS SESSION
           Dominion Room

8:00 p.m. COLLEGIATE BRANCH BUSINESS MEETING
           Imperial C

PLACEMENT SERVICE AND PRESS ROOM

The Placement Service desk will be in the Burgundy Foyer.
Members of the press should make inquiries at the Silver Chimes Conference Room.

LADIES’ HOSPITALITY ROOM

There will be a hospitality room and information center open daily in the Harlequin Room.

MEETINGS

Sunday, November 1

10:00 a.m. & BOARD OF DIRECTORS
           W. A. Frazier, Chairman
           Empire Room

Monday, November 2

4:45 p.m. AMERICAN POMOLOGICAL SOCIETY
           SUMMER MEETING
           O. A. Bradt, President
           Baroque Room

Tuesday, November 3

4:00 p.m. ASHS BUSINESS MEETING
           James M. Beattie, President
           Carillon Room

COMMITTEE MEETINGS

Saturday, October 31

9:00 a.m. & FINANCE AND EXECUTIVE
           COMMITTEES
           Dillon S. Brown and W. A. Frazier, Chairman
           Dominion Conference West

3:00 p.m. COORDINATION WITH INDUSTRY
           COMMITTEE
           W. Grierson, Chairman
           El Dorado Conference

3:00 p.m. MARKETING OF HORTICULTURAL
           CROPS COMMITTEE
           Glenn H. Sullivan, Chairman
           Imperial Board Room

3:00 p.m. PUBLIC RELATIONS COMMITTEE
           Andrew A. Duncan, Chairman
           Dominion Conference East

3:00 p.m. SCIENCE FUNDING POLICIES STUDY
           COMMITTEE
           William L. Hollis, Chairman
           Empire Room

7:30 p.m. PUBLICATIONS COMMITTEE
           R. E. Hardenburg, Chairman
           Dominion Conference East
8:30 p.m.  ENVIRONMENTAL POLLUTION COMMITTEE
           Edward J. Ryder, Chairman
           Dominion Conference West

8:30 p.m.  MEMBERSHIP COMMITTEE
           Norman F. Childers, Chairman
           El Dorado Conference

Monday, November 2
5:00 p.m.  EDUCATION COMMITTEE
           Ervin L. Denisen, Chairman
           Silver Chimes East

SPECIAL SESSIONS

Monday, November 2
8:30 a.m.  PLENARY SESSION
           Horticulture, Horticulture Everywhere
           (Joint session with the American Horticultural Society)
           Casanova Room, Deauville Hotel

Tuesday, November 3
3:30 p.m.  PLENARY SESSION
           President’s Message
           Carillon Room

DISCUSSION SESSIONS

Monday, November 2
7:30 p.m.  VEGETABLE BREEDING AND VARIETIES SESSION
           Baroque Room

GROWTH CHAMBER RESEARCH: ENVIRONMENTAL REPORTING
   REQUIREMENTS AND BASE-LINE GROWTH STUDIES
           Imperial A

POLLUTION AS RELATED TO HORTICULTURE
           Imperial B

FLORICULTURE; ORNAMENTAL AND LANDSCAPE HORTICULTURE
   SECTION COMMITTEE: DISCUSSION ON WATER RELATIONS
           El Dorado Conference

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SYMPOSIA

Monday, 9:30 a.m.

A CHALLENGE TO RESEARCH TO MEET THE FUTURE NEEDS OF INDUSTRY
Carillon Room

Monday, 1:30 p.m.

FRUIT ABSCISSION
Carillon Room

BACCALAUREATE AND NON-BACCALAUREATE PROGRAMS IN HORTICULTURAL EDUCATION
Silver Chimes East

Monday, 7:30 p.m.

FRUIT BREEDING
Empire Room

Tuesday, 9:00 a.m.

ETHYLENE
Carillon Room

Tuesday, 1:00 p.m.

THE TECHNOLOGY AND FEASIBILITY OF BULK STORAGE PROCESSING IN FRUIT AND VEGETABLE INDUSTRIES

Wednesday, 8:30 a.m.

VEGETABLE SEED QUALITY
Carillon Room

Wednesday, 1:00 p.m.

SOIL TESTING AND PLANT ANALYSIS IN AGRICULTURE
Carillon Room

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CONTRIBUTED PAPER SESSIONS

All papers are 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 that 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 slide projector for showing 2” x 2” slides will be provided. Please give your slides to the projectionist before the session begins.

CHURCHES IN MIAMI BEACH

Following is a list of churches in Miami Beach, near the Carillon Hotel, and the times for their Sunday services. These and other churches in the Miami area are also listed in the classified pages of the telephone directory.

FIRST UNITED METHODIST CHURCH
4760 Pine Tree Drive
Service at 11:00 a.m.; Bible Study at 9:00 a.m.

ALL SOULS EPISCOPAL CHURCH
4025 Pine Tree Drive
Services at 8:00, 9:15, and 11:00 a.m.

FIRST BAPTIST CHURCH (SOUTHERN BAPTIST)
2616 Sheridan Avenue
Service at 11:00 a.m.

FIRST CHURCH OF CHRIST SCIENTIST
228 89th Street (Surfside)
Service at 11:00 a.m.

FIRST PRESBYTERIAN CHURCH
7141 Indian Creek Drive
Service at 11:00 a.m.

ST. JOSEPH ROMAN CATHOLIC CHURCH
8670 Byron Avenue (Surfside)
Masses at 7:00, 8:00, 9:30, and 11:00 a.m.

CHURCH-BY-THE-SEA (CONGREGATIONAL)
501 96th Street (Bal Harbor)
Services at 9:30 and 11:00 a.m.

HISTORY AND MISSION OF THE AMERICAN SOCIETY FOR HORTICULTURE SCIENCE

Since its founding in 1903, the American Society for Horticultural Science (ASHS) has served as the professional society for horticulturists - to promote and encourage scientific research and education in horticulture within the USA and throughout the world.

Founders of the Society recognized that a scientific basis was necessary for continued progress in horticulture. They were concerned that the scientific work being done in America along horticultural lines was not fully appreciated in scientific circles because it was admixed with popular features. At the organizational meeting, the late Professor S. A. Beach made the following appeal: “Horticulture is thousands of years old and the art has been brought empirically to a high degree of development. For further progress, science is necessary . . . the objective of the Society is to give dignity and definiteness of aim to scientific work in horticulture.”

Horticultural science today embraces both the acquiring and the application of knowledge in the basic biological, physical, and social sciences (such as genetics, physiology, chemistry, physics, economics, and sociology); and, more importantly, brings such knowledge to focus on the problems and practices of breeding, propagating, production and management, harvesting, handling and storage, processing, marketing, and utilization of horticultural plants and products - fruits and nuts, vegetables, flowers, ornamental and landscape plants - for the benefit of mankind. To this end, the American Society for Horticultural Science provides leadership in national and international horticultural research and education through its meetings, its publications, and its cooperative efforts with individuals and other organizations concerned with horticulture and the related sciences.

The Society’s goals are furthered through:

I. PUBLICATIONS: Scientific and educational information is disseminated to some 3,000 members and to over 1,000 subscribers (mostly libraries) in the USA and in 90 other countries through the following publications: a) Journal of the American Society for Horticultural Science (formerly the Proceedings), issued bimonthly, containing over 200 papers per year presenting detailed results of scientific research in all phases of horticultural science; b) HortScience, issued bimonthly, containing condensed research reports, feature and review articles, annual meeting programs and abstracts of papers to be presented, symposium papers, annual listings and descriptions of new varieties of fruits and nuts and vegetables, editorials, letters-to-the editor, book reviews, personnel and news notes, placement service listings, and reports of officers, committees, regional groups, and representatives to other organizations; also, the “call for papers” and other information concerning plans for annual meetings of the Society (formerly carried in the Newsletter, which is no longer published); c) special publications, issued occasionally, such as proceedings of special conferences and colloquia; and d) a career guidance brochure, Horticulture - A Rewarding Career, of which over 30,000 copies are distributed annually to students, guidance counselors, vocational and science teachers and others in the USA and Canada.

II. MEETINGS: One national and five regional meetings are held each year at which members and invited speakers: a) present the results of scientific research in all phases of horticultural science - including genetics and breeding, physiology, nutrition, production and management practices, harvesting and handling, storage and processing, marketing and utilization; b) discuss
information and share experiences concerning undergraduate and graduate instruction and extension education in horticulture; and c) participate in tours, "corridor conferences," committee sessions, and other activities which contribute to the advancement of horticultural science, improvement of horticultural practices, and enhancement of the profession.

III. INTERDISCIPLINARY COOPERATION: The Society has representatives to and cooperates with the following organizations in matters relating to horticultural science and education: American Institute of Biological Sciences, American Association for the Advancement of Science, National Research Council-National Academy of Sciences, Agricultural Research Institute, American National Standards Institute, American Horticultural Society, International Society for Horticultural Science, National Junior Horticultural Association, Council on Pesticide Application, and Council on Soil Testing and Plant Analysis.

IV. SERVICES: A more efficient utilization of trained manpower in horticulture is made possible through the Society's recently established Placement Service; and, a Visual Aids Service is being established to handle the collection and distribution of educational color slides (35mm transparencies) as a source of visual aids for teachers, extension workers, and others engaged in educational work.

V. RECOGNITION ACTIVITIES: The Society, in cooperation with various donors, encourages high standards of professional competence and achievement in horticulture through: a) the annual presentation of up to 9 awards to the authors of outstanding research papers published in the previous year's issues of the Society's Journal and HortScience; b) the annual presentation of awards for distinguished teaching and extension work in horticulture; c) the presentation of up to 4 awards for meritorious Collegiate Branch papers presented by undergraduate students at annual meetings, and an award to the Outstanding Collegiate Branch Horticultural Club each year; and d) special recognition to ASHS members who have been selected "Fellows of the Society" each year on the basis of their noteworthy contributions in advancing the Society's objectives.

MEMBERSHIP: Since its founding in 1903 with 27 Charter Members in the USA and Canada, the Society's membership has grown to more than 3,000, including research scientists, educators, and other professional horticulturists in the USA and in 69 other countries throughout the world.

HEADQUARTERS OFFICE: Correspondence regarding membership or other ASHS matters should be directed to Cecil Blackwell, Executive Director, American Society for Horticultural Science, P.O. Box 109, St. Joseph, Michigan 49085. (See Application for Membership form below).

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APPLICATION FOR MEMBERSHIP

To: Cecil Blackwell, Executive Director
American Society for Horticultural Science
P. O. Box 109
St. Joseph, Michigan 49085, USA

I wish to become a member of the American Society for Horticultural Science, with privileges in accordance with the category of membership checked below, for which my remittance is enclosed for calendar year 19___

[ ] Active Membership .......... $ 25.00
[ ] Graduate Student Membership* .......... $12.50
[ ] Associate Membership .......... $ 8.00
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[ ] Sustaining Membership .......... $100.00

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ZIP Code ____________________________ (for USA addresses)

Employer (institution or company)

Title or Position

*Graduate Student status certified by ____________________________ (Major Professor's Signature)

**Undergraduate Student status certified by ____________________________ (Department: Chairman's Signature)

NOTE: Make checks or money orders payable (in U.S. dollars) to: American Society for Horticultural Science.
PROGRAM SCHEDULE AND ABSTRACTS

Monday Morning, November 2

(1) PLENARY SESSION

JOINT SESSION WITH THE
AMERICAN HORTICULTURAL SOCIETY
Casanova Room, Deauville Hotel

Presiding: Henry M. Cathey, USDA, Beltsville, Maryland.

8:30 Horticulture, Horticulture Everywhere. 1

Participants:

E. T. York, Jr., Provost for Agriculture, University of Florida, Gainesville.

James M. Beattie, President, American Society for Horticultural Science, and Associate Director, Ohio Agricultural Research and Development Center, Wooster.

Fred C. Galle, President, American Horticultural Society, and Director of Horticulture, Callaway Gardens, Pine Mountain, Georgia.

Bea Jones, President, Garden Writers Association of America, and Garden & Home Editor, NEWSDAY, Garden City, L.I., New York.

Louis B. Martin, President, American Association of Botanic Gardens and Arboreta, and Director, Brooklyn Botanic Garden, Brooklyn, New York.

10:00 Industry Needs in Relation to Genetics, Plant Breeding, and Variety Selection. 3

10:30 Industry Needs in Relation to Cultural Information. 4
Fred Heringer, Fruit and Vegetable Producer and Vice-President, California Farm Bureau Federation.

11:00 Industry Needs in Relation to Postharvest Horticulture. 5
A) Fresh Produce:
Leon Miller, Duda & Sons, Oviedo, Florida.

B) Processing:

11:30 What Can We Do As An Action Program? 6
Neil W. Stuart, USDA, Beltsville, Maryland.

(3) COLLEGIATE BRANCH FORUM:
STUDENT PAPERS
Dominion Room

Presiding: Leslie Hafen, Purdue University, Lafayette, Indiana

10:00 The Genetics of Salpiglossis. 7
Deutsch, James A., Purdue University, Lafayette, Indiana.

10:15 Stimulation of Lettuce Seed Germination with Electricity. 8
Dean, Bill, Washington State University, Pullman.

10:30 Soil Persistance Study of Potassium Azide as a Broad Spectrum Soil Fumigant. 9
Lineberger, R. Dan, North Carolina State University, Raleigh.

10:45 Panel Distinctions Between Waxed and Nonwaxed Apples as Affected by Film Overwraps. 10
Karony, Walter N., Michigan State University, East Lansing.

11:00 Polyaerylamide Gel Electrophoresis Analysis of Isozyme Changes in Developing Flowers of Starking 'Red Delicious' and 'Beacon' Apples. 11
Stimart, Dennis J., University of Minnesota, St. Paul.

Eight Concurrent Sessions

(2) SYMPOSIUM:
A CHALLENGE TO RESEARCH TO MEET THE FUTURE NEEDS OF INDUSTRY
Carillon Room

Sponsored by: ASHS ad hoc Committee for Coordination with Industry.

Presiding: L. L. Claypool, University of California, Davis.

9:30 Keynote Address: The Role of Tax-Supported Research Scientists in Solving Problems Associated with the Horticultural Industries. 2
John Carew, Michigan State University, East Lansing.

[29]
11:15 Evaluation of Ethrel as a Post-Bloom Thinning Material for Peaches. 12
Vodraska, J. Dale, Ohio State University, Columbus.

11:10 The Effect of Succinic Acid, 2,2-Dimethyl Hydrazide (Alar) on Size, Color, and Ripening of Six Peach Varieties. 13
Kenworthy, Robert A., Rutgers University, New Brunswick, New Jersey.

11:15 Germination of Citrus Pollen in vitro. 14
Rose, Andy, University of Florida, Gainesville.

(4) FRUIT:
GROWTH AND DEVELOPMENT
Baroque Room
Presiding: Clive W. Donoho, Jr., North Carolina State University, Raleigh.

9:30 Rootstock Effects on 'Lisbon' Lemon Yields and Fruit Quality. 15
Rodney, D. R. and Donald E. Harris, University of Arizona, Tucson.

'Lisbon' Lemon Scions (Frost Nucellar Strain) were budded onto 10 rootstocks and planted in a desert sandy soil of high pH (8.2). After 8 years in the orchard, trunk circumferences were not significantly different on the various rootstocks but yields and some fruit quality factors were affected.

Four years of data showed trees on Citrus Macrophylla rootstocks to have consistently had the highest yields. Percent acid in the juice was highest for fruit from trees on sour orange rootstocks and percent juice (by weight) was highest on 'Carrizo' cirtanges rootstocks.

9:45 A Comparison of 'Valencia' Orange Trees Carrying a Mild Strain of Exocortis with Virus-Free Trees on Five Exocortis Sensitive Rootstocks. 16

Five years' yield data and tree size of 12-year-old Valencia trees on 'Carrizo', 'Savage', 'Troyer', and 'Morton' cirtanges and on 'Rangpur' lime show that the virus carrying old line trees, although smaller in size, out-produced the virus-free trees.

10:00 Anatomy of the Budunion in Mango. 17
Soule, James, University of Florida, Gainesville.

Seedling stocks of 3 mango cultivars were chip budded at several growth stages up to one year with 'Haden' and 'Saigon' scions. Callus proliferated mainly from tissues adjacent to the cambium, with the scion firmly attached to the stock within 8 days. A cambial bridge across the union was apparent after 12 days. Misalignment of the components or lack of growth of either one resulted in continued and often extensive proliferation of callus without sign of a cambial bridge. Rate of callus proliferation was mainly a function of stock vigor, rather than stock age. Examination of the union after 6 to 8 months showed several cylinders of new tissue continuous between stock and scion and a definite circumferential shift in stock tissues toward the scion at a point directly below the original wound. Formation of the budunion in mango follows closely the general pattern in citrus and other woody plants.

10:15 Orchard Performance of M. sikkimensis, M.VII, and Western Seedlings Under Three Cultivars. 18
Cummins, James N., New York State Agricultural Experiment Station, Geneva.

Growth and production effects of apomictic seedlings of Malus sikkimensis (Arnold Arboretum strain), M.VII, and western seedling were compared. The cultivars 'McIntosh', 'Cortland', and 'Red Delicious' were used during this 18-year study.

Trees on M. sikkimensis were smaller than those on western seedling but considerably larger than those on M.VII. The M. sikkimensis stock proved extremely susceptible to drought, while M.VII seemed drought resistant. Trees on M. sikkimensis were relatively unproductive and the fruit was poorly colored and small. Trees on M.VII were highly productive of top quality fruit; no anchorage problems were encountered.

10:30 The Influence of Strains and Rootstocks on Photosynthesis, Respiration and Morphology of 'Delicious' Apple Trees. 19
Ferre, Maurice E. and John A. Barden, Virginia Polytechnic Institute, Blacksburg.

The performance of greenhouse grown container stock of young spur-type and standard 'Delicious' apple trees on seedling, MM 106 and M VII rootstocks was studied. Measurements of the net CO₂ assimilation rates (NAR) of spur-type tree leaves showed a higher trend than the NARs of standard strain leaves. Leaves of 'Delicious' trees on seedling rootstocks, however, had higher NARs than on MM 106. The leaf respiration rates were not affected by strains or rootstocks. Standard 'Delicious' trees were more vigorous than trees of the spur type. The spur-type trees had, however, a greater bark-wood ratio. Rootstocks affected both leaf size and leaf dry weight, whereas the strains did not. It was also noted that the strains responded differentially in leaf area on the 3 rootstocks.

10:45 Root Formation in in vitro Cultures of Apple Stem Tissues. 20
Cummins, James N. and W. C. Ashby, New York State Agricultural Experiment Station, Geneva, and Southern Illinois University, Carbondale.

Rhizogenesis in stem tissues of the apple rootstock cultivars M.VII and MM 106 was studied in vitro. Nodal explants taken from control plants and from plants sprayed with 186 ppm NAA (1-naphthaleneacetic acid) rooted on media containing 1 or 2 ppm NAA but not on auxin-free media. Callus cultures transferred to NAA-media produced roots, but transfers to auxin-free media did not root and survived for only a short time.

The evidence indicates that an auxin is necessary in the culture medium for both root initiation and root growth and that the presence of auxin in the medium does not suppress growth of roots once initiated.

11:00 Protein and Free Amino Acids in Roots of Three Dwarf Apple Rootstocks. 21
Lashea, Aly M. and Raymond G. Lockard, University of Kentucky, Lexington.

Biochemical analysis showed percent protein about 4 times
higher in roots of 'EM IX' and about 3 times higher in roots of 'MM 111' than in roots of 'MM 106'. This corresponds favorably with the percentage increase in fresh weight and the mean fresh weight of leaves per node of these same rootstocks. A total of 18 free amino acids were found in roots of the three rootstocks. In all cases both total free amino acids and individual free amino acids were also found at much higher concentrations in 'EM IX' and 'MM 111' roots than in roots of 'MM 106'. This accumulation of free amino acid especially in 'EM IX' may indicate a reduction in the rate of amino acid translocation in these rootstocks. This suggestion is supported by the data from experiments in which 'MM 111' was a rootstock and 'Red Delicious', 'MM 106', and 'EM IX' were intersems. Total free amino acids and most of the individual free amino acids accumulated in roots of 'MM 111' rootstock only when 'MM 106' and 'EM IX' were used as interstem but not when 'Red Delicious' was used as interstem.

11:00 Simulation of Wind Effects on Orchard Heating. 73

Gerber, John F. and J. David Martsof, Pennsylvania State University, University Park.

The influence of wind upon orchard heating for temperature modification was simulated by a numerical technique. The simulation model predicts either the quantity of heat required to produce a specified temperature or the temperature produced by a specified heat input. The model is 2-dimensional and does not account for lateral diffusion at right angles to the mean wind flow.

11:45 Mist Propagation of Vitis rotundifolia Using Hormones and Bed Heat. 24

Nesbitt, William B., Von H. Underwood and John B. Earp, North Carolina State University, Raleigh.

Softwood cuttings of Vitis rotundifolia cultivar Magnolia were taken in June and rooted under intermittent mist. A split plot design was used to test the effect of bed heat and hormones on the percent rooting and total growth of cuttings. After five weeks all cuttings that would root had rooted. Where no bed heat was used, IBA increased the percent of rooting. With 80°F constant bed heat the control produced more rooted cuttings than the treatments. By potting the rooted cuttings in six inch pots after five weeks under mist, plant size was increased.

(5) FRUIT:

ENVIRONMENT

Silver Chimes Room East


9:30 Partial Implementation of the Box Model Approach to Frost Protection. 25

Martsolf, J. David and John F. Gerber, Pennsylvania State University, University Park, and University of Florida, Gainesville.

The advection term of the box model describes this horizontal convection as the product of the time-averaged wind velocity and the time-averaged temperature integrated over the vertical facets of the box. Observations of the wind velocity using component anemometers and of the temperature using associated integrating temperature sensors are used to estimate the advection term in a small sour cherry orchard served by a pipe-line heater system. In addition, observations with net radiometers and a thermistor network deployed through the orchard are used to estimate other terms in the box model.

9:45 Energy Fluxes and Citrus Grove Heating Efficiency. 26

Bartholic, Jon F. and Raymond E. Smithey, USDA, Weslaco, Texas.

Energy sources and sinks have been determined in a citrus grove in the Lower Rio Grande Valley during radiation freeze conditions for three winters. The measurements included total incoming, solar, and net radiation; air temperatures within, above, and between the trees; leaf, trunk, and stem temperatures; soil temperatures and moisture, both under and between the trees; and wind movement. These measurements were used to calculate the radiation fluxes, soil heat flux, and the change in energy stored in the tree layer. The relative importance of nocturnal incoming thermal radiation, air temperature and movement above the grove, and soil heat flux is shown. Using these results and findings during heating experiments, the efficiency of grove heating is evaluated.

10:00 Simulation of Wind Effects on Orchard Heating. 27

Gerber, John F. and J. David Martsolf, Pennsylvania State University, University Park.

The influence of wind upon orchard heating for temperature modification was simulated by a numerical technique. The simulation model predicts either the quantity of heat required to produce a specified temperature or the temperature produced by a specified heat input. The model is 2-dimensional and does not account for lateral diffusion at right angles to the mean wind flow.
Temperature and wind profiles upwind of the orchard are generated. Wind profiles in and through the orchard are calculated from the upwind profiles tree spacing, tree height and tree shape. Temperature profiles in the orchard are computed as a function of fire size, wind speed and inversion strength.

A rapid increase in heat loss is predicted to occur at wind speeds around 150 cm/sec. Between 200 and 250 cm/sec the loss is relatively constant. Above 300 cm/sec the loss rises rapidly and nearly linearly. It soon becomes the predominant means of heat loss.

10:15 Modification of Citrus Seedling-Cold Hardiness in Artificial Climates by Chemical Sprays.

Young, Roger, USDA, Orlando, Florida.

Citrus seedlings hardened in artificial conditions were sprayed with chemicals reported to influence the cold hardiness of other plant types. Maleic hydrazide, a growth inhibitor, increased cold hardiness, but cycocel, succinic acid 2,2-dimethyl hydrazide, and abscisic acid, all growth retardants, did not. Abscisic acid, at high concentrations, reduced cold hardiness, as did gibberellic acid, a growth promoter. Benzyladenine, kinetin, decenylsuccinic acid, and 2-chloroethylphosphonic acid had little or no effect on cold hardiness. The success of a growth inhibitor and the failure of several growth retardants and growth promoters are consistent with considerable evidence that growth of citrus in the winter must stop before significant cold hardening occurs.


Unrath, C. R., North Carolina State University, Raleigh.

A low volume over-tree sprinkler irrigation system designed to apply 0.56" of water/hr was used to continuously irrigate apples when air temperature was in excess of 87°F. Air, fruit, leaf and bark temperatures were monitored at 5 min intervals. Results were compared with under-tree sprinkler irrigation and natural rainfall. Dry bulb temperature was lowered an average of only 3.5°, however fruit tissue was cooled over 12° with over-tree irrigation. Spot picking results based on color showed 25% more fruit removed in the first two weeks of harvest. All fruit was removed in 3 weekly pickings vs. 4 required for other plots. Both total and solid red color were increased by over-tree irrigation. Fruit diameter, length and L/D ratio were improved resulting in a substantial increase in fruit weight. Fruit firmness was slightly reduced, however there was no effect on storage breakdown. The pack-out yields (by box count) of graded fruit was greatly altered.


Warner, Robert M. and J. A. Crozier, University of Hawaii, Honolulu, and Cal Chemical, Fresno, California.

‘Olinda valencia’ and ‘Frost Washington’ oranges grafted on 5 rootstocks were established at 4 locations differing in elevation, rainfall and soil type. Girth measurements of scion and stock and tree size for the first 5 years indicate scion effect on size as well as scion x stock. Soil and location influences were marked. Relative vigor of ‘Rough’ lemon decreased with elevation compared to ‘Hinckley’ sweet and ‘troyer’ citrange. ‘Rubidoux’ trifoliate performed well on heavy clay soils. Tree size was smaller on Trifoliate and ‘Cleopatra’ mandarin.

11:00 Forecasting the Maturity Date of the ‘Concord’ Grape in Southwest Michigan.

Van Den Brink, Ceel and Ernest B. Williams, ESSA Weather Bureau, Michigan State University, East Lansing, and ESSA Weather Bureau, Houghton Lake, Michigan.

The time of optimum maturity of the ‘Concord’ grape in southwest Michigan can vary as much as three weeks from one season to another. Using the heat-unit or growing-degree-day approach, a technique has been developed whereby the optimum maturity (16.5% soluble solids) date of the ‘Concord’ grape can be predicted 60 days in advance, with a relatively high degree of accuracy. The forecasts are based on daily temperatures obtained in the grape-producing areas.

In ten years of predicting maturity dates, verification has been within five days in nine years out of ten. Eight years out of ten, verification was within two days.

A forecast of optimum maturity 60 days in advance gives both growers and processors adequate time for preparation of harvest.


Johnson, Timothy J. and David R. Dilley, Michigan State University, East Lansing.

Various methods of ‘Bartlett’ maturity prediction are evaluated. These methods incorporate data on early morphological, physiological and environmental changes. Events in the early growth of fruitlet and embryo are related to ultimate maturity. The ripening response of immature and mature fruit to ethylene is used to ascertain the ideal commercial harvest periods. Environmental conditions in a 50-day post-bloom period are used to predict maturity 8 to 10 weeks in advance of the harvest seasons. The environmental evaluation method yields a prediction formula that is accurate to within 5 days in most instances. The effect of chilling of the fruit on the tree in the immediate pre-harvest period is discussed as a probable cause of early maturity in relation to the long range prediction.


Facteau, Timothy J. and Shiow-ying Wang, Oregon State University, Hood River.

‘Royal Ann’ and ‘Bing’ sweet cherry trees were fumigated with 1.6, 4.5, and 24 ug F/M³ for 48 hours and allowed to recover for 7 days. Respiration rates, in both varieties, were found to vary with the concentration of fluoride in the leaf tissue. High F vegetation levels stimulated respiration whereas low leaf F levels inhibited respiration. Fluoride fumigated leaves of both varieties also had lower protein nitrogen, citric, malic, and alpha-ketoglutaric acids and higher amino nitrogen, and succinic acid levels than did control leaf tissue. The succinate/malate ratio of fumigated leaves suggests inhibition of succinic dehydrogenase. During the recovery period, the ‘Bing’ variety appeared to lose foliar F faster than did the ‘Royal Ann’ variety.

11:45 Differential Sensitivity to Water-Saturated Conditions and Cyanogenesis by Peach, Apricot and Plum Roots.

Rowe, R. N. and P. B. Catlin, Department of Agri-
MONDAY MORNING

The sensitivity of peach, apricot and plum seedlings to water-logging as influenced by temperature was measured in the greenhouse. Differences in sensitivity between peach and apricot were not clearly established but both were more sensitive than plum. The sensitivity of all three species increased with temperature between $17^\circ$ and $27^\circ$C. Hydrolysis of cyanogenic glycoside occurred in the roots of peach and plum during water-logging treatments. Considerably more hydrolysis took place in peach than in plum roots. Exposure of detached root systems of the three species to anaerobic conditions caused HCN to be released. The rate of cyanogenesis increased both with temperature and time. HCN evolution by peach roots was not different than that by apricot but was greater by both than by plum. A close association exists between differential sensitivity, glycoside hydrolysis and cyanogenesis in N$_2$. However, the latter may be secondary, though contributory, to cellular disorganization as a cause of sensitivity.

(6) VEGETABLES:
BREEDING AND GENETICS
El Dorado Room

9:45 Similar Cellular Injuries Induced by Gamma Radiation and Maleic Hydrazide in the Shoot Apex of Maize. 35
Graham, Effin T., University of Tennessee, Knoxville.

Two distinct injuries, cytoplasmic condensation and nuclear pyknosis, were observed in both irradiated and MH-treated maize seedlings. Injured cytoplasm was made visible only by RNA-selective stains, and was not revealed by protein-specific or general stains. Pyknotic nuclei were revealed by stains specific for DNA, histone or total protein, and by general stains. The cytoplasmic injury developed before nuclear pyknosis, and was characteristic of interphase cells. Cytoplasmic injury was more extensive than nuclear pyknosis in terms of the number and location of affected cells. Certain differences between treatments were observed in relation to time of development and distribution of the injuries. However, the cytoplasmic condensates displayed no differences in cytochemical properties in relation to radiation or MH treatments. Likewise, pyknotic nuclei were cytochemically similar in relation to treatment.

10:00 A Mutant Gene Causing Albinism in Solanum chacoense L. 36
Lam, Shue-Lock and H. T. Erickson, Purdue University, Lafayette, Indiana.

A lethal albino character has been observed in Solanum chacoense, a diploid potato species. This character is controlled by a single recessive gene with green (A) dominant to albino (a). The gene has been located on the long arm of the chromosome 12 in S. chacoense using trisomic analysis.

10:15 Varietal and Seed Treatment Effects on Low Temperature Seed Germination in Tomato. 37
Tigchelaar, Edward C., Purdue University, Lafayette, Indiana.

10:30 Response of Tomato to Population Pressure. 38
Fery, R. L. and Jules Janick, Purdue University, Lafayette, Indiana.

Marketable tomato yields for multiple harvests and early single harvests were found to be asymptotically related to plant population, but for mid-season and late single harvests yield peaked at a finite population. The "modified reciprocal" equation $w^{\beta} = A + Bw$, where $w = $ yield per plant, $p = $ plant population, and $\beta$, $A$ and $B$ are constants, was found to be an adequate yield-density model for tomatoes under all conditions. With a multiple harvest system square spacing was found to be superior to row spacing over a range of populations in early pickings but at the late harvests the row spacing out yielded the square because of a regrowth of the plants into the interrow space. Studies using F$_1$ hybrids indicated that heterosis for total seasonal yields is evident only at low populations, but for early yield it is found at all populations. A comparison of the effect of genes affecting vine type in 2 sets of isogenic lines indicates an heterotic effect for early yield of the dwarf locus in the heterozygous condition ($+\frac{d}{d}$) at all population levels.

10:45 Maternal and Genic-cytoplasmic Differences in Reciprocally Crossed Tomatoes. 39

A series of generations was synthesized to study reciprocal differences for 3 developmental periods, early yield and fruit size in tomatoes. A small fruited, early cultivar, 'Johnny Jumpup', and a large fruited, later cultivar, 'Bounty', were used as parents. From individual, cloned parent plants, and their reciprocal F$_1$'s, all possible first backcrosses and F$_2$ lines were derived. Maternal effects were demonstrated in BC$_1$ lines for each of 3 periods and for early yield. Genic-cytoplasmic differences were demonstrated in BC$_1$ lines for each of 3 development periods and for early yield. Earliness for each of these characters was associated with lines having common cytoplasmic recurrent parentage, over those not having common such parentage. Similarity in direction and magnitude of differences in F$_1$ and F$_2$ lines indicated that matroclinous reciprocal F$_1$ differences for the development periods and early yield were persistent through the F$_2$.

11:00 Investigation of the Probable Action of the X Locus in the Tomato. 40
Vriesenga, J. D. and Shigemi Honma, Michigan State University, East Lansing.

A probable mechanism governing the action of the X locus in the tomato was explored by studying the pollen behavior. A pollen
mixture of X bearing and x bearing pollen (1:1 by volume) was used to pollinate the x pollen parent bearing the recessive jointless pedicel (jj) marker. A 1:1 ratio of jointed to jointless was observed suggesting equal fertilization capacities of X and x bearing gametes. Excision of styles at determined times after pollination with X, x and F1 pollen resulted in lower number of fruit set and lower number of seeds set by the F1 pollen. The data suggest an interaction between the X and x gametes when produced on the F1 plant.

Pollen germination and growth characteristics were studied by observing the various pollen types grown on agar. Pollen bearing the X allele germinated more rapidly than either x or the F1 pollen. The X and x bearing pollen had a greater number of pollen tubes that were longer in length than the F1 pollen. The data again suggest a competitive advantage only when pollen bearing X and x gametes are produced on the same plant.

11:15 The Use of Asparagus Monoploids for Inbred Production. 41

Bassett, Mark J., University of Florida, Gainesville.

A recessive seedling marker was used to detect monoploids resulting from parthenogenesis among asparagus seedlings. Nine out of the 10 plants showing the marker characteristic were monoploid. The frequency of monoploidy resulting from parthenogenesis was 1 seedling among 2,400.

Colchicine treatments were applied to the monoploids obtained above to double the chromosome number to the diploid level. It was found that seedlings over 2 weeks old could not be doubled because the crown tissues were not sufficiently active.

Nitrous oxide treatments were applied to diploid female plants at various intervals after pollination to induce parthenogenesis. Nitrous oxide gas under pressure causes genetic reconstitution of the generative nucleus if applied at the proper stage of nuclear division. The seeds produced by the treated flowers were aborted.

11:30 Breeding for Root-Knot Resistance in Beans (Phaseolus vulgaris). 42

Hartmann, Richard W., University of Hawaii, Honolulu.

An F2 population from a cross of ‘Hawaiian Wonder’ (susceptible) x ‘Alabama No. 1’ (resistant) was grown in a field heavily infested with root-knot nematodes (Meloidogyne incognita). Numerous plants free of galls were obtained and there seemed to be a range of susceptibility which was not due to different rates of infection. 413 plants were graded on a scale of 0 (free of galls) to 5 (heavily galled). The observed segregation was 0—38, 1—49, 2—62, 3—43, 4—49, 5—172. F3 progeny of selected individuals grown in the same field did not reveal any major misclassification in the F2. The observed ratio could not reasonably be fitted to any sort of two-factor scheme as has previously been suggested. However, by groupings of resistant versus susceptible classes, a reasonably close fit to a three-factor scheme was obtained. Further evidence for a three-factor scheme was obtained from F2 individuals which were true-breeding for a low level of galling.

11:45 Response of Corn to Population Pressure. 43

Fery, R. L. and Jules Janick, Purdue University, Lafayette, Indiana.

The response of both corn grain or ear and total top yield to changes in plant density can be expressed by the “modified reciprocal” equation \( w = \frac{Ap + B}{p} \), where \( w \) = yield per plant, \( p \) = population, and \( A, B \) are constants. This formula, was adequate in describing the response of diverse cultivars over wide population ranges. No other proposed model tested was found to be adequate under these conditions. The parameter \( \theta \) can be estimated using \( \alpha \) from the relation \( w = \frac{\text{total top}}{\text{total} \alpha \text{ grain}} \) as \( w \) total changes with population pressure. The parameter \( \alpha \), which quantifies the relationship between grain yield and total top yield, may be useful both as a selection criteria in breeding for increased yield and as an a parameter in population and plant distribution studies.

(7) VEGETABLES:
NUTRITION
Empire Room

Presiding: C. M. Geraldson, Florida Gulf Coast Experiment Station, Bradenton.

9:45 Nitrogen, Mulch and Irrigation Effects on Eggplant Production. 44

Paterson, James W. and Norman J. Smith, Rutgers University, New Brunswick, New Jersey.

The effectiveness of nitrogen, mulch and irrigation on the production of eggplants grown on a fumigated sandy loam soil in 1969 was investigated. Total yields and individual fruit weight of eggplants grown under irrigation and mulched conditions increased as the rate of nitrogen was increased. Mulching and irrigating increased total yields of eggplants 41 percent. The mulch, a clear plastic, encouraged early plant growth and large early yields.

10:00 A Two-year Study of Pepper Production Under Varying N-K Rates and Ratios, With Plastic Mulch, Using Several Planting Patterns. 45


Peppers were grown near Ft. Lauderdale on Pompano fine sand, using 2 or 3 plant rows per bed and 2 in-the-row spacings. Similar experiments were conducted during dry and wet years. Simultaneously increasing N and K from 334 and 276 kg/ha, respectively, to 2000 and 1772, respectively, decreased total and marketable fruit yields, although US fancy yields were unaffected. In the dry year yields were better in the mulched plots; but in the year with leaching rains, the periodically side-dressed plots were better. A N:K ratio of 1:2.5 was generally superior to wider or narrower ratios in the wet year, but it did not affect yields in the dry year. Whereas the number of rows and the spacing in the row generally did not affect the yield, stripe and ghost spot incidence were affected. At constant K, increasing N reduced soil and leaf K.

10:15 Calcium and Nitrogen Accumulation in Peas and Cucumbers as Influenced by Nitrogen Nutrition. 46

Maynard, D. N. and A. V. Barker, University of Massachusetts, Amherst.

Experiments were conducted in sand culture in the greenhouse to study the relationships between Ca and N nutrition of pea (Pisum sativum L.) and cucumber (Cucumis sativus L.) plants. Peas accumulate amide-N, whereas cucumber plants are usually relatively low in amide-N. The total N concentration in shoots was a function
of the rate and source of N and of the plant species. Nitrate concentration was principally related to the proportion of NO₃-N in the nutrient solution, but also varied significantly between species. The Ca concentration in cucumber shoots increased as the NO₃-N level in the medium increased, but was unaffected in pea shoots. Ammonium nutrition decreased the Ca concentration in cucumber shoots, but did not influence the Ca concentration in pea shoots. Cucumber shoots had a higher Ca concentration than pea shoots. The results are discussed in relation to N metabolism.

10:30 Cation Nutrition of Cantaloupe as Related to pH. 47

Berry, Wade L. and L. F. Lippert, University of California, Riverside.

Cantaloupes (PMS-45) were grown in culture solutions in which the pH of the solution was controlled. Significant reduction in top growth did not occur until the pH of the culture solution was reduced below pH 4.5. If the osmotic potential of the culture solution was increased the plants were less tolerant of a low pH and yield reduction occurred at a higher pH. Symptomology appearing on plants grown in low pH solution was similar to those appearing on Mg deficient plants.

Chemical analysis of the tissues from these plants showed that the concentration of the different cations Ca, Mg, K, and Na were altered as the pH of the culture solution was lowered. Magnesium was more sensitive to these pH changes than the other cations.

10:45 Internal Necrosis of Potato Tubers — Calcium Deficiency. 48

Kelly, William C. and Jorge A. Christiansen, Cornell University, Ithaca, New York.

Internal necrosis is one of many terms used for the brown corky areas within the vascular ring of potato tubers. Varieties differ in susceptibility and there are seasonal and cultural practice effects. Withholding calcium from sand cultures when tubers were rapidly enlarging induced internal necrosis symptoms. The similarity was both macroscopic and microscopic. Therefore, occurrence in the field follows a diminished calcium supply to rapidly enlarging tubers.

11:00 Influence of Fertilizer Placement and Micronutrient Rate on Watermelon Composition and Yield. 49


 Marketable fruit weights and number of fruit were significantly increased by broadcast application of 2,000 lbs/A 6-8-8 while the number of small fruit was increased with the band fertilizer placement. Yields were influenced by interactions between micro-nutrient source and placement. At the 4 lbs/A Cu rate, yields were highest where Cu was banded; at the 8 lbs/A Cu rate, yields were highest with the broadcast placement. Yields were similar at both placements where F.T.E. 503 was applied at 30 lbs/A. But, at the 60 lbs/A rate, yields were significantly higher with the broadcast placement.

Broadcast applications of both major and micronutrients resulted in significant increases in plant stand, growth rate, and fruit yields as compared to either or both nutrients applied in a band. Broadcast fertilization resulted in significant increases in K, Zn, Mn, and P in young tissue but decreased Ca and Mg.

11:15 Strip Mulch Over Banded Fertilizer to Reduce Leaching. 50

Hayslip, Norman C. and W. W. Deen, Jr., Florida

Indian River Field Laboratory, Fort Pierce, and Florida Everglades Experiment Station, Belle Glade.

Heavy rainfall on south Florida's sandy soils causes serious leaching of fertilizers. An economical technique and strip mulch application equipment have been developed and found effective in reducing this leaching. High analyses fertilizers are banded in the bed center 2 inches deep and covered with 8” to 10” wide plastic or sealed paper strips in an inverted “U” fashion. The plant bed has a slight crown shape to promote seepage away from the fertilizer into water furrows. The crop is seeded or transplanted on one or each side of the fertilizer.

The strip mulch applicator is attached to a modified commercial bedder. This tractor mounted equipment makes possible in one operation a completed plant bed containing the season's fertilizer covered by strip mulch, and the seeded crop. Vegetable crop response has been equal to or better than standard fertilization methods and full bed cover with mulch.

11:30 Several Responses of Sweet Corn to Differential Fertilizer Treatments in Single Replication Experiments. 51

Smith, Cyril B., Pennsylvania State University, University Park.

Single replication sweet corn fertilizer experiments were carried out in 6 production areas using NK-199 compared to other hybrids. Treatments comprised 3 levels of N and K and 5 of P (each varying from 0 to 100 lbs/acre) in all combinations in split plot design and also Mg plots at 0 and 50 lbs/acre. Yields were increased significantly only at lowest rates by average of 7, 10 and 6% by applications of N, P and K at 50, 25, and 50 lbs/acre respectively. Applied N decreased vigor and delayed maturity while applied P increased vigor and hastened maturity. Increasing K increments generally gave fewer well-filled ears and restricted absorption of N, P, Ca and Mg. Even at site where severe K deficiency evident, 50 lbs/acre proved adequate. Mg treatment gave no favorable responses but restricted absorption of N, P and Ca. Hybrids showed many differences in absorption but similar responses to treatments.

(8) WOODY ORNAMENTAL:

RHODODENDRON GROWTH AND DEVELOPMENT

Presiding: R. J. Stadtherr, Louisiana State University, Baton Rouge.

9:30 Chemically Tailoring Azaleas for Greenhouse Forcing. 52

Conover, Charles A. and Jasper N. Joiner, University of Florida, Gainesville.

Effectiveness of chemical pruning agents were found to be dependent on type of plant growth as well as chemical concentration. This was due to necessity of pruning chemicals remaining on the meristematic area for a period of time to effect bud abortion. Humidity and temperature were also observed to effect drying time and therefore effectiveness of pruning chemicals.

Best application procedures for greatest growth and most uniform plants were obtained in commercial plantings when combinations of hand pruning and chemical pruning agents were used. This method produced commercially salable plants in one-half the time necessary with hand pruning alone.

Pruning and dwarfing compounds also effected number of flowers at forcing and days from cold treatment to maximum bloom.
9:45 Variations in Response of Several Cultivars of Azalea (Rhododendron sp.) to Gibberellic Acid. 53
Sydnor, T. Davis and Roy A. Larson, North Carolina State University, Raleigh.

The study was made in order to ascertain the differences in response of several commercially important cultivars of azalea (Rhododendron sp) to gibberellic acid. Several cultivars of azaleas were sprayed with gibberellic acid (GA_3) at 500 ppm at weekly intervals and at four day intervals. All plants were sprayed a total of five times. The sprayed plants were then compared to plants receiving six weeks of cold treatment at 48°F as is currently suggested for commercial growers.

The bud size and stage of development were also ascertained to determine the optimum stage for the chemical or environmental breaking of flower bud dormancy.

10:00 Influence of Photoperiod and Temperature on Shoot Development in Greenhouse Forcing Azaleas, Rhododendron cv. 54
Barrick, William E. and Kenneth C. Sanderson, Auburn University, Auburn, Alabama.

Influence of photoperiod and temperature on shoot development in azalea cultivars 'Kingfisher', 'Roadrunner', and 'Red Wing' was studied in both growth chamber and greenhouse experiments. Objectives were to determine effects of post-shearing treatments on number and length of developing shoots. Position, order, and rate of development of lateral buds after shearing were also observed. Increased photoperiods seemed to have no significant effect on number of shoots. High temperature (95°F vs 75°F) produced greatest number of shoots. Highly significant increases in shoot length occurred under both extended photoperiods and high temperature. Buds no. 1, 2, and 3 (counting from shearing point) developed uniformly in number and length. Buds no. 4, 5, and 6 developed sporadically. Ultimate shoot length was not influenced by position. Buds no. 1, 2, and 3 developed consistently at either 75°F or 65°F, while a higher percentage of buds no. 4, 5, and 6 developed at 65°F.

10:15 A Chimeral Sport of 'Red Wing' Azalea. 55
Stewart, Robert N., N. W. Stuart and S. Asen, USDA, Beltsville, Maryland.

A sport of 'Red Wing' azalea carried flowers of a distinct orange-red color in the corolla in contrast to the normal red of this cultivar. On plants forced to mid-winter bloom, the flowers of both forms were essentially single but with somewhat enlarged and identically-colored, pale-red calyces. Pigment was present only in epidermal cells of the corolla except in the area of spotting at the throat where sub-epidermal cells were also pigmented. The epidermal cells of the calyces of both forms were colorless and the pale-red color of the calyx was due to pigment in internal cells. The sport apparently resulted from a color mutation confined to the epidermal layer. The sport is a periclinal chimera with internal cells still of 'Red Wing' genotype. Thus the calyx, whose color is in the internal cells, is the same in 'Red Wing' and in the sport.

10:30 An Orange Sport of Rhododendron (Series: Azalea) X 'Red Wing' Due to the Suppression of the Synthesis of Flavonol Co-pigments. 56
Asen, Sam, R. N. Stewart and K. H. Norris, USDA, Beltsville, Maryland.

A quercetin 5-methyl ether and five quercetin glycosides were isolated from flowers of 'Red Wing' azalea but were found only in trace amounts in an orange sport of this cultivar. The anthocyanins (cyanidin glycosides) extracted from the orange and red flowers were identical, even though the absorption spectra of the intact cells differed. The absorption spectrum of the orange sport was simulated with a 10^-3 M aqueous solution of cyanidin 3,5-diglucoside at the pH of the tissue, 2.8. The absorption spectrum of 'Red Wing' was matched with cyanidin 3,5-diglucoside at the same concentration and pH, co-pigmented with the 3-rhamnoside or galactoside of quercetin.

10:45 Accelerated Flower Bud Initiation on Rhododendron Catawbiense Cultivars Using Growth Retarding Chemicals. 57
Myers, Stanley P. and Philip C. Kozel, OARDC, Wooster, Ohio.

The rhododendron has long been a showpiece in American gardens. There is adequate experimental data to suggest that it could also become a note-worhty pot plant. Various concentrations of two growth retardants—Cycoce and Phosfon—were applied to rhododendron liners at two different times. One group of plants was treated prior to the 1st flush of growth in the spring. A 2nd group of plants was treated after the 1st flush was hardened, but before the 2nd flush had begun. This was in early summer. These treatments were then divided into 3 supplementary light treatments: 1 with no supplementary light, 1 given supplementary light from potting until the 1st flush had hardened, and 1 given supplementary light until the 2nd flush had hardened. All other variables were held constant. Treatments were applied to three rhododendron cultivars. Results demonstrated that nurserymen can accelerate rhododendron flower bud initiation using growth retarding chemicals.

11:00 The Effect of Environmental Factors on the Response of Vegetative Buds of Rhododendron indicum and R. obtusum to Chemical Pinching with Methyl Esters of Fatty Acids (C-6 to C-12). 58
Brabson, William E. and Richard S. Lindstrom, Virginia Polytechnic Institute, Blacksburg.

Emulsified methyl esters of fatty acids (C_5 - C_12) were applied under various environmental conditions to azalea plants (R. indicum and R. obtusum) cv.'s. Coral Bells, Red Wing and Gloria. These chemicals induce a chemical pinch and replace the hand pinching operation. Although this operation is considered standard practice by many horticulturists, there are still scattered reports of erratic results. This study was initiated to investigate the effect of environmental factors which influence the chemical pinch.

The environmental factors under study included air movement, light intensity and temperature. There was no statistical evidence which directly related air movement to a positive pinch although there were trends which indicated differences in the effect of air movement from one to another season of the year. There were no significant differences in pinching due to light intensity. Temperature was found to be the factor for determining positive pinch. Low-temperature pre-conditioned plants were more sensitive to the pinching chemical than were plants pre-conditioned at high temperatures.

11:15 Effects of Succinic Acid 2,2-dimethyl hydrazide (Alar) and Phosphorus treatments on Rhododendron Flowering and Growth. 59
Flower bud formation and plant growth in response to phosphorus treatments and Alar sprays applied separately and in combination were studied with container and field grown rhododendrons.
Sprays of 0.75 or 1% Alar on ‘Humming Bird’ plants resulted in 5- to 15-fold increases in number of flower buds the first year. Applications the second year at 1.0 and 1.25% gave up to 5-fold increases.
Treatments that significantly increased flower initiation the second year on field grown ‘Cynthia’ plants were preplant incorporation of triple phosphate, a root drench of dilute H₃PO₄, and 2 applications of 1% Alar. Combinations of Alar and phosphorus treatments resulted in increases approximately equal to the sum of the 2 treatments applied separately. The greatest effect of Alar on growth of ‘Cynthia’ plants was a 70-80% reduction in the number of shoots in the second growth flush, following application on the first flush.

(9) FLORICULTURE:
CHRYSANTHEMUM GROWTH AND DEVELOPMENT
Imperial B
Presiding: R. A. Larson, North Carolina State University, Raleigh.

9:30 Foliar Analyses of Chrysanthemum morifolium, (cv) ‘Albatross’ and CF#2 ‘Good News’ Grown in Processed Garbage Amended Media. 60
Gogue, Jay and Kenneth C. Sanderson, Auburn University, Auburn, Alabama.

Chrysanthemums grown in processed garbage amended media often exhibit foliar injury. Foliar analyses for N, P, K, Ca, Na, Zn, Mn, Fe, Cu, B, and Al were used in two experiments on two cultivars to determine if the injury was a result of elemental toxicities or deficiencies. The per cent processed garbage varied from 16.67 – 50.00% with the media being reused in experiment 2. Foliar analyses differed in plants grown in new and reused media. Excess Zn occurred in both cultivars and in both new and reused media. ‘Albatross’ contained excess K in both media; whereas, K was excessive in ‘Good News’ only in new media. Both cultivars grown in new media contained excess B. Fe was low for both cultivars in new and reused media. Cu and Mn content was low in ‘Albatross’ grown in reused media.

9:45 Copper Deficiency in Chrysanthemum: Critical Level and Symptoms. 61
Nelson, Paul V., North Carolina State University, Raleigh.

A series of experiments was conducted with ‘Giant Betsy Ross’ chrysanthemum grown in acid washed quartz sand. The nutrient solution was buffered at an alkaline pH to induce Cu deficiency while Fe, Mn and Zn were supplied in high quantities to avoid simultaneous deficiencies. Deficiencies were monitored by tissue and analyses.
The critical level of Cu for ‘Giant Betsy Ross’ was determined to be 7 ppm. The deficiency first appears in the form of light green leaves followed by interveinal chlorosis. At this stage the green pigmentation associated with the veins occurs in a broader pattern than in the case of Fe deficiency. In the late stages of deficiency interveinal chlorosis appears followed by necrosis of leaves located immediately below the first fully expanded leaf. There is a concomitant regreening of foliage at the terminal end of the shoot which lasts for a short time. In the final step the shoot apex dies.

10:00 Effect of High Intensity Supplementary Illumination on Potted Chrysanthemum morifolium, Ram.62
Norton, Robert A. and Francis A. Mullen, Washington State University, Mt. Vernon.

In an attempt to develop an economically feasible system of supplementary artificial lighting for use in greenhouses during the winter months, several chrysanthemum cultivars were grown under various light sources, including fluorescent and mercury lamps in various combinations of duration. High intensity (400–800 fc) continuous illumination applied at the beginning of the short day period for from 7–28 days resulted in up to 11 days advancement in market maturity with a proportional increase in flower number and quality, plant height and stem diameter. Continuous illumination applied from the day of planting the cuttings for a period up to 14 days advanced maturity up to 16 days with no loss of plant or flower quality. The data suggest that continuous artificial lighting may be used to reduce or eliminate the normal long-day incandescent treatment applied to chrysanthemums during the fall, winter and spring.


Capillary watering of 4-inch and 6-inch pot chrysanthemums was shown to be an efficient and reliable method of production. Peat-lite medium was used in the studies because of its good characteristics when using capillary watering and its reproducibility. “Osmocote” (14-14-14), a resin coated slow-release fertilizer, incorporated into the peat-lite medium at rates of 10 to 13 lbs. per cubic yard of mix alleviated problems of salt “build-up” and algae growth while supplying sufficient nutrients for plant growth. Watering frequencies of 3 and 8 times per day as well as cultivar was shown to affect the nutrient status of the plants.

10:30 Chemical disbudding of Chrysanthemum morifolium. 64
Kofranek, Anton M., University of California, Davis.

Plants were sprayed with an emulsion of xylene and a surfactant to remove the lateral flower buds from the stems. Concentrations of xylene between 0.1 to 0.8 of one percent were used depending on the developmental stage of the terminal flower bud at the time of the spraying. Plants were given from 7 to 16 inductive short days before the emulsions were applied. A double application of a low concentration was most effective in removing lateral buds without serious injury to young leaves. A 3 day period between spray applications was found to be best. The cultivar ‘Princess Anne’ was used in most of these studies.

10:45 Empirical Experiments for Commercial Chrysanthemum Propagation by Meristem Culture. 65
Wenghofer, Wolfgang and Paul E. Read, University of Minnesota, St. Paul.

Research was conducted which was designed to apply aseptic meristem cultural techniques to practical production problems of chrysanthemums, particularly pathologial problems. Diseased stock plants were grown for 4 to 8 weeks at 38°C, prior to meristem excision. Improved techniques for excising meristems were developed which included the use of an inverted conical cut. Murashige
and Skoog's medium modified by addition of 1 mg/l. each of NAA and kinetin was found to be most effective and a filter paper bridge in liquid medium was demonstrated to be superior to the use of a solid agar medium. First observable growth developed within 2 days of placing the meristems on the medium and green leaves 2–3 mm long were developed within 8 days. Transplanting within 2 weeks to a medium containing 8 mg/l. kinetin and no auxin delayed development compared with meristems left on the original medium.

11:00 Levels of Rooting Cofactors in Chrysanthemum during Mist Propagation. 66


Cuttings of 2 cultivars of Chrysanthemum morifolium were analyzed for rooting cofactors during propagation under intermittent water mist. Ethanol extractions were made of lyophilized leaves, and 2 stem portions of the cuttings, and were bioassayed by the mung bean bioassay. Levels of cofactors fluctuated during the propagation period, reaching a peak just prior to root initiation. It appears that the mist plays a role in enhancing development of substances conducive to rooting.

11:15 Studies of an Ethylene Producing Compound, 2-chloroethylphosphonic Acid, and Its Effects on Chrysanthemum morifolium Ramat and Antirrhinum majus L. 67

Steere, Anthony A., Jr., and James B. Shanks, University of Maryland, College Park.

Experiments were conducted to investigate the influence of 2-chloroethylphosphonic acid (CEPA) on seed germination, root and stem growth, and flowering of chrysanthemum and snapdragon cultivars. Quantitative determinations of ethylene were made by gas chromatography to study the rate and longevity of ethylene evolution following CEPA applications to foliage or to soils.

Foliar and soil applications of 900 and 2700 ppm CEPA retarded stem length and reduced stem and root dry weights of yellow Mandala chrysanthemums and Potomac Pink snapdragons. CEPA treatments delayed chrysanthemum flowering and resulted in smaller flowers but did not influence branching. Seed germination was inhibited and hypocotyl and radicle elongation was reduced by treatment. Ethylene was detectable 42 days following foliar sprays or 77 days following soil drenches of 2700 ppm CEPA.

11:30 Effect of 2,7-Dichloro-9-hydroxy fluorene-carbolic acid-(9)-methylester (morphactin) on the growth and auxin distribution of Chrysanthemum morifolium ‘Golden Yellow Princess Anne’. 68


The growth regulator morphactin induces branching on several woody ornamental plants. Experiments on chrysanthemums showed similar results. During the winter season, when low light intensity prevails, spraying pinched chrysanthemum plants at the date of pinch with several levels of morphactin caused an increase in lateral branching. Ten parts per million gave the best results in terms of increased lateral branching without a decrease in quality attributes. Higher concentrations resulted in more lateral breaks, but the quality of the plants was reduced due to malformed leaves and flowering delay. Plants sprayed with 20 and 100 ppm were analyzed for possible differences in auxin levels due to treatment. Stem pieces one inch from the growing point were excised and examined by the agar block method for the presence of diffusible auxins. Polar transport of auxins on treated plants was either reduced or eliminated, as measured by bioassay using the wheat coleoptile, straight growth test.
(11) SYMPOSIUM:  
BACCALAUREATE AND NON-BACCALAUREATE  
PROGRAMS IN HORTICULTURAL EDUCATION  

Silver Chimes East  
Sponsored by: ASHS Education Committee  
Presiding: Ervin L. Denisen, Iowa State University, Ames.

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<tr>
<th>Time</th>
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<tr>
<td>1:00</td>
<td>Improving the Image of Horticulture Via the Non-Baccalaureate Program.</td>
<td>Hans A. Zutter, Temple University, Ambler, Pennsylvania</td>
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<tr>
<td>1:15</td>
<td>Teaching Horticulture to Non-Majors in Elementary Education and Home Economics.</td>
<td>J. Lee Taylor, Michigan State University, East Lansing.</td>
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<td>1:30</td>
<td>The Blue-Collar Worker in Horticulture.</td>
<td>Wesley P. Judkins, Virginia Polytechnic Institute, Blacksburg.</td>
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<td>1:45</td>
<td>Discussion</td>
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<td>2:30</td>
<td>Occupational Opportunities in Horticulture for Urban Youth and Related Instruction in Public Schools.</td>
<td>Ronald Regan, Supervisor, Agricultural Education, Los Angeles City Schools, California.</td>
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<tr>
<td>2:45</td>
<td>Transition from Traditional “Vo-Ag” to “Vo-Agri Business” and “Vo-Hort” in the Mid-West.</td>
<td>Alan A. Kahler, Iowa State University, Ames.</td>
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<td>3:00</td>
<td>Recess</td>
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MONDAY AFTERNOON

(12) FRUIT:  
GROWTH AND DEVELOPMENT  

Baroque Room  
Presiding: L. D. Tukey, Pennsylvania State University, University Park.

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<tr>
<td>3:30</td>
<td>Management Program in Processing (Fruit and Vegetable).</td>
<td>Clyde C. Singletary, Mississippi State University, State College.</td>
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<td>3:45</td>
<td>Technical Education Centers in South Carolina.</td>
<td>T. L. Seen, Clemson University, Clemson, South Carolina.</td>
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<tr>
<td>4:00</td>
<td>Fitting Junior College Transferees into Baccalaureate Programs in Horticulture.</td>
<td>Jasper N. Joiner, University of Florida, Gainesville.</td>
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<td>4:15</td>
<td>Role of Amateurs in Horticultural Education.</td>
<td>Fred Widmoyer, New Mexico State University, Las Cruces.</td>
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<td>4:30</td>
<td>Undergraduate Students As Teaching Assistants.</td>
<td>Edwin D. Carpenter, University of Connecticut, Storrs.</td>
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<td>4:45</td>
<td>Discussion</td>
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<td>5:00</td>
<td>Adjourn for Education Committee Meeting (open to all interested persons).</td>
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Both mature ‘Delicious’ and ‘Golden Delicious’ apple trees on EM II rootstock were treated with N-dimethylaminosuccinic acid (DMAS) at 1000 ppm as a foliar dilute aqueous spray at 30 days after full bloom to determine the effect of treatment on mechanical properties and enlargement of developing apple fruits. Mechanical properties measured were force to bio-yield, or point of initial bruising, and force to rupture. DMAS treatment did not affect the rate of enlargement or the harvest size of tagged ‘Delicious’ and ‘Golden Delicious’ apple fruits. However, the treatment did cause the development of a significant increase in fruit resistance to bruising and rupture injuries in the ‘Delicious’. Such responses were not found for the ‘Golden Delicious’. The onset of increased resistance to bruising injuries in ‘Delicious’ by DMAS occurred before that of increased resistance to rupture injury.
1:15 Effects of Gibberellins and 6-Benzyladenine on the Shape and Fruit Set of ‘Red Delicious’ Apples. 89
Stembridge, G. E. and Marvin S. Cely, Clemson University, Clemson, South Carolina.

Growth regulator sprays were applied to mature ‘Red Delicious’ trees in mid-June and mid-August. Gibberellins A4 + A7 (GA4+7), but not GA3, increased the fruit length-diameter (L/D) when applied during bloom. Postbloom sprays were less effective, and gibberellin applications at 3 weeks after bloom or later had no significant effect on fruit shape.

A cytokinin, 6-benzyladenine (BA), also increased the fruit L/D ratio when applied during bloom. Combinations of BA and GA4+7 produced elongated fruits with prominent calyx lobes. Although BA apparently delayed fruit drop, neither BA nor GA4+7 significantly altered the final fruit set. None of the treatments had any apparent effect on vegetative growth or fruit quality.

1:30 The Response of ‘McIntosh’ Apples to Successive Annual Applications of Succinic Acid 2,2-Dimethylhydrazide. 90
Southwick, F. W. and William J. Lord, University of Massachusetts, Amherst.

Annual sprays of Aral for five successive years (1965 through 1969) were applied to the same ‘McIntosh’ trees at rates ranging from 500 to 4000 ppm during the period from mid-June to mid-August. During the first four years Aral had no significant influence on total yield, although previous Aral treatments induced a heavier fruit set in 1968. The greater fruit set on Aral treated trees in 1968 inhibited cropping in 1969 and yields were significantly reduced.

In 1968, 500 ppm Aral applied in mid-June was inadequate for preharvest drop control. The same concentration applied in mid-July or mid-August, 1969, gave drop control until October. Treatments at 1000 to 2000 ppm in 1969 were still inhibiting fruit abscission in mid-October when over 99 per cent of the fruit had fallen from the control trees.

1:45 Effects of Annual Sprays of Aral on the Performance of Young ‘Delicious’ Apple Trees. 91
Lord, William J., University of Massachusetts, Amherst.

Five consecutive annual applications of succinic acid 2,2-dimethylhydrazide (Aral) were applied, commencing with 2-year-old trees, in mid-July or mid-August at rates of 1000, 2000 or 4000 ppm. Other trees in the same block received 2 consecutive annual applications of 500 or 1000 ppm Aral in mid-June (approximately 1 month after bloom) or mid-July.

None of the Aral treatments had an effect on trunk circumference increase, amount of bloom or fruit set. There was no terminal growth suppression of practical significance.

All concentrations of Aral reduced fruit size, reduced rate of flesh softening at harvest and delayed the development of water core. Both the previous season’s and current season’s Aral treatments suppressed fruit size.

2:00 The Influence of Gibberellins and Cytokinin on the Shape and Quality of ‘Delicious’ Apples. 92
Unrath, C. R., North Carolina State University, Raleigh.

50, 100 and 200 ppm of both Gibberellin A4A7 and a Cytokin
Dostal, Purdue University, Lafayette, Indiana.

The influences of succinic acid 2,2-dimethyl hydrazide (Alar), Alar analogues, gibberellic acid (GA\(_3\)), and 2-chloroethylphosphonic acid (CEPA) on peach fruit growth and maturation were investigated. Experiments were designed to determine the optimum dosage of Alar required to hasten maturity in relation to the physiological stages of fruit development, to evaluate Alar analogues and other growth regulators as to their ability to hasten maturity, and to alter the fruit growth curve with CEPA.

Alar applications hastened the maturity of peach fruit when trees were sprayed during stages I, II, and III of fruit growth. The greatest hastening of fruit maturity was evident with high concentrations of Alar (4000 and 8000 ppm) applied between the mid-point and the end of stage I. The optimum concentration during stage II for hastening maturity was at 1000 ppm. Applications of Alar in stage III hastened fruit color development and delayed fruit softening. Five of six Alar analogues were effective in hastening fruit maturation when applied in the first half of stage II.

3:30 Effect of Alar and CEPA on Peach Growth and Maturation.
Dostal, Herbert C., Ross E. Byers and Frank H. Emerson, Purdue University, Lafayette, Indiana.

CEPA hastened the occurrence of the rapid rate of growth (stage III) of peach fruits when applied during stage II. CEPA hastened peach fruit ripening, and combinations of CEPA plus Alar were additive in their effect on hastening maturity. CEPA applied to peach trees during stage I of fruit growth did not hasten fruit ripening. CEPA applied later during stage II had a greater effect on the hastening of maturity.

3:45 Effects of Alar on Peach and Nectarine Condition at Harvest.
Mattus, George E., Virginia Polytechnic Institute, Blacksburg.

Alar at 1000 or 2000 ppm applied before pit hardening stimulated ripening of peaches and nectarines. Alar hastened red and yellow skin coloring, fruit softening, and flesh color. Picked at a comparable stage of ripeness, Alar resulted in a slight reduction in fruit size, fruit weight, and soluble solids.

4:00 Effect of Alar on Vegetative Growth, and on Fruit Color, Quality and Size of ‘Montmorency’ Tart Cherry.
Tehrani, Ghassem, Horticultural Research Institute of Ontario, Vineland Station, Ontario, Canada.

Cherries treated with 2000 and 3000 ppm of Alar in 1968 and 1969, produced redder fruits at full maturity than the control. When trees treated in 1968 were sprayed with the same concentration of Alar for the second successive year; the fruit color was similar to the controls and to trees which received only 4000 ppm in 1968.

After one and two years treatment, PH and total soluble solids of cherries were unchanged at full maturity. However, total acidity was reduced.

Fruit size and range of sizes were unaffected by one year's treatment. Application of Alar for two consecutive years reduced size of fruit and increased its variability.

The internode length of current season's shoots was reduced in trees sprayed with 2000 and 3000 ppm Alar for one or two years. At full maturity the % of treated cherries with 400 g and higher fruit retention force was lower than the control.

4:15 Preliminary Studies of Vegetative Growth and Fruit Color, Quality and Size of ‘Montmorency’ Tart Cherry Following Combined Application of Alar and GA\(_3\).
Tehrani, Ghassem, Horticultural Research Institute of Ontario, Vineland Station, Ontario, Canada.

Cherries were sprayed with 3000 ppm Alar, combined with 80, 120 or 160 ppm GA\(_3\) and data recorded 35, 41, 51 and 59 days later. At 35 days, both the color and size of cherries receiving Alar with 120 or 160 ppm GA\(_3\) were poorer than the control. At full maturity (59 days) no difference between the various treatments, was observed in total anthocyanin, PH, total acidity or total soluble solids.

Trees receiving Alar and 160 ppm GA\(_3\) had a lower percentage of cherries in medium size range (19–21 mm) diameter. No effect was observed on length of internodes or current season's shoots. The effect of Alar at 3000 ppm was nullified by GA\(_3\) concentrations reported.

Both Alar and sour cherry yellows virus promote flower bud initiation at the expense of vegetative buds. The possible detrimental effects of Alar alone on virus-infected trees are discussed.

Warren, James M., Charles M. Mainland and Walter E. Ballinger, North Carolina State University, Raleigh.

Ethrel was applied at 2, 4, and 8 thousand ppm as a fruit dip at six levels of blueberry development to determine the effect upon fruit ripening. Applications made at the end of stage 2 produced berries that ripened first. For applications made during or at the end of stage 2, an increase in concentration caused the fruit to ripen earlier. Application of Ethrel early in stage 2 produced less effect than application late in stage 2. Applications made during stage 3 caused fruit to ripen slightly earlier than nontreated fruit but there was no difference between concentrations. Berry size decreased with each increase in concentration at each time of application. Time of application had no effect upon berry size.


Tomatoes inoculated with soft rot bacteria and held 6 days at 55°F kept significantly better in an atmosphere with 1/4 or 3% O\(_2\) and 5% CO\(_2\) than in air. An atmosphere containing 5% O\(_2\) and 5% CO\(_2\) was no better than air in inhibiting decay development. Red fruits showed significantly less decay than fruits of any other color. Pink fruits kept as well as breaking fruits, and better than green fruits. Decay lesions were smallest on fruits stored in 1/4% O\(_2\) and 5%
CO₂, and smaller on fruits stored in 3% O₂ and 5% CO₂ than on those stored in air. Lesions on red fruits were significantly smaller than lesions on green, breaking, or pink fruits. In other tests, red and green tomatoes held in 3% O₂ and 5% CO₂ or in air, for 8 days after inoculation developed less decay at 45⁰ than at 55⁰ or 65⁰. The low-O₂ atmosphere was most effective in reducing decay at 55⁰.

1:30 Viscoelastic Properties of Irradiated Floradel Tomatoes.


Floradel tomatoes at the breaker stage were irradiated with doses of 0, 150 and 300 Krad of 137Cs gamma rays and ripened at 20°C and 90% R. H. for periods up to 7 days.

Maximum penetration forces of tomato slices were reduced and occurred at shallower depths for the irradiated as well as the ripened fruit. Compression tests of whole fruit indicated that they softened due to irradiation and ripening. Softening due to ripening was more pronounced than that caused by irradiation. Changes in softening occurred at varied rates for the different irradiation doses and ripening periods. Organoleptic evaluation of softness of tomato fruit followed similar patterns to those of the objective measurements. Cyclic loading tests showed that both irradiated and ripened fruit were less capable of recovering from applied stresses.

1:45 Carbon Dioxide Injury and Market Quality of Lettuce Held in Controlled Atmospheres.


Storage atmospheres with increased levels of CO₂ caused a physiological injury to lettuce almost identical to the brown stain observed previously in retail shipments of lettuce in which CO₂ concentrations exceeded 2% at destination. Carbon dioxide injury, or brown stain, was not always evident immediately after the lettuce was removed from the controlled atmosphere in which it had been held for 7 days at 38⁰ F, but became more evident during a subsequent 4 days at 50⁰ in normal air. About 16% of the heads held at 2-1/2% CO₂ developed brown stain while 38% and 86% of the heads developed the disorder in lots held at 5% and 10% CO₂, respectively. Lowering the O₂ level to 3% increased the susceptibility of lettuce to CO₂ injury. Decay, pink rib and tipburn were not significantly influenced by the O₂ or CO₂ level.

2:00 Texture of Watermelon Flesh as Influenced by Hydration and Dehydration.

Showalter, R. K., University of Florida, Gainesville.

Flesh breakage is an important factor in marketing watermelons. Increasing the water content of flesh samples markedly reduced their maximum deformation and amount of force required for breakage. Changes in texture of flesh cylinders were measured with commercial instruments with force applied at a rate of 0.5 inch per minute.

After water was added to the flesh by vacuum infiltration, the flesh could be deformed only about two-thirds as far as untreated flesh without breakage. When the moisture content of samples from the same melons was decreased by osmotic dehydration, the deformation before breakage increased significantly. These results indicate that hydration of watermelon flesh influences resistance to breakage as determined by deformation and force measurements.

2:15 Alkaloid Toxicology of Solanum tuberosum.


Four potato tuber cultivars from New York and 12 cultivars or breeding lines from Florida were analyzed for alkaloid (solanine) content. About 95% of the alkaloid is contained in the peel. Solanine was lethal to white experimental rats. The LD₅₀ for stomach tube administration was 59 mg. of solanine per 100 gram of rat, and intraperitoneal injection administration was 7.5 mg. of solanine per 100 grams of rat.

Growth rate of rats was suppressed when fed on a diet containing 200 mg. of solanine per 100 grams of food.

Post mortem examinations of rats showed that lesions, which are suggestive of chemical toxins, were not present. The examination failed to reveal the cause of death of rats poisoned by solanine.

2:30 Fiber Content of Asparagus.

Hermer, Robert C., Michigan State University, East Lansing.

The relationship between temperature, asparagus spear diameter and spear length on crude fiber development was investigated. Crude fiber content, as determined by the blender method, was much higher on a percentage basis in small diameter spears (less than 3/8 inch) as compared to that in large diameter spears (1/2 to 5/8 inches). The amount of crude fiber was greatly influenced by weather conditions, primarily temperature, which resulted in nearly four times as much fiber when the temperatures were cold prior to harvest as compared to warm temperatures. Attempts to separate effects of temperature on growth and fiber development will be described.

2:45 Some Factors Associated with Chilling Injury in Four Varieties of Stored Sweet Potatoes.

Marr, Charles W. and Homer D. Swingle, University of Tennessee, Knoxville.

Four sweet potato varieties were stored at 35⁰ 45⁰ & 55⁰ F for weekly storage periods up to 6 weeks. Both cured & non cured roots were studied. Roots were evaluated for visual symptoms of chilling injury. Measurements of several physical & biochemical factors associated with chilling injury were made and will be discussed.

3:00 Recess

3:15 Phenolic Acids in Sweet Potatoes.

McCombs, C. L. and Daniel T. Pope, North Carolina State University, Raleigh.

Six varieties of sweet potatoes were analyzed for total phenolic acid content at harvest, immediately after curing, and at two storage withdrawals. Determinations were made on the peel, cambial zone, and interior parenchyma tissues. Developed paper chromatograms of extracts of these tissues exhibited a number of fluorescing spots which gave positive reaction with various phenol detecting reagents. Poly-phenol oxidase activity of extracts of aceton powders of these tissues was determined spectrophotometrically using caffeic acid as a substrate. Electrophoretic separation of the proteins or these extracts using a citrate-borate buffer system with an initial pH of 9.0, followed by incubation in DOPA (3,4 DL-dihydroxy phenylalanine) revealed as many as nine isozymes. The changes in these values with time will be presented.
3:30 Polymethylgalacturonase Activity in Tomato Fruits.  

Hall, Chesley B., University of Florida, Gainesville.

Evidence will be presented for the presence of polymethylgalacturonase activity in tomato fruit based on substrate, pH response, absence of pectin, transeliminase and pectinesterase, and differential levels with regard to polygalacturonase activity.

3:45 The Influence of Certain Growth Regulators on Pectolytic Enzymes in Tomato Fruits.  


The activities of pectolytic enzymes isolated from tomato fruits were determined during ripening following 30 minute immersion of mature green fruits in certain growth regulators.

Fruits treated with certain regulators had little or no pectolytic activity for as long as 5 days after color inception at the stalar end. Other treatments delayed the appearance of pectolytic activity. Firmness and color measurements were also taken on the individual fruits assayed for enzymes.

4:00 The Effect of Temperature on Sorption of Organic Molecules by Isolated Tomato Fruit Cuticle.  

Morse, Ronald and Martin J. Bukovac, Michigan State University, East Lansing.

The effect of Temperature on sorption of methylene blue (cationic dye), 2,4-dichlorophenoxycetic acid (2,4-D) at pH 0.8 (undissociated) and 2,4-D at pH 5.8 (dissociated) was established by determining sorption isotherms at 5, 15 and 25°C. Linear isotherms were obtained for 2,4-D acid with higher temperatures resulting in decreased sorption. Methylene blue and 2,4-D anion sorbates produced classical Langmuir isotherms, however, increasing the temperature enhanced sorption. Calculations derived from the Langmuir isotherms established that enhanced methylene blue and 2,4-D anion sorption at higher temperatures was associated with an increased "effective" sorptive area. Higher temperatures did not enhance 2,4-D acid sorption. These data support the hypothesis that there are two different pathways or mechanisms of sorption of organic molecules by the cuticle. The results will be discussed in relation to penetration of growth regulators and pesticides through plant cuticle.

4:15 The Effect of Pre-Harvest Treatments on Air Cracking in Sweet Potatoes.  

Swingle, Homer D. and Charles W. Marr, University of Tennessee, Knoxville.

The tendency of sweet potatoes to crack when exposed to the air at digging time was studied in NC-212 sweet potato breeding line for two growing seasons. Yields were not significantly influenced by preharvest treatments. The percent cracked roots was reduced by certain preharvest treatments. Soil moisture appeared to be related to the degree of air cracking.

4:30 Changes in Soluble Solids, Red Pigment, and Texture of Table Beet Cultivars.  


Cultivar differences and changes with growing time in three quality attributes of table beets were measured during two seasons. There were highly significant cultivar differences in soluble solids in 1969 and there were significant changes in soluble solids with growing time during both seasons. There were highly significant differences in red pigment among cultivars and a pronounced decrease in this factor with increasing growing time. Texture or firmness of the processed product increased greatly with increasing growing time and there were highly significant cultivar differences.

All three quality attributes varied with root size. Soluble solids and red pigment were higher in small roots (1 to 1½ inches) compared with larger roots (1¾ to 2½ inches) while the opposite was true of texture.

(14) VEGETABLES: GROWTH REGULATORS  

El Dorado Room

Presiding: H. J. Hopen, University of Illinois, Urbana.

1:00 The Effect of Alar on Plant Competition and Tomato Yield.  


Tomato seedlings, cv. Heinz 1370, were treated with Alar-85 (0, 2500 and 5000 ppm) at the 2nd true leaf stage prior to transplanting. Forty days after field transplanting a second group of plants was treated with the same Alar rates when the 2nd flower cluster was at anthesis. Plants in each of the 6 treatments were planted in plant populations of 17,424, 8,712 and 4,356 per acre. Alar applied in the seedling stage had no significant effect on the time of flowering, fruit set, number of marketable fruit per plant and marketable yield per acre. Alar applied at the flowering stage caused a reduction in the number of marketable fruit produced per plant from 26.5 to 19.0 to 15.1 at 0, 2500 and 5000 ppm, respectively. Plants treated with 2500 and 5000 ppm Alar at this stage produced 27 and 42% fewer marketable fruit per acre, respectively. The time or rate of Alar application had no effect on fruit size. Plants grown at the 3 population densities did not differ significantly in their yield response to the rate of Alar application.

1:15 The Influence of Four Growth Substances on ‘SMR 58’ Pickling Cucumbers.  

Tompkins, Daniel R., University of Arkansas, Fayetteville.

Foliar sprays of Alar, Ethrel, GA plus NAA, and Ethrel plus GA were applied in 1969 to plants growing in the field. Plants treated with 62 ppm of Ethrel produced more fruit than untreated plants. Yields tended to be higher, also. More misshapen cucumbers were produced by plants treated with 125 and 250 ppm of Ethrel. However, the addition of GA to the treatment tended to reduce the number of misshapen fruit. Cucumbers from many of the treatments were as firm as cucumbers from the check treatment.

1:30 Chemical Regulation of Flowering, Fruiting And Yield Distribution in Cucumber and Squash.  

Abdel-Rahman, Mohamed and B. D. Thompson, University of Florida, Gainesville.

Maleic hydrazide (MH) naphthaleneacetic acid (NAA) and triiodobenzoic acid (TIBA) modified both vegetative and reproductive growth of squash and cucumber plants. They reduced vegetative
growth, increased pistillate and reduced staminate flower production. Early and total yields of plants were increased by MH at 100 ppm. Both NAA and TIBA tended to concentrate production into a shorter harvest period.

1:45 Uniformity of Flowering and Fruiting in Squash in Response to Plant Density and Ethrel Treatments.

Abdel-Rahman, Mohamed and B. D. Thompson, University of Florida, Gainesville.

Ethrel (2-Chloroethylphosphonic acid) and plant density modified flowering and fruiting habits of squash (Cucurbita pepo, cultivar: Yellow straightneck). A concentration of 300 ppm of ethrel was more effective in inducing a concentrated yield than 100 or 500 ppm. A plant density of 5.0 sq. ft./plant resulted in higher yields at a single harvest than 2.5, 10.0 or 15.0 square feet.

2:00 Increasing Pickling Cucumber Yields with New Growth Regulating Chemicals.

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

Use of Ethrel (2-chloroethylphosphonic acid), Alar (succinic acid, 2,2-dimethylhydrazide) and other chemicals to modify sex expression in monoecious cucumbers has been widely reported. However, in recent research, two newer chemicals have been found to change the growth and flowering patterns of plants of 'NK 805', a gynoecious pickling cucumber variety. NIA 10637 (Ethyl hydrogen 1-propylphosphonate) and MBR 6033 treatments caused increases in marketable fruit number per plant of 15-25% in field research trials on Minnesota sandy soils. These increases were achieved with foliar sprays of 250 ppm NIA 10637 and 25 ppm MBR 6033 applied at the 5-6 true leaf stage. Fruit number increases were attributed to the development of a larger number of marketable fruits per node. Implications for mechanized harvest of high-population plantings are obvious, but further investigation is required.

2:15 Effect of Ethrel on Fruit Ripening of Canning Tomatoes.


During the 1969 tomato season in California a series of field trials were conducted to study further the use of Ethrel on fruit ripening of canning tomatoes. A field of direct-seeded tomatoes (variety VF 145-88) in the Palo Verde Valley was used for the experiment. The treatments consisted of the following: Five rates of application as expressed in pounds per acre of actual material – ACP 68-240 Ethrel (0.21, 0.42, 0.83, 1.66, and control); two volumes of spray in gallons per acre (100 and 300); four times of application as percent red and pink fruit (1%, 11%, 24%, and 37%); and six harvests in number of days after treatment or application (6, 9, 12, 15, 18, and 21).

The highest significant yield of ripe fruit and dollar value per acre was obtained at the 0.21 pounds of Ethrel rate applied when 24% of the fruit was red and pink and harvested 18 days after treatment application. Both earliness and uniformity in maturity was obtained. Earlier harvest may be obtained with application rates of 0.42 and 0.83 pounds per acre applied when 1 to 11 percent of the fruits are red and pink.
3:30 Morphactin: An Exciting Growth Regulator for the Study of Tomato Flower Development. 124

Sixty-five day old seedlings (10 true leaves) of the indeterminant greenhouse tomato cultivar WR 25 were sprayed with a morphactin (Bay 102614; 0, 1, 10, 100, 1000 ppm). No abnormal morphological changes were observed in plants treated with 0 (control) or 1 ppm. Higher concentrations resulted in stem bending and leaf blight. With 100 ppm the 1st through 3rd clusters were formed but remained minute and non-functional. Instead abnormal flower clusters were formed in leaf axils in the place of vegetative axillary shoots. Vegetative growth of the main axis ceased at the 16th node with the formation of a terminal fasciated flower cluster. Plants treated with 1000 ppm were distorted and had no normal flowers. All leaf axils produced abnormal flower structures devoid of sepals and petals but with many stamen – and pistil-like parts complete with pollen.

3:45 The Response of Dwarf and Tall Tomato Plants to Applied Gibberellin With and Without Indoleacetic Acid. 125
Grunwald, C. and Raymond G. Lockard, University of Kentucky, Lexington.

GA3 or GA4+7 was applied to the tip of 14 to 25 day old dwarf or tall tomato plants either alone or in combination with IAA at 10^-4 or 10^-3 molar. Measurements were taken at 7 and 14 days after treatment. The dwarf plants gave the maximum response at 100 ug/ml of GA. The tall 3 gave the maximum response at 1000 ug/ml of GA. Response of all plants to GA3 was similar but the tall plants responded far more to GA4+7 than did the dwarfs (220% for the tall compared to 50% for the dwarfs when compared with their controls). GA3 in the presence of IAA at 10^-3 molar increased plant growth over GA3 alone on tall plants but not on dwarf plants. This effect did not occur when GA4+7 was used. With the exception noted above IAA at either 10^-4 or 10^-3 molar resulted in less plant growth.

4:00 Penetration of Nitrofen and Its Effect Upon Cell Permeability. 126
Pereira, Jose F., Walter E. Splittstoesser and Herbert J. Hopen, University of Illinois, Urbana.

Leaf applied nitrofen produced severe contact burning of the leaves of `Rio Verde` cabbage while `Hybelle` had little damage below 7 kg/ha. `Rio Verde` plants grown under conditions favoring cuticle deposition were more tolerant and tolerance increased with age. `Hybelle` plants were susceptible to nitrofen if the cuticle was rubbed off, showing a toxicity similar to that shown by `Rio Verde` plants. The application of 5% sucrose to either leaf surface with or 1 day before nitrofen application prevented the injury symptoms in both cultivars. The germination of both cultivars was reduced 85% by 7 kg/ha nitrofen when grown in solution culture. Nitrofen enhanced the permeability of red beet sections. This effect was overcome by sucrose or mannitol. The results suggest that the variability of cabbage cultivars to nitrofen toxicity was due to penetration of nitrofen and that the primary action of nitrofen is upon cell membrane permeability.

4:15 Reduction of Adventitious Root Formation on Sweet Potato, Ipomoea batatas, Vines. 127
Robbins, M. LeRon and Lewis E. Peterson, Iowa State University, Ames.

Dacthal (2,3,5,6-tetrachloroterephthalate), in addition to effectively controlling weeds in sweet potatoes, reduced adventitious root formation on runner vines, prevented fibrous root formation on crown stems, and caused enlargement of crown stems. Runners of plants in Dacthal-treated soil rooted down less, making harvesting the crop easier.
was most effective from the time the flower began to enlarge until pollination occurred. Addition of fatty acid esters increased the effectiveness of Ethrel. This effect was partially an effect of the surfactant. Retardation of vegetative growth was noted, but growth distortion was not.

1:45  The Effect of New Plant Growth Retardants on the Vegetative Growth of Silver Maple and Green Ash.  

The vegetative growth of trees beneath or near electrical power lines is a continuous problem for utility companies and a source of considerable expense to cities. Periodic pruning of such trees is essential in order to prevent tree branching from disrupting electrical service.

In 1969, and again in 1970 several new growth retarding chemicals were tested to determine their effectiveness in preventing regrowth of trees following pruning. Several new chemicals demonstrated excellent results and appear to have wide commercial adaptation.

2:00  IAA Oxidase Activity in Juvenile and Adult Hedera helix Tissue.  
Smith, Richard J. and Wesley P. Hackett, Univ. of California, Davis.

IAA oxidase activity was followed by sterile incubation of thin stem slices of juvenile and adult phases of Hedera helix in a pH 6.0-phosphate buffer with Mn** and IAA-1-C14 (specific activity 7.2 x 10** uc/mm). Addition of the monophenol 2,4 dichlorophenol was not essential for activity as measured by the amount of C14O2 trapped; addition of catechol inhibited IAA destruction. IAA destruction occurred in the tissue, not in the medium, and rates increased with time when fresh media was supplied daily for at least 5 days.

2:15  Evidence for a Non-mobile Component Regulating Root Initiation.  
Frenkel, Chaim, Charles E. Hess and Victor Corona, Rutgers University, New Brunswick, New Jersey.

Root initiation is regulated by mobile compounds which are synthesized in the leaves and buds and are translocated to the base of the cutting. The mobile compounds include auxins, phenolic compounds, sugars, and amino acids. In addition to the mobile compounds there is evidence that a non-mobile component may also limit root initiation. Evidence for the non-mobile component can be obtained from reciprocal grafts between easy- and difficult-to-root cuttings.

Proteins are prime candidates for the non-mobile component. To determine the role of proteins in root initiation, protein extracts were obtained periodically from hypocotyls of mung bean explants incubated in water or a solution of IAA and catechol. A general protein stain following gel electrophoresis revealed the appearance of a new protein just prior to root initiation. Incubation with selective substrates showed the presence of several new isozymes of polyphenol oxidase, peroxidase, and IAA-oxidase. A marked reinforcement of the isozymes occurring when the cuttings were supplied with IAA and catechol.

2:30  Comparison of Commercial Auxin-like Chemicals with Other Growth Regulators for Stimulation of Rooting of Cuttings.  

Read, Paul E., R. J. Henny and D. A. Heng, Univ. of Minnesota, St. Paul.

Indolebutyric acid (IBA) is used commercially to stimulate the production of adventitious roots in cuttings. Certain more recently discovered growth regulating chemicals, notably N-dimethylaminosuccinamic acid (B-Nine), have shown promise for use in rooting cuttings of ornamental species. Commercial utilization of B-Nine aqueous dip treatments has been extended to include geraniums, chrysanthemums, dahlias, carnations and poinsettias. Such treatments have improved rate and quality of root formation when compared with standard materials containing IBA. Additional species have responded in a similar fashion, including Juniperus chinensis var. Pfitzeriana and Hibiscus rosa-sinensis.

CCC, (2-chlorehyl) trimethylammonium chloride, caused retarded rooting at high rates (500 ppm and up), but very dilute solutions tended to stimulate rooting. Stimulation has also been achieved with MBR 6033, NIA 10637, Ethrel, certain morphactins, abscisic acid, and B-Nine and analogs. More investigation is indicated to determine their relative value for stimulation of adventitious root production and to delineate their mode of action.

2:45  Ecotypic Variation in Pinus halepensis.  
Leiser, Andrew T. and James J. Nussbaum, Univ. of California, Davis.

Ecotypic variation in the Pinus halepensis – P. brutia complex was studied using wild-collected seed from sites ranging from Morocco to Afghanistan. In just three years striking differences were found in gross morphology, growth habit and growth rates. Preliminary work (artificial freezing tests) indicated very real differences in hardiness. The range of variation is described and specific seed sources are suggested for particular horticultural and environmental uses. The implications for rapid evaluation of other woody plants are discussed.

3:00  Recess

3:15  Rooting of Pine Fascicles Affected by Photoperiod.  
Witte, Willard T. and James B. Shanks, Univ. of Maryland, College Park.

Three year old seedlings of Pinus strobus and P. ponderosa were subjected to four photoperiod regimes (8, 16, 24 hr. at natural) from July to October. Fascicles were excised in January, treated with a rooting hormone (0, 5000, 10,000 ppm) quick dip, and placed in sand media under intermittent mist. Data taken 200 days later showed photoperiods longer than normal seriously reduced rooting. Short photoperiod increased rooting when fascicles were not treated with rooting hormone. On an experiment wide basis, 5000 ppm rooting hormone was optimum. Results of the most current experiment involving short photoperiod regimes at various times in the growing season will also be reported.

3:30  Effects of Alar and ABA on the Frost Resistance and Spring Development of Burford Holly.  
Pair, John C. and Ray A. Keen, Kansas State University, Manhattan.

Alar at 2000 ppm was applied to Ilex cornuta burfordi at various dates during summer, fall and winter in an attempt to delay growth and retard the loss of hardiness the following spring. In January plants were exposed to simulated spring conditions in a growth chamber. New growth was delayed most by fall and winter
applications of Alar and the killing point was lowered by about two degrees.

Under actual spring conditions Alar at 2000 ppm and ABA at 500 ppm were applied just prior to initiation of spring growth. Although new growth was delayed only one or two days, Alar greatly reduced the amount of freezing injury as determined by the electrical conductivity method. Reduction in freezing injury by ABA was nonsignificant.

Application of Alar at the time the summer flush of growth was maturing greatly increased the initiation of flower buds. Earlier applications shortened internodes significantly.

Gouin, Francis R. and Conrad B. Link, University of Maryland, College Park.

In the Northeast, the winter survival of container grown woody ornamental plants is the primary limiting factor preventing the expansion of this form of nursery production. Preliminary results indicate that the winter survival of woody plants growing in containers is directly related to the cold hardiness of their roots.

Summer applications of varying levels of P and K and late summer and fall applications of varying levels of N did not increase the winter survival of Ilex crenata latifolia and Pyracantha coccinea 'Laland' overwintered in containers. Late summer and fall applications of Alar, Cycocel, N-decenylic acid and MH-30 alone and in combination with DMSO, Sun Oil No. 6E, or with Folicoat also had little effect in increasing winter survival.

Controlled freezing studies with plants treated with Alar and Alar combined with DMSO applied in late summer and early fall indicated no significant increase in the cold-hardiness of roots and leaves.

4:00 Winter Storage of Evergreens. 139
Davidson, Harold and Roy A. Mecklenburg, Michigan State University, East Lansing.

Four ornamental evergreen species were overwintered in portable conduit type polyethylene houses. The houses were covered with two types of 'poly' (clear and opaque), were oriented in north-south and east-west direction, using two replications. Temperatures were recorded for air (at three levels), soil, and leaves periodically during the winter and early spring. Considerable differences were observed in the temperature between the houses covered with clear vs. the opaque plastic. Temperatures being higher in the clear house than in the opaque house and higher in the east-west oriented than the north-south oriented houses. But the relative humidity was lower in the clear house than in the opaque house. The net result was that three species of evergreens stored under the clear plastic desiccated, whereas under the opaque plastic all four species remained in a healthy, vigorous condition.

4:15 Mechanism of Tree Seed Dormancy. I. Effects of Chemicals on the Germination of Selected Tree Seeds. 140

The seeds of loblolly pine, baldcypress, hackberry and black cherry were treated with various chemicals to overcome the dormancy associated with these seeds. Soaking of loblolly pine seeds in KNO3 and GA3 solutions increased the total final germination considerably over the control. Scarification increased germination, but scarification followed by chemical treatment slightly reduced the effectiveness of scarification or chemical treatment alone. Moist prechilling of loblolly pine seeds for 9 weeks only slightly improved the total germination over the control. Prechilling reduced the effectiveness of KNO3, while that of GA3 remained more or less unchanged. Prechilled seeds treated with thiourea gave the highest percent germination obtained with any treatment, while chloroethanol completely suppressed germination.

Potassium nitrate had little or no effect on the germination of baldcypress seeds, while prechilling or GA3 treatment slightly increased the total percent germination. We have failed so far to improve the germination of intact hackberry and black cherry seeds. However, isolated embryos from hackberry germinated best out of all the species studied.

4:30 Mechanism of Tree Seed Dormancy. II. Histochemical Studies on Dormant and Germinating Seeds of Selected Tree Species. 141

The seeds of loblolly pine, baldcypress, hackberry and black cherry were used in this study. Sections 5μ thick were cut from the embryos and endosperm tissues of dormant and germinating seeds and stained specifically for proteins, carbohydrates and lipids. Results indicated that except for loblolly pine, a large amount of proteins was present in the embryos of baldcypress, hackberry and black cherry. The endosperm tissues of loblolly contained more protein than the endosperm of other seed species studied. Germinating loblolly pine seeds contained less protein as compared to the dormant seeds.

A large amount of uniformly distributed starch grains were found in the embryos of loblolly and baldcypress seeds. The endosperm tissues of these two species contained relatively low amounts of starch and also the distribution was not uniform. Baldcypress contained a large amount of amylopectin and a small amount of amyllose while the reverse was true for loblolly. The seed tissues of hackberry and black cherry did not have much starch and also the distribution was uneven.

4:45 Fruit Drop of Cocos nucifera Induced by 2 Chloroethanephosphonic Acid and Chlorfluorenol, a Morphactin. 142
Cirile, Richard A., University of Hawaii, Honolulu.

Reduced fruit set and abortion of young fruits of the coconut palm was achieved following sprays of 0.5% Ethrel (2-chloroethanephosphonic acid) and Maintain (a morphactin; methyl 2-chloro-9-hydroxyfluorene-9-carboxylate). Maleic hydrazide at the same concentration was less effective. No effects of the chemicals were evidenced if the inflorescence was sprayed prior to the time when the female flowers were receptive. Fruits ranging in diameter from 4 to 8 cm abscised the most readily, but occasionally maturing fruit of up to 20 cm diameter were affected.

The results may be a cost-reducing factor in maintenance of coconut palms along parkways and public passages.

NOTICE - IMPORTANT
Members of ASHS who receive a copy of this Program & Abstracts Section by mail prior to the Annual Meeting are encouraged to bring it with them if they attend the meeting; otherwise, additional copies available at the meeting will cost $1.00 per copy.
MONDAY AFTERNOON

(16) FLORICULTURE:
ROSE GROWTH AND DEVELOPMENT
Imperial B

Presiding: H. P. Orr, Auburn University, Auburn, Alabama.

1:00 The Use of Cuticular and/or Epidermal and Venule Characters and Patterns for the Identification of Rosa hybrida Cultivars.

Coon, Margaret E. and Kenneth W. Reisch, OARD, Wooster, Ohio.

Different methods to obtain epidermal replicas and venation patterns of Rosa hybrida leaves were evaluated. A silicone rubber technique proved to be most satisfactory to obtain replicas of living and developing abaxial leaf surfaces. Photomicrographs, taken with darkfield illumination, of epidermal characters and venule patterns from leaves of Rosa hybrida ‘Peace’ and several of its sports and hybrids obtained from India, Israel, New Zealand, California, Ohio, Pennsylvania and Texas were examined and compared. Differences in stomata/epidermal cell number and size and veinlet ending patterns have been observed. These differences, along with other distinguishable characters, will aid in the identification of plants at the cultivar level.


Kohl, Harry C., Jr., and D. Edward Smith, University of California, Davis.

A series of experiments indicated that new shoots are parasitic on the mother cane, once that the elimination of new shoots resulted in a much stronger root system and many more renewal canes which are highly desirable led to comparison of cultural practices based on the above with usual cut-back (renewal) practices. Results showed that the combination of no spring knife pruning to build up a large mature-leaf area, plus allowing plants to bloom-out before an all at once pruning to 12” to 18” in late spring to early summer resulted in superior plant renewal.

1:30 Nitrogen, Phosphorus and Potassium Fertilization of Roses on Oldsmar Fine Sand. I. Effects on Number of Blossoms and Stem Lengths.

Young, T. W., G. H. Snyder, F. G. Martin and N. C. Hayslip, Univ. of Fla., Homestead, Univ. of Fla., Belle Glade, Univ. of Fla., Gainesville, Univ. of Fla., Ft. Pierce.

‘Christian Dior’ and ‘Happiness’ roses on Rosa fortuniana stock, fertilized with 3 rates each of N, P, and K factorially combined, were grown for 3 years at Fort Pierce, Florida. All fertilizer was band applied under plastic mulch at the beginning of the experiment just before the bushes were planted. About 2300 lbs/A of N on ‘Christian Dior’ and 2100 lbs on ‘Happiness’ produced the greatest number of blossoms. Levels maximizing stem lengths were slightly lower. The independent effect of P was minor and low levels were best. Within the experimental range (249 to 2241 lbs/A of K), the number of blossoms decreased with increasing K fertilization, whereas stem lengths increased up to a maximum at about 1700 lbs/A. At times, various nutrient interactions were noted. ‘Christian Dior’ consistently yielded more blossoms than ‘Happiness’. With minor exceptions, ‘Happiness’ had longer stems.

1:45 Nitrogen, Phosphorus and Potassium Fertilization of Roses on Oldsmar Fine Sand. II. Mineral Composition of Tissue and Soil, and a Discussion of the Plastic Mulch Culture Employed.

Snyder, G. H., T. W. Young, N. C. Hayslip and F. G. Martin, Univ. of Fla., Belle Glade, Univ. of Fla., Homestead, Univ. of Fla., Ft. Pierce, Univ. of Fla., Gainesville.

‘Christian Dior’ and ‘Happiness’ roses on Rosa fortuniana stock, fertilized with 3 rates each of N, P, and K factorially combined were grown for 3 years. All fertilizer was band applied under plastic mulch at the start of the study. Leaf tissue N at 18 months was increased by N fertilization up to 2100 lbs N/A (which approximately corresponded with the N rate giving maximum blossom production), and increased throughout the experimental N range 300–2700) at 32 and 36 months. Tissue and soil N were decreased by K fertilization. Tissue and soil K generally were increased by K and decreased by N fertilization. Tissue P increased with P and K, and varied quadratically with N fertilization, being minimal at about 2200 lbs N/A. Based on yield and soil and tissue data from this and associated studies, it appears that roses can be successfully grown with yearly applications of soluble fertilizers under plastic mulch, when sub-surface irrigated.

2:00 Automatic “Fertigation” of Roses in Five Media.

White, John W., Pennsylvania State University, University Park.

‘Red American Beauty’ roses grown in 50:50 Lelite and coarse sphagnum peat moss and irrigated daily with 100 ppm nitrogen supplied by 21-7-7 and 15-15-15 Peter’s fertilizers yielded more total stem length than any other combination of media, fertilizer or irrigation regime studied. There was an almost 300 per cent spread in yield between the best and poorest of 40 treatments. Anthracite coal and coal by-products were used as growing media. Time clocks were used to control daily and twice daily operated Gates perimeter irrigation systems. These two regimes were compared with a tensiometrically controlled perimeter system and with a constant drip regime using ozee irrigation tubes.

2:15 The Effect of Soil Moisture, Watering Methods and Carbon Dioxide Fertilization on Flower Production and Quality of Greenhouse Roses.

Link, Conrad B., University of Maryland, College Park.

A report of four years production of rose cvs Briarcliff and Pearl of Aalsmeer under greenhouse conditions. Plants were grown in 4 different combinations of loam soil, peat and perlite and the plants watered by systems using manual control, time switches and moist scale. Carbon dioxide was supplied to one replication to supply at least 1000 ppm to the atmosphere during the daylight hours of the winter months. Production records taken October through April showed increased production and stem length with the addition of carbon dioxide. The considerable variation in soil mixtures and watering methods gave a commercial performance of plants that allows for automation of watering and fertilizing practices.

2:30 Photoperiods Effect on the Growth and Flowering of the Greenhouse Rose.

Carpenter, William J. and Reynaldo C. Rodriguez,
Michigan State University, East Lansing.

Four greenhouse rose clones ('Forever Yours', 'Red American Beauty', 'Mary De Vor' and 'Jack Frost') were given 9, 12 and 16 hour photoperiods from Sept. 1, 1969 to May 1, 1970. Plants in the 12 and 16 hour photoperiods received 60 to 75 ft. c. of combined fluorescent and incandescent light nightly. Individual stems were tagged and dated after cutting each flower to determine the days required for a return to flowering. Other measurements included flower stem length, fresh and dry weights and the number of nodes for each stem. The results showed that plants receiving the longer photoperiods produced more flowers with a substantial increase in stem length and fresh weight. No significant differences were found in the numbers of nodes or dry weight per flowering stem among the photoperiodic treatments.

2:45 Effect of High Intensity Lighting of Roses in the Greenhouse. 150


A comparison was made of the growth and flowering of rose clones 'Forever Yours' and 'Shocking Pink' grown: 1) under normal greenhouse light conditions from Dec. 15, 1969 to May 15, 1970; 2) lighted with Gro Lux lamps at 250 ft. c. for 9 hours (6 p.m. to 3 a.m.) nightly, and 3) lighted continuously with Gro Lux lamps during the daylight hours and 9 hours nightly. Records included flower production, days required for a return to flowering, flower stem length, fresh weight and number of nodes. Additional measurements were made of the total reducing sugars in individual leaves after exposure to each treatment for 24 hours. Rose 'Forever Yours' responded well to supplemental lighting of high intensity. Numbers of flowers per plant were increased significantly and bottom breaks developed in large numbers. Clone 'Shocking Pink' responded less to lighting. Sugar levels were increased considerably in both clones by lighting, while flower stem lengths, fresh weights and number of nodes were reduced slightly.

3:00 Recess

3:15 The Effect of Supplemental Light on the Growth of Rosa hybrida, cv. Forever Yours During Periods of Low Light Intensity. 151

Wiseley, Donald K. and Richard S. Lindstrom, Virginia Polytechnic Institute, Blacksburg.

The greenhouse rose (R. hybrida) cv. Forever Yours was grown under high intensity supplemental light in a greenhouse from December through April. The plants were grown under two different light sources, Sylvania 215 W Wide Spectrum Gro-Lux fluorescent lamps and 400 W Sylvania Metalarc lamps on a 18-hour photoperiod. The fluorescent tubes were placed 4 feet over the bench surface in a horizontal position and the Metalarc lamps were placed 7 feet above the surface of the bench.

There was a significant difference in the number of roses produced and a decrease in the time interval to produce a rose as compared with the control plots (existing photoperiod and light).

3:30 Response of Greenhouse Roses to Supplementary Irradiation. 152

Mastalerz, John W., Pennsylvania State University, University Park.

Supplementary irradiation with fluorescent light (wide-spectrum Gro-Lux lamps at 16 and 32 lamp watts per sq. ft.) increased the yield but decreased the stem length of greenhouse roses. The quality of flowers (based on a stem length to weight ratio of 0.4 grams per centimeter) from irradiated plants was similar to flowers from plants receiving natural light only. Larger increases in yield (43 to 92%) were obtained from lamps placed between the plants than from lamps placed above the plants (14%). The response to supplementary irradiation appears to be a response to light energy and not the result of extended photoperiods.

3:45 Soil-Applied Benomyl as a Systemic Fungicide for Control of Rose Blackspot in the Field. 153

Semeniuk, Pete and John G. Palmer, USDA, Beltsville, Maryland, and USDA, Laurel, Maryland.

Benomyl [methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate] applied in weekly sprays had confined foliar infection by Diplocarpon rosae on three hybrid tea roses to between 30% and 40% of the leaflets as compared to almost 100% infection in the unsprayed controls after 4 months. Plants were sprayed with an aqueous suspension of conidia 2 weeks after initial fungicide application. The fungicide applied once to the soil surrounding each of the plants, at the rate of one pound of the active ingredient per 25 feet of soil surface, held infection to approximately 60%. The best soil treatment, three applications of the 1-pound rate applied monthly, held infection to approximately 35% on Pink Radiance, 40% on Nocturne, and 50% on Red Radiance. With soil applications blackspots were small and linear in form between veins. Typically large, oval spots developed on plants that were untreated or which had been sprayed.

4:45 AMERICAN POMOLOGICAL SOCIETY SUMMER MEETING

O. A. Bradt, President, L.D. Tukey, Secretary

Open to all APS members and interested persons.

Baroque Room

5:00 EDUCATION COMMITTEE

Ervin L. Denison, Chairman

Open to all interested persons.

Silver Chimes East

EXTENSION HORTICULTURE BANQUET

Monday, November 2

Speaker: Leon Miller, Production Research Manager

A. Duda & Son, Oviedo, Florida

7:00 p.m.
MONDAY EVENING

Monday Evening, November 2

(17) SYMPOSIUM:
FRUIT BREEDING
Empire Room

Sponsored by: ASHS Fruit Breeding Committee
Presiding: J. N. Moore, University of Arkansas, Fayetteville.

7:30 Breeding for Cold Hardiness in Subtropical Plants. 154
R. J. Knight, Jr., USDA, Miami, Florida.

8:00 Breeding Blueberries for Low-Chilling Requirement. 155
R. H. Sharpe, University of Florida, Gainesville.

8:30 Breeding Grapes for Central Florida. 156
J. A. Mortensen, Florida Watermelon and Grape Investigations Laboratory, Leesburg.

9:00 Breeding Rubus for Warm Climates. 157
W. B. Sherman, University of Florida, Gainesville.

9:30 Breeding Peaches for Warm Climates. 158
H. H. Bowen, Texas A&M University, College Station.

DISCUSSION SESSIONS

7:30 VEGETABLE BREEDING AND VARIETIES SESSION
E. A. Borchers, Chairman
Baroque Room

GROWTH CHAMBER RESEARCH: ENVIRONMENTAL REPORTING REQUIREMENTS AND BASE-LINE GROWTH STUDIES
T. W. Tibbetts, Chairman
Imperial A

POLLLUTION AS RELATED TO HORTICULTURE
Edward J. Ryder, Chairman
Imperial B

FLORICULTURE, ORNAMENTAL AND LANDSCAPE HORTICULTURE SECTION COMMITTEE: DISCUSSION ON WATER RELATIONS
Roy A. Larson, Chairman
El Dorado Conference

8:00 COLLEGIATE BRANCH BUSINESS MEETING
Imperial C

TUESDAY MORNING

Tuesday Morning, November 3

Seven Concurrent Sessions

(18) SYMPOSIUM:
ETHYLENE
Carillon Room

Sponsored by: ASHS Post-Harvest Horticulture Committee
Presiding: David R. Dilley, Michigan State University, East Lansing.

9:00 Introductory Remarks

9:15 Synthesis and Biosynthesis of Ethylene. 159
Morris Lieberman, USDA, Beltsville, Maryland.

10:00 Physiology and Mode of Action of Ethylene. 160
Stanley P. Burg, Fairchild Tropical Gardens and University of Miami, Miami, Florida.

10:45 Recess

11:00 Practical Applications of Ethrel in Agriculture Production. 161

11:45 General Discussion

(19) FRUIT:
NUTRITION I
Baroque Room

Presiding: J. Benton Storey, Texas A&M University, College Station.

8:30 A Survey of Nutritional Conditions of Fruits and Vegetables in Northwest India. 162
Cahoon, G. A., K. S. Chauhan, J. P. Nauriyal and F. S. Howlett, Ohio Agricultural Research and Development Center, Wooster, University of Udaipur, Udaipur, Punjab Agricultural University, Ludhiana, and Ohio Agricultural Research and Development Center, Wooster.

During the previous two year period foliar samples from approximately 3,000 fruits and vegetables were gathered for analysis from the States of Rajasthan, Punjab, Haryana and Himachal Pradesh. Samples were shipped to the Plant Analysis Laboratory, Ohio Agricultural Research and Development Center, and analysed for 15 elements by the L.5 meter Jarrell-Ash Atomcounter, Total nitrogen was determined by a standard Kjeldahl Procedure. Prior to
summarizing the data return visits by the Author were made to many of the survey areas during February—April 1970 in order to compare results with existing plant conditions.

From visual observations as well as foliar analysis data citrus was the most outstanding crop affected by nutritional abnormalities. Zinc was the most predominant deficiency; the second was nitrogen. Low to deficient levels of Boron, Potassium, Manganese, Magnesium and Phosphorus were observed. Elements often found in excess were Iron and Boron.

8:45 Effect of Rainfall Distribution on the Seasonal Levels of Nitrogen and Potassium in ‘Mcintosh’ Apple Leaves. 163


Mid-shoot leaves from individual apple trees were sampled and analyzed at weekly intervals from mid-June to the first week of September. The samples were collected from the same trees in three apple growing regions of New York (Hudson Valley, Lake Champlain and Western New York) during the 1964, 1965 and 1966 growing seasons. The seasonal distribution of rain effected nutrient levels more than the total seasonal rainfall. Of the elements determined (N, P, K, Ca, Mg, Zn, Mn, Fe, Cu and B), potassium levels were affected more than any of the other elements.

9:00 Uptake and Translocation of Amino Acids in Apple Trees. 164

Titus, John S. and Patricia W. Spencer, University of Illinois, Urbana.

Glutamate-14C and aspartate-14C were supplied to the roots of 1-year-old MM 106 rooted apple cuttings. Both compounds were readily absorbed and translocated to the aerial parts of the plants. Glutamate, and its metabolic products, tended to accumulate in phloem tissues to approximately the same levels as were detected in the xylem. This was in contrast to aspartate, and its products, which were concentrated in the xylem.

Extensive metabolism occurred during uptake and translocation with detectable label in respiratory CO2 and in protein. However, emphasis is given to the recovery of labeled amino acids recovered in aerial tissues. This supports previous findings indicating the significance of amino acids as N carriers in the apple.

9:15 Gas and Liquid Displacement of Xylem Sap of Apple and Pear and the Influence of Nitrogen on Its Composition. 165

Catlin, P. B., C. A. Priestley and E. A. Olsson, University of California, Davis, East Malling Research Station, England, and University of California, Davis.

To obtain xylem contents that would more accurately represent substances actually in transit than determinable by solvent extraction, gas and liquid displacement techniques were compared. Xylem sap was obtained from shoots of small apple and pear trees grown in pots and from apple trees in the field. Nitrogen applications were made to facilitate evaluation of methods. Asparagine, glutamine, and aspartic and glutamic acids were predominant in xylem sap. Soluble carbohydrates were low and consisted mainly of sorbitol, sucrose, glucose and fructose. Photosynthetically fixed 14C was rapidly incorporated into both amino and carbohydrate constituents. Marked increases in the amounts of amides and amino acids occurred within 40 hr after addition of NH4NO3 to the soil.

9:30 Phosphorus Compounds Present in Apple Spurs of the Biennial ‘Kinhead Red Spy’. 166

Miller, Sherwood R., Canada Department of Agriculture, Trenton, Ontario.

Fruiting spurs and spurs of ‘Kinhead Red Spy’ forming flower buds were collected at 3–4 day intervals during June and July 1968. Phosphorus levels in the wood from potential flower cluster bases were four times higher than in fruiting shoots. The most marked difference between wood that will or will not form flower buds is that the former have ten times the accumulation of perchloric acid soluble organic phosphorus. An increase in the amount of nitrogen applied to the apple tree increased the level of acid soluble and nucleic acid phosphorus in the potential flowering spurs. The phosphorus levels of the leaves and bark were not altered by the changes in nutrition or type of spur sampled.

The data will be discussed in relation to the biennial flowering habit of this variety.

9:45 Iron-Manganese Relationships Associated with the Occurrence of Internal Bark Necrosis (IBN) of ‘Delicious’ Apples. 167

Ziegler, D. C. and J. E. Shelton, North Carolina State University, Raleigh.

‘Delicious’ trees grown in sand culture and supplied with a high concentration of Mn developed IBN and a chlorosis typical of Fe deficiency. Chlorotic leaves were not lower in Fe than non-chlorotic leaves.

Mn was over three-fold and Mn/Fe ratio over eight-fold greater in leaves from trees having chlorotic leaves.

Ground one-year-old shoot shoot tissue exhibited color differences associated with level of Mn supply. Color of ground shoot tissue was also associated with Mn/Fe ratios in leaves, shoots and bark, concentration of Mn in leaves and bark, but not in shoots and with severity of external IBN symptoms.

10:00 Recess

10:15 Iron-Manganese Relations in ‘Sungold’ Peaches Under Field Conditions in Western Colorado. 168

Rogers, Ewell A., Colorado State University, Western Slope Branch Station, Austin.

Ammonium sulfate at 1620 and 2700 g and ammonium sulfate at 1620 g plus 56,113, or 226 g per tree sodium ferric ethylenediamine di-(o-hydroxyphenylacetate) or ammonium sulfate at 1620 g plus 136 or 272 g FeSO4 per tree were applied in April 1964 to 1966, inclusive, to ‘Sungold’ peach trees in Western Colorado. For each 56 g sodium ferric ethylenediamine di-(o-hydroxyphenylacetate) applied, the ppm Fe of the peach leaves increased by 3.40 ppm and the Mn decreased 2.82 ppm. For each 1000 g of ammonium sulfate applied per tree, the total per cent N of the leaves increased by .085%. The N of the leaves increased .029% by each addition of 56 g sodium ferric ethylenediamine di-(o-hydroxyphenylacetate). The treatments had no significant effect on Zn uptake, trunk or shoot growth or size, yield and color of the fruit.

10:30 Cuticular Penetration, Metabolism, and Field Evaluation of Nitrate Foliar Sprays in Prunus Species. 169

Leece, David R. and A. L. Kenworthy, Michigan
TUESDAY MORNING

State University, East Lansing.

In field and sand culture studies stone fruit trees showed no meaningful response to foliar sprays of 4 per cent potassium nitrate. However when nitrate was supplied to the leaves of apricot, sweet cherry and plum trees via the petiole nitrate reductase enzyme activity was induced, indicating that *Prunus* leaves can metabolize nitrate. Thus lack of significant cuticular penetration appears responsible for the lack of response to foliar sprays. Preliminary studies with leaf discs and with enzymatically isolated cuticles indicate that the epicuticular wax may be acting as a barrier to nitrate penetration of the cuticle.

10:45 Effects of N, K and Alar on Vegetative Growth, Yield and Quality of Sour Cherry, *Prunus cerasus* L., cv. Montmorency. 170

Crocker, Thomas F. and A. L. Kenworthy, Michigan State University, East Lansing.

Three levels of N (0, 3, 6 lbs. NH₄NO₃/tree) two levels of K (0.2 lbs. KC1/tree) were applied to sour cherries starting in the spring of 1967. In the 1969 season these levels of N and K were split with two levels of Alar (0, 4000 ppm).

High N resulted in increased yields, less fruit removal force and no loss of firmness or color. High K increased fruit color. Alar increased color, firmness, reduced fruit removal force and hastened maturity by one week.

11:00 Response of Peach and Apple Trees to Packet or Tablet Fertilizers at Planting. 171

Rom, Roy C., E. H. Arrington and F. M. Jones, University of Arkansas, Fayetteville.

Reporting 4 years study involving 4 experiments at 3 locations on inherently poor soil, peach and apple, several varieties, various rootstocks. Fertilizer tablets (20 gram Agriform 28-8-4) and packets (2 ounce Exesky Grow 16-8-16) in varying number and location placed at tree planting. Growth and nutrient analysis compared to yearly applications of 10-10-10 or 33-0-0. Growth and foliar levels equal to that obtained from conventional fertilizer treatments existed through the first two years. Nitrogen levels particularly in peach declining to shortage levels in 3rd and 4th year. Positioning of the packet or tablet were found unimportant. Increasing number of packets or tablets at planting had little effect.

11:15 Influence of Pollination and Nutritional Status on the Yield and Quality of Highbush Blueberries. 172


Caged experiments were designed and constructed at three locations in each of two years. Treatments consisted of a caged control with no bees, an uncaged control, and caged plants with bees added at 0, 25, 75 and 100% of full bloom. Locations differed in the level of bee population available for field (uncaged) pollination. Locations 1, 2 and 3 had 5, 3, 1 hives/acre, respectively. Among the factors measured were yield, berry diameter, seed number, status of leaf nutrients, and incidence of powdery mildew. Results suggest that 25% of full bloom is the latest time for bees to be added if one is to insure maximum yields. Significant positive correlations existed between yield and berry diameter, berry diameter and seed number, hives/acre and yield of uncaged control. A negative correlation existed between powdery mildew and yield.

TUESDAY MORNING

11:30 Cranberry Growth and Composition as Influenced by Nitrogen Treatment. 173

Eck, Paul, Rutgers University, New Brunswick, New Jersey.

Increasing rates of N fertilizer from 16 to 64 lbs. of N/A. were associated with increased vine growth, and increased upright length in ‘Early Black’ cranberry. N content of stem tissue averaged 0.40%, runner leaves ranged from 0.92 to 1.09% N, fruiting uprights from 0.84 to 1.04% N, and non-fruiting uprights from 0.89 to 1.10% N. Leaf and upright N composition were highly correlated to N rate but stem N content did not correlate with N level. N content of runner leaves correlated best with vegetative growth. A significant quadratic component of the regression of N content of runner leaves upon upright length and of N content of fruiting uprights on runner production suggested that excessive vegetative growth may have influenced N composition in these tissues through a dilution mechanism.

11:45 Effects of Boron and Nitrogen Levels on Growth and Fruiting of Papaya (*Carica papaya*). 174

Perez Lopez, Agripino and Norman F. Childers, Puerto Rico Agricultural Experiment Station, Rio Piedras, and Rutgers University, New Brunswick, New Jersey.

This study involved the application of different levels of N and B to papaya under greenhouse sand culture conditions. With an increase in these 2 nutrients in the culture solution there was an increase in the number of nodes per plant, total number of fruit set, total yield, and a decrease in leaf angle. High N plants had thicker stems and petioles. High B plants had thinner stems and petioles. Flavor evaluations of ripe papayas indicated that fruits coming from high N and low B plants were preferred by a taste panel over those from low N and high B. The taste panel showed a marked acceptance of fruits with low soluble solids to acids ratio. These fruits were borne on trees with the highest N and low B content.

(20) FRUIT: PHYSIOLOGY

Silver Chimes East

Presiding: Melvin Westwood, Oregon State University, Corvallis.

8:30 The Aseptic Culture of Excised Apple Buds, and Their Employment in Dormancy Studies. 175

Powell, Loyd E., Cornell University, Ithaca, New York.

Bud growth and dormancy are phenomena that are usually studied on intact plants. However, there are some advantages in conducting such investigations, in part, at least, on excised material cultured aseptically where various parameters can be easily controlled and manipulated. We have developed a technique for the in vitro culture of apple buds in connection with studies on requirements for apple bud growth and dormancy.

Apple buds, sterilized using conventional aseptic techniques, will, in the light, grow into leafy shoots when provided with sucrose, macro-nutrients and certain micro-nutrients. Stationary culture on agar yields dwarfed, but otherwise normal, appearing shoots.
Bathing the shoots periodically with nutrient solution in rotating culture results in normal sized shoots.

Basal portions of non-chilled, non-growing shoots appear to be in deeper rest than apical portions, as evidenced by poor growth of excised buds. Low concentrations of abscisic acid prevents bud growth.

8:45 Isolation and Identification of an Inhibitor Present in Flower Buds of Apricot. 176
Ramsey, Juan A. and George C. Martin, Universidad de Oriente, Venezuela, and University of California, Davis.

Spur flower buds were collected from apricot trees (cv. Royal), freeze-dried and then extracted with 80% methanol. The extracts were partitioned into 4 phases: water, neutral ethyl acetate, acidic ether and acidic butanol. Wheat coleoptile bioassays indicated that most of the inhibitory activity of the extracts was present in the acidic ether phase, from which the inhibitor was further purified using paper and thin-layer chromatography.

Evidence from thin-layer co-chromatography of the bud inhibitor and abscisic acid using ten different solvent systems, gas chromatography of their methylated derivatives, ultraviolet light spectra and their physiological effects upon the extension growth of apricot seedlings indicate that the apricot bud inhibitor is similar, if not identical, to abscisic acid.

9:00 Characterization of Endogenous Growth Substances in Immature Ovules of Pecan, Carya illinoensis. 177
Amling, Harry J., Maw Jian Cherng and Karen A. Marcus, Auburn University, Auburn, Alabama.

A successful method for the isolation, purification, and bioassaying of acidic indole compounds and growth inhibitors using TLC is described. Endogenous growth substances were found to occur both in a bound as well as in a free state. The primary acidic indole present was similar to IAA in all respects. The primary growth inhibitor gave a positive color reaction to Van Urk's reagent. The described procedure will separate Exogenous IAA from GA3 before employment of TLC.

9:15 Seasonal Changes in the Ethylene Content of 'Golden Delicious' Apple Tissues. 178
Blanpied, G. D., Cornell University, Ithaca, New York.

Peaks in ethylene content (nl C2H4/gm fr wt) occurred in flower and shoot buds in February and at bud break, in fruits at June drop and ripening and in leaves at early and mid-season and in autumn. Comparisons are made with data collected for other fruits.

9:30 Comparative Study of Phenolic Compounds in Sweet Cherry Rootstocks. 179
Yu, Kyungs S. and Robert F. Carlson, Michigan State University, East Lansing.

The methanolic extracts of sweet cherry rootstock, P. mahaleb and P. avium were analyzed for their phenolic composition. On the unit dry weight basis, 'Mazzard' rootstock contained more phenolic compounds in leaf, bark and root-tissue than did the counterparts of 'Mahaleb'. Variations of phenolics of the two seedling rootstocks were also compared over the growing season. By two dimensional paper chromatography, G.L.C. and spectrophotometer readings, it was found that both rootstocks contained six identical compounds; o-coumaric acid, isoflavone and 4 others not yet identified. 'Mahaleb' rootstock contained a particular compound, herniarin (Rf in BAW .84, 2% HAC 52) and more coumarin than 'Mazzard'. Sap of Mahaleb shoots obtained by centrifugation also contained coumarin and herniarin compounds as shown by G.L.C. and paper chromatographic determination.

9:45 The Distribution of Abscisic Acid in Apple Shoots: Does It Really Play a Role in Terminal Bud Formation? 180

Abscisic acid (ABA) is believed by some to be responsible for the formation of terminal buds on woody shoots. This concept originated partly with the discovery in Wareing's laboratory that under short days Betula pubescens and Acer pseudoplatanus form terminal buds and concomitantly accumulate abscisic acid, and that exogenously applied ABA promoted the formation of terminal buds on B. pubescens.

During the past three years we have determined ABA content in apple shoots by bioassay and gas chromatography. The highest concentration of ABA is invariably found in the rapidly growing apical region of the shoot. Exogenously applied ABA can induce terminal bud formation during short winter days in apple, but buds are not readily formed when considerably higher quantities of ABA are used in early summer. These results suggest that, while ABA may possibly play some role in terminal bud formation, in apple, it probably is not the decisive factor.

10:00 Recess

10:15 Some Effects of Abscisic Acid on Apple Trees. 181
Robitaille, Henry A. and Robert F. Carlson, Michigan State University, East Lansing.

The effects of abscisic acid (ABA) on young apple trees was studied using an injection technique. ABA was found to inhibit growth of young trees, there being a linear relationship between growth inhibition and concentration injected. At higher concentrations ABA completely arrested growth. ABA effects on growth were temporary, since growth resumed almost immediately after injections were terminated. In comparison, Alar stopped growth at much lower concentrations and was much more persistant than ABA. The effect of ABA on GA3 induced growth and on clonal rootstocks of different vigor will also be discussed.

10:30 Absorption and Metabolism of 14C-2-Chloroethylphosphonic Acid in Apples and Cherries. 182

Radioactive 2-chloroethylphosphonic acid (Ethrel) was applied to leaf and fruit surfaces 6 to 10 days before normal harvest date. Samples were collected periodically following application and analyzed for Ethrel with appropriate extraction and counting procedures. The level of radioactive Ethrel increased in the fruit for about 48 to 72 hours, then decreased to a low level after 6 days. No intermediate metabolites were detected in the fruits. It was found that the majority of the Ethrel in the fruits moved there from the application on adjacent leaves; relatively small amounts moved directly into the fruit from surface application. Radioactive ethylene was detected within 6 hours after application of the 14C-Ethrel on the leaf surfaces.
10:45 The Influence of Cycloheximide on the Ethylene Production Activity and Abscission of Developing Leaves and Fruit of Citrus Trees.

Cooper, W. C. and W. H. Henry, USDA, Orlando, Florida.

The ethylene production activity of developing citrus leaves and fruit from the spring burst of new growth to senescence and abscission was measured for several citrus varieties on trees sprayed with 2 to 20 ppm cycloheximide and on untreated trees. The rates of ethylene production in the very young, mature, and old tissues are substantially increased by applying cycloheximide, but such applications have practically no effect on the green fruit and leaves during the summer. If a 20-ppm solution of cycloheximide is used at and shortly after the spring burst of growth, ethylene production by the tissue is likely to reach levels high enough to cause abscission of leaves, flowers, and small fruits, as well as the mature fruit. These toxic side effects of the standard cycloheximide treatments are alleviated by the use of lower concentrations of the chemical (5 ppm). Pretreatment of the trees with gibberellic acid reduces the injurious effects of the abscission chemical on the small green fruit; whereas, pretreatments with 2,4-dichlorophenoxy acetic acid increase the injury.

11:00 Screening Compounds for Effect of Production of Ethylene by Citrus Fruit and Leaves.


Detached fruit and leaves were dipped in solutions of the chemicals, sealed in separate plastic containers for 24 hours, and the ethylene content of the air in the containers was measured by gas chromatography. A wide range of chemicals, including vitamins, herbicides, growth retardants, gibberellins, cytokinins, and antibiotics, iron and copper compounds, food additives, protein inhibitors, cycloheximide derivatives, chloroethylphosphonic acid analogues and derivatives and hydroxyhydrozine derivatives were tested. The chloroethylphosphonic-acid group generally showed substantially more ethylene production by leaves than fruit; whereas, cycloheximide acid showed approximately the same ethylene activity for fruit and leaves. Gibberellin A13, vitamin K, and folic acid were among the compounds that stimulated ethylene production in the fruit and very little in the leaves.

11:15 A New Explant Method for the Study of Fruit Abscission in Citrus.

Ismail, M. A., Florida Citrus Experiment Station, Lake Alfred.

Fruit are harvested with 2 to 3-inch stems, trimmed later to 1 inch, washed, and surface sterilized with sodium hypochlorite. A rind disc around the fruit button is excised with 0.75-inch diameter cork borer. The explants, each consisting of 1-inch long stem and a rind disc, including the abscission zone, are placed in holes made in an agar layer in a deep petri dish, 10 explants to a plate. This method allows both distal and proximal application of test chemicals to the explant. Less space is required than for other fruit explant tests, and the incubation of fruit explants under controlled light and temperature conditions is possible. The method greatly facilitates the study of localized biochemical events during fruit abscission.

11:30 Accumulation of Naphthaleneacetic Acid by Leaf Cells.

Brenner, Mark L. and Martin J. Bukovac, Michigan State University, East Lansing.

Uptake of naphthaleneacetic acid (NAA) was investigated using leaf strips (250μm wide x 250 mm long) treated in a medium developed to provide optimum conditions for reduction of neurotransmitter. Time and concentration studies revealed that an interaction occurred such that once an internal concentration of 100 p moles of NAA/10 mg dry weight of tissue was established, the uptake rate increased rapidly. The metabolism of NAA played a dominant role in its own accumulation with the product appearing to be a compound that chromatographed identically to naphthalene-acetyl aspartate (NAAp). The conjugated NAA was tightly bound within the tissue. By use of metabolic inhibitors and substrates, it appeared that an enzyme (likely L-aspartic acid-N-acylase) was either activated or synthesized which, when functional, would account for the higher rate of NAA uptake. Results with low temperature and metabolic inhibitors support the concept that NAA uptake required metabolic energy. Light had a slight depressing effect on uptake.

11:45 Plant Growth Regulants Synthesized from Citrus Limonene.


A number of new quaternary ammonium derivatives of limonene retard the growth of (greenhouse grown) grapefruit seedlings whereas other commercial retardants have virtually no effect. Phytotoxic symptoms are rarely observed. The residual activity life of these limonene derivatives on citrus and other woody species such as privet, red oak and american sycamore is short however, thereby requiring repeat applications. The most active derivative (1-p-menthanol-2-dimethylamino, heptyl bromide) is twice as effective as Alar on calendula and chrysanthemums.

(21) VEGETABLES:

BREEDING AND GENETICS

El Dorado Room


8:15 Characterization and Methods for Testing Attractant Substances in the Cucurbitaceae.

da Costa, Cryo P. and Charles M. Jones, Purdue University, Lafayette, Indiana.

Cucurbitacins are high molecular weight compounds present in small amounts in the Cucurbitaceae. They are attractive to several insects which feed on cucurbits and so could potentially be important in selection of insect resistant types. Methods are described for dealing with the compounds on an individual plant basis through thin layer chromatography and gas liquid chromatography. Included are in vivo and in vitro methods of testing with insects. The attractiveness of these compounds to one group of insects and their apparent antibiotic effect on other groups of insects is discussed with respect to evolution and the ecology of plant-parasite relationships.
8:30 Measurement of and Variation in Sugar Content of Cucumber Fruit. 189
Lower, R. L. and C. L. McCombs, North Carolina State University, Raleigh.

Several varieties and breeding lines were extensively assayed for reducing sugar, total sugar, and refractive index. The sugars found in the cucumber were cellulose, fructose, glucose, and sucrose. Nearly all of the sugar present was reducing sugar in the form of glucose. Reducing sugar contents were generally lowest in size 1 fruits (less than 1-1/16 inches diameter), and highest in the larger size 2 and 3 fruits (greater than 1 1/2 inches diameter); however, refractive index values were generally highest with size 1 fruits and lowest in size 2 and 3 fruits. Significant differences were recorded between varieties, fruit sizes, and harvest dates for both reducing sugar and refractive index data, however, most differences were not consistent from year to year. Data from 4 growing seasons will be presented.

8:45 Influence of Genetic Background on Sex Conversion by Ethrel in Monoecious Cucumbers. 190
George, William L., Jr., Connecticut Agricultural Experiment Station, New Haven.

Six monoecious cultivars of cucumbers with widely divergent female sex tendencies were treated with ethrel. 'Marketer' and 'Wisconsin SMR18' exhibit strong; 'Marketmore', 'Ashley', and 'Spot Free' moderate; and 'Tokyo' weak female sex tendencies. Single spray applications of ethrel at 125, 250, and 500 ppm were applied at the first true-leaf stage. Ethrel significantly increased female sex expression in 'Marketer', 'Wisconsin SMR18', 'Ashley' and 'Spot Free', listed in decreasing order of response. The female sex tendency of 'Marketmore' and 'Tokyo' did not differ significantly from the control at the ethrel concentrations tested. These results suggest that the effect of ethrel in increasing female sex expression is influenced by the genetic system controlling sex tendency. Ethrel significantly delayed flowering in all cultivars except 'Wisconsin SMR18'.

9:00 Preliminary Studies with Three Ploidy Levels of Cucumbers. 191
Smith, O. S., Jr. and R. L. Lower, North Carolina State University, Raleigh.

Tetraploids of several cucumber varieties were induced by soaking diploid seed in a 0.5% aqueous solution of colchicine for 12 hours. Preliminary determination of ploidy level was by measurement of pollen diameter. The diameter of pollen from tetraploid plants was approximately 25% greater than pollen from diploid plants of the same variety. Suspected tetraploid plants were selfed and crossed with diploids to produce tetraploid and triploid seed. Chromosome counts were made on plants grown from tetraploid selfed and crossed seed and on plants from seed obtained from diploid crosses to verify ploidy level. Diploid, triploid, and tetraploid plants were grown in the field and in the greenhouse. Growth rate, morphological characteristics, flower sex ratio, and fertility were measured for each ploidy level.

9:15 Use of Hermaphroditic Cucumber Lines in Development of Gynoecious Hybrids. 192
Pike, Leonard M. and William A. Mulkey, Texas A & M University, College Station.

A true hermaphroditic cucumber line was derived from the andromonoecious variety 'Crystal Apple'. Hybrids developed by using gynoecious lines and the hermaphroditic line, designated as TAMU 950, were 100% gynoecious. In addition the cucumbers produced on the hybrids were similar in size and shape to the gynoecious parent. The use of the hermaphroditic in development of hybrids eliminated unpredictable sources of pollen which proved advantageous two ways. Precise quantities of pollinator could be added to the gynoecious hybrids at planting time and development of parthenocarpic hybrids would be possible.

9:30 Unstable Breeding Behavior of Fruit Shape in the F1 of Butternut x Crookneck Squash (Cucurbita moschata Poir). 193
Coyne, Dermot P., University of Nebraska, Lincoln.

The breeding behavior of fruit size in the F1 of three Butternut x three Crookneck squash crosses was investigated. The Crookneck types and the small fruited 'N. H. Butternut' bred true to type. The Butternut selections BNT-7 and BNT-13 were unstable for fruit shape. Butternut and an occasional dimorphic plant occurred in the reciprocal F1 NHBN x Crookneck 67-1-7. A similar result was obtained in the F1 NHBN x 'Golden Cushaw' (Crookneck) but in the reciprocal F1, Butternut, Crookneck, and dimorphic plants were observed. All three classes of plants occurred in the reciprocal F1 Crookneck 67-1-7 x BNT-7. Ethrel could be used to develop a female line of NHBN for use in crossing to unstable large fruited true Butternut varieties to produce large fruited F1 hybrids with a very low percent of Crookneck fruits.

9:45 Increasing the Yield of Winter Squash Through Interspecific Heterosis and Seedlessness. 194
Denna D. W., Colorado State University, Ft. Collins.

Variatel crosses between Cucurbita maxima and Cucurbita moschata show large differences in the ease with which the various crosses are made, the number of seeds produced per pollination and their germination percentage. The interspecific F1 progenies, in turn, show large differences in earliness, degree of seedlessness, vigor and yield. Combining abilities of various varieties within the two species will be discussed. Special attention will be given to certain crosses which produce very high yielding interspecific hybrids. The possible commercial production of the interspecific seed will also be considered.

10:00 Recess

10:15 The Use of a Modified Embryo Culture Technique in Cucumber Breeding. 195
George, B. F. and L. V. Crowder, Cornell University, Ithaca, New York.

The time involved for a backcross program or production isogenic lines can be substantially reduced by seed coat removal and germination of seeds prior to "full maturity". The least amount of time from generation to generation occurred with seeds that were mature enough not to require nutrient agar for germination and growth, yet respond to seed coat removal. Four generations of the variety 'SMR 18' were grown within a year by harvesting fruit approximately 30 days after pollination and removing the seed coat prior to germination.

10:30 Male Sterility Genes in Cucurbita pepo. 196
George, William L., Jr., Connecticut Agricultural Experiment Station, New Haven.

A male sterile line has been isolated in the ornamental gourd, Cucurbita pepo var. ovifera. This male sterility is inherited as a
CARILLON HOTEL PUBLIC AREA
(WHERE ASHS SESSIONS WILL BE HELD)

Floor plan of the Carillon Hotel Public Area showing where ASHS sessions, committee meetings, and other activities will be held. Note particularly the rooms off the main Lobby (the Carillon, Baroque, Burgundy, and Silver Chimes Rooms); those in the Lower Lobby area (Imperial Rooms A, B, and C); and those on the Mezzanine level (Dominion, Empire, and El Dorado Rooms West and East).
Mendelian recessive and is the third male sterile gene to be reported in C. pepo. Of the other two only one, m_{s2} (Eisa and Munger, PASHS 92: 473) isolated in the Egyptian summer squash cultivar ‘Eskandarany’ is available (as P.I. 228,241). Tests for alleles with m_{s2} show the new locus, designated m_{s3}, is independent. Male sterile m_{s3}/m_{s3} plants produce staminate buds which contain small, shrivelled stamens similar to m_{s2}/m_{s2} plants. The new mutant differs phenotypically from m_{s2} in that staminate flowers abort before they open. The male sterile plants also have reduced female fertility. If female fertility can be increased m_{s3} could offer promise in hybrid production since roguing of male fertile plants could be done without close examination of male flowers.

10:45 The Inheritance of Some Biochemical Components of Cucurbita pepo L. Seedlings and Their Relationship to Spotted Cucumber Beetle Diabrotica undecipunctata Howardi feeding. 197
Sharma, Govind C. and Charles V. Hall, Kansas State University, Manhattan.

Black Zucchini (susceptible) was crossed with ‘Early Golden Bush’ Scallop (resistant) and compared with the F_{1},F_{2} and backcross generations to spotted cucumber beetle injury with controlled populations. Individual seedlings were then analyzed for cucurbitacin and total sugar content. Cotyledon injury was positively correlated with cucurbitacin content and is probably conditioned by two to three effective genetic factors. Seedlings with high and low cucurbitacin content occurred in approximately 3:1 and 1:1 ratios in F_{2} and backcross generations indicating a monofactorial control. Total sugar, which was only slightly associated with the injury appears to be controlled by at least two effective factors. Various components of genetic variance and estimated of gene effects were also determined. Susceptibility was induced in the resistant seedlings by topical application of pure cucurbitacin to the cotyledons.

11:00 Spotted Cucumber Beetle Diabrotica undecipunctata Howardi Feeding as Influenced by Cucurbitacin, Total Sugar and Fatty Acid Content of Seedlings of 15 Cucurbitaceous Species. 198
Sharma, Govind C. and Charles V. Hall, Kansas State University, Manhattan.

The cucurbitacin, total sugar and fatty acid content of seedlings were analyzed and correlated with spotted cucumber feeding on 15 species from 5 genera of Cucurbitaceae. These were Citrullus colocynthis, lanatus; Cucumis anguria, dispaceus, ficifolius, longipes, melo, myriocarpus and prophetarum; Cucurbita foetidissima, pepo ‘ovifera’, pepo; Lufa acutangula, cylindrica; and Lageneria vulgaris. Seedling injury ranged from 0 (none) to 3 (severe). Seedlings were analyzed for total cucurbitacin, total sugar and the three fatty acids, palmitic, linoleic and linolenic. Regression analysis of data indicate that all except linoleic acid significantly contribute to insect feeding the correlation between concentration and feeding was positive. The decreasing order of importance was cucurbitacin, palmitic acid, linolenic acid and total sugar content, all appear to relate to the preference for specific strains or varieties.

11:15 A Comparison of Recurrent Mass Selection Based on Single Plant Performance and Recurrent Mass Selection Based on Clonal Family Mean Performance. 199
Anderson, Robert L., Michigan State University, East Lansing.

Source population improvement, as opposed to final phase testing, also commonly termed second test evaluation, is the subject dealt with for all commercially asexually propagated crops. A statistical genetics comparison is made between recurrent mass selection based on single plant performance (RMS), and recurrent mass selection based on clonal family mean performance (RMSCF). The research is theoretical in nature. The model researched assumes a single metric trait, 2 alleles per locus, no epistasis, and linkage equilibrium. The focus is on the importance of population size, selection intensity, heritability, length of reproductive cycle, and clonal family size. RMS is found to be superior to RMSCF unless heritability is very small. The other factors listed two sentences earlier can necessitate qualifying this general conclusion. These qualifications are also discussed.

11:30 Genetic Variation in the Methionine Levels in the Seeds of Common Bean (Phaseolus vulgaris L.). 200
Kelly, John F., Campbell Institute for Agri. Research, Cinnaminson, New Jersey.

In 1968 more than 3000 cultivars, lines and single plant selections were assayed for available methionine using a microbiological assay. Eighty-two single plant selections from Plant Introduction lines were selected at Rancocas, New Jersey, in 1968 on the basis of assaying greater than 133% of the standard ‘Sanilac’ seed in three successive assays. 1969 seed from 63 of these 82 selections again assayed more than 133% of the standard. Two lines selected for low methionine in 1968 were again low in 1969. There was a significant difference in the response of a few lines over the two years but the differences between strains were apparent regardless of the environmental difference encountered.

11:45 Variation in the Nutritional Value of Bean Cultivars and Species as Determined by the Growth Response of Rats. 201
Kelly, John F. and Kenneth W. Keane, Campbell Institute for Agr. Research, Cinnaminson, New Jersey and Campbell Soup Company Research Institute, Moorestown, New Jersey.

Seeds of 25 distinct types of beans varying in protein and methionine composition and representing five species were fed to rats to evaluate protein quality. Nineteen lines and cultivars showed ranges of 0.52–1.48 for Protein Efficiency Ratio (PER) and 0.13–0.50 grams gain per gram of bean consumed over 4 weeks. The relationship between growth and methionine composition was not consistent but there was a general trend for more growth in the high-methionine lines. Two samples of southern peas were superior in protein quality to most common beans. 'Pimero' lima bean had a high PER but was a poor source of protein because of low total protein content. 'Hycinth' beans were a very poor source of protein and gave essentially no weight gain in rats despite consumption of large quantities of beans.
9:00 Influence of Magnesium Nutrition on the Sensitivity of Tomato Plants to Air Pollution.  202
MacLean, David C., Boyce Thompson Inst., Yonkers, New York.

Tomato plants grown in sand culture and provided complete nutrient solution or solutions containing deficient or superoptimal Mg concentrations were fumigated with HF at 5.0 or 9.7 μg F/m³ for 7 days. The severity of HF-induced chlorosis on apical and medial leaves was enhanced in Mg deficient plants and suppressed in plants grown at the highest level. Foliar accumulation of F was inhibited in plants provided the lowest and highest Mg levels. The presence of necrotic tissue probably suppressed F accumulation in Mg deficient plants; however, it was not a factor in plants given superoptimal Mg. The HF X Mg interactions, with respect to foliar injury and F accumulation, revealed that Mg deficient plants were more susceptible and plants given excess Mg were more resistant to HF than plants cultured on complete nutrient media.

9:15 Nitrogen Dioxide and Sulfur Dioxide Interact to Injure Horticultural and Agronomic Crops.  203

Six horticultural and agronomic crops were exposed for 4 hours to nitrogen dioxide (NO₂) and/or sulfur dioxide (SO₂) in greenhouse exposure chambers. Concentrations of NO₂ in excess of 200 ppm and concentrations of SO₂ in excess of 50 ppm were required to cause injury. Plant injury developed when the gases were mixed together in the concentration ranges of 5–25 ppm of both gases.

Injury from either NO₂ or SO₂ acting alone appeared as a marginal and interveinal bifacial necrosis. The injury produced by the mixture of the two gases developed as chlorotic and necrotic flecking on the upper leaf surface of the interveinal areas of tomato, radish, oats, and tobacco. Reddish-brown pigmented lesions developed on pinto bean and soybean. Lower leaf surface injury frequently occurred in mixed gas fumigations with little or no upper surface injury. Upper leaf surface injury on all plants was similar to ozone injury. The low concentrations of these gases causing phytotoxicity implies that this interaction could be important in causing plant injury in the field.

9:30 Lettuce Growth and Tipburn Incidence as Influenced by CO₂ Concentration and Light Intensity.  204
Read, Michael and T. W. Tibbits, University of Wisconsin, Madison.

‘Meikoningin’, a butterhead lettuce cultivar was grown from seedling in fertilized peat soil at 70°F, 80% relative humidity, with 16 hr of light and under CO₂ concentrations of 350 ppm and 2000 ppm. Within each CO₂ concentration were 2 light intensities: 1000 and 2000 ft-c. The higher CO₂ concentration increased length and width of the leaves while increased light intensity decreased length and width of the leaves. After 4 weeks of growth the number of leaves on the plants was about the same at the two CO₂ concentrations but was increased about 25% by increasing light intensity. Dry weight was increased almost 75% by raising CO₂ concentration and increased about 100% by raising light intensity. The incidence of tipburn was accelerated both by increasing CO₂ concentration and by increasing light intensity. Acceleration of tipburn appeared to be a consequence of an increased growth rate.

9:45 Accelerated Growth of Lettuce Plants Under Controlled Environments.  205
Krizek, Donald T., Herschel H. Kluter and William A. Bailey, U.S. Department of Agriculture, Beltsville, Maryland.

The growth of leaf lettuce (Lactuca sativa L., ‘Grand Rapids’) plants was greatly accelerated by direct seeding in a specially designed propagation unit in which the carbon dioxide level was maintained at a minimum of 400 ppm or in a growth chamber at 1000 ppm. Fresh weights of tops of 21-day-old plants grown in the propagation unit at 400 ppm CO₂, approximately 80/70°F day/night temperature, 2500 ft-c of light, and a 16-hr photoperiod, were nearly 10 times greater than those of plants grown from seed in the greenhouse (April—May 1970) at 400 ppm CO₂, 70°F minimum night temperature, and a 16-hr photoperiod. Seeding directly in the growth chamber at 1000 ppm CO₂, 86/75°F day/night temperature, 65% RH, 2500 ft-c of light, and a 16-hr photoperiod, resulted in approximately a 20-fold increase in fresh weight of tops over greenhouse controls.

10:00 Recess

10:15 Influence of Carbon Dioxide on the Development of Tubers in the Potato Solanum tuberosum.  206
Paterson, Donald R., Texas A & M University, College Station.

The root systems of ‘Red La Soda’ potato plants were exposed to a constant flow of an atmosphere of greater than 50 per cent carbon dioxide for 12 hours. Tuber formation in control plants occurred at the end of underground stolons. Treated plants showed either an increased tuberization along the length of the stolon or vegetative tuber stolons and branching of the stolons. There were significantly more tubers on the plants treated with carbon dioxide. In some experiments both fresh and dry weights of potato plants were reduced by the modified atmosphere treatment. Carbon dioxide stimulated both top and root growth in other studies.

10:30 Effect of Mulch Type and Irrigation Applied Beneath Mulch Films on Soil CO₂ Evolution and Muskmelon Response.  207
Schales, Franklin D., University of Maryland, College Park.

Water applied through soaker hoses under paper mulches coated with wax, polyethylene, and aluminum foil, and under clear and black plastic resulted in greater muskmelon yields than use of these mulches without irrigation beneath the film, when compared with an unmulched check. CO₂ level between the mulch film and soil surface was influenced most by mulch type, with the highest levels being under the plastic films and plastic coated paper.
10:45 Carbon Dioxide Enrichment of Greenhouse Vegetables Through the Use of Diesel Exhaust Gas. 208
Jensen, Merle H. and Carl N. Hodges, University of Arizona, Tucson.

Two cucumber and eight lettuce varieties were grown in two air-supported, closed-environment plastic greenhouses, one with approximately ambient CO₂ levels, and the other enriched with 1400 ppm CO₂. Diesel exhaust gas was the source of the carbon dioxide. Once the exhaust gases were scrubbed through seawater and put through an activated charcoal filter, essentially no other gases entered the greenhouse along with the CO₂. Cucumbers grown in the enriched environment came into production one week earlier, and one variety produced significantly higher yields, than those grown at near ambient levels of CO₂. Lettuce grown in the CO₂ enriched greenhouse weighed, at market maturity, nearly twice as much as lettuce grown at ambient levels.

11:00 An Evaluation of Methods for Carbon Dioxide Enrichment of Field Vegetables. 209
Kretchman, Dale W., Ohio Agricultural Research and Development Center, Wooster.

Seven types of introduction techniques were evaluated to develop methods for enriching the atmosphere with carbon dioxide around nine vegetable crops growing in the field. Polyethylene row covers proved effective in retaining introduced CO₂. Bibb lettuce, muskmelon and cucumber responded favorably with this technique. However, very high temperatures developed within the covers under maximum sunlight, introduction of the gas under the plant canopy of the several crops by means of perforated plastic tubes and several modifications thereof, gave variable responses. Wind above five to eight miles per hour greatly reduced the amount of the CO₂ retained within the plant canopy. Underground additions of the gas resulted in reduced growth and yield of tomato and potato and malformed potato tubers. Misting crops with carbonated water was ineffective.

11:15 Differential Responses of Bean Cultivars to Ozone and Ambient Air. 210
Howell, Robert, K. USDA, Beltsville, Maryland.

Sixteen entries of bush green beans, including the cultivars ‘Tempo’, ‘Tenderwhite’, ‘Earli Gallatin’, ‘Slenderwhite’, and several Greenpod entries, were cultured in either carbon-filtered air or in non-filtered air outside of the greenhouse during June and July of 1969. Plants cultured in carbon-filtered air were exposed to ozone (.15 ppm 2 hr.) at 28 days of age, and extent of foliar injury was determined. Plants cultured in outside air were evaluated for injury at 35 days of age. All entries were injured by ozone, but ‘Tempo’ was the most sensitive; ‘Slenderwhite’, ‘Tenderwhite’, and ‘Green-seeded 407’ were only moderately injured; and all Greenpod entries were least damaged. Foliage of ‘Tempo’ and ‘Slenderwhite’ was extensively injured by outside air. The remaining varieties were nearly free of any foliar injury. The cultivar ‘Tempo’ appears to be very sensitive to air pollutants and may be a useful biological monitor in the field or the greenhouse.

11:30 Sensitivity of Lettuce Varieties to Ozone. 211

Eight different lettuce varieties were grown for 4 weeks in a 50-50 mixture of peat-perlite watered with half-strength Hoagland’s and exposed to ozone (O₃) in greenhouse exposure chambers. Ozone concentrations were varied for selected time periods to develop dose response equations for each variety. In variated studies 6 plants were exposed to 100 ppm or 70 ppm O₃ for 1½ hours and evaluated for percent injury. ‘Dark Green Boston’ and ‘Romaine’ varieties were the most sensitive at 100 ppm O₃ whereas ‘Dark Green Boston’ and Grand Rapids Forcing’ were the most sensitive at 70 ppm O₃. The least sensitive varieties were ‘Great Lakes’ and ‘Black Seeded Simpson’ at both levels of O₃. Ozone injury in lettuce ranged from a cell clearing, without collapse, to chlorotic fleckling and bifacial necrosis. Under surface injury and cell collapse was observed in some varieties and in the ‘Big Boston’ variety pigmentation developed in injured tissue.

11:45 Electrolyte Leakage as an Index of Ozone Injury with White Potato and Sweet Corn Cultivars. 212
Fieldhouse, Donald J. and Myron Sasser, University of Delaware, Newark.

Two cultivars of sweet corn and 10 cultivars of white potato were fumigated for 8 hours with ozone at 10 and 20 ppm under controlled conditions. Discs were taken from half of each leaf and soaked in distilled water. Conductivity readings were taken to determine electrolyte leakage from the cells as an indication of cell membrane injury. Correlations were made between conductivity readings and the visual symptoms of ozone injury which occurred later. Conductivity readings and ozone injury ratings were shown to differ between cultivars, between leaves on the same plant and between locations on the corn leaves.

(23) WOODY ORNAMENTALS AND TURFGRASSES: PROPAGATION AND GROWTH
Imperial A
Presiding: F. O. Lanphear, Purdue University, Lafayette, Indiana.

8:30 Effects of Cutting Age, Propagation Method and Time in Mist on Growth and Chemical Composition of Viburnum suspensum Lindl. 213
Dickey, Ralph D., University of Florida, Gainesville.

Expt. 1 — Rooted cuttings of mature wood taken in January were grown in 6" metal cans. Variables were: factorial combinations of rooting method — greenhouse bench, plastic and peat pots; time under mist — 65, 80, 95 days. Rooting method did not affect size, but 95 days under mist reduced plant quality. N, P, K, Ca was lower and Mg content higher (percent dry wt. of cuttings) of misted cuttings than cuttings taken at experiment's initiation (no mist).

Expt. 2 — Cuttings of young wood taken in May. Conditions and treatments same as exp. 1 except cuttings were under mist for 58, 73, 88 days. Plants from cuttings misted for 88 days were smaller and of lower quality than those misted for 58 or 73 days. N, P, K, Ca, Mg content of misted cuttings was lower than those taken at experiment's initiation (no mist).

8:45 The Effects of a Polymeric Resin Coated Slow Release Fertilizer on the Growth and Nutrient Composition of Taxus cuspidata and Viburnum rhytidophyloides. 214
Taxus cuspidata and Viburnum rhytidophylloides were grown outdoors in gallon containers using two planting media. Six rates of a polymeric resin coated fertilizer (18-6-12) were applied either on the surface or incorporated into the media at planting. Check treatments consisted of plants receiving no fertilizer and slow release tablets. Plant foliage was analyzed monthly during the growing season for both macro- and micronutrients as an indication of fertilizer availability and for possible correlations with plant growth. Physical measurements of fresh weight, dry weight, and length of new growth were recorded at harvest. The fertilizer application methods and rates and the media types resulted in significant differences in growth and foliar nutrient content of the plants. Visual evaluation of winter hardiness on plants overwintered under milky plastic indicated noticeable differences between treatments on Viburnum.

9:00 Rooting of Cuttings from Pre-misted Stock Plants of Euonymus alatus ‘Compacta’. 215
Lee, Choong Il. and H. B. Tukey, Jr., Cornell University, Ithaca.

Rooting of cuttings from stock plants of Euonymus alatus ‘compacta’ grown under intermittent water mist for one month were compared with those from non-misted plants. Significantly better rooting both in quantity and quality was obtained in cuttings from pre-misted stock plants. Leaf tissue of pre-misted plants contained slightly more carbohydrates, chlorogenic acid, flavonols, total phenolic substances, auxin, had a higher C/N ratio, and contained much more phenylalanine ammonia lyase, flavans, leucoanthocyanins and rooting cofactors than did non-misted plants. In stem tissue, pre-misted plants contained more chlorogenic acid, auxin, and rooting cofactors, although slightly more flavonoids and total phenolics, and a higher C/N ratio were found in non-misted plants. Levels of chemical constituents in misted plants were influenced by leaching of substances and modification of factors affecting metabolism. Changes of endogenous substances in misted plants offer additional explanation for the success of mist propagation for some species.

9:15 Effect of Intermittent Mist on Anthocyanin Synthesis in Euonymus alatus ‘Compacta’. 216
Lee, Choong Il. and H. B. Tukey, Jr., Cornell University, Ithaca.

When Euonymus alatus ‘compacta’ was grown under intermittent mist, anthocyanin synthesis was inhibited and leaf abscission was delayed even after cold treatment. Leaf tissues of misted plants had a lower content of reducing and total sugars, soluble N, asbassic acid, and K, and a higher starch content than did non-misted plants. In misted plants, degradation of starch and protein during cold treatment did not occur as rapidly as in non-misted plants, resulting in a high content of these substances in misted plants. Levels of phenylalanine ammonia lyase, related flavonoids, and total phenolic substances were consistently higher in misted plants. This suggests that inhibition of anthocyanin development in misted plants is due primarily to lack of specific factors for the conversion of flavonols to anthocyanin, rather than shortage of substrates for flavonoid synthesis. When asbassic acid and K, which were easily leached by the mist, were added to leaf discs, there was an increase of anthocyanin synthesis with attendant decreases of flavonols.

9:30 Grafting of Larch. 217
Bonaminio, Vincent P. and Edwin D. Carpenter, University of Connecticut, Storrs.

A discussion concerning the feasibility of propagating Larix decidua forms by grafting. Emphasis is to be placed on the relationship of L. decidua and L. leptolepis rootstock to “Blue” and “minima” L. decidua scions.

9:45 Culture of the Proteads Under Glass. 218
Armstrong, R. J., Longwood Gardens, Kennett Square, Pennsylvania.

The secret to successful cultivation of the Proteads seems to be what might be called studied neglect. A nearly sterile potting mixture consisting of sand and surface with a small amount of peatmoss and loam seems to be best. A pH of 6 or less is desirable, but not essential. High light levels, low humidity, cool summer temperatures and plenty of air movement over the plants are beneficial. Fertilizer of any kind is detrimental. The plants are readily propagated from seed. Mortality is high the first couple of years, but no higher than in nature. Propagation from cuttings and by grafting generally has not been successful. Contrary to the common belief, repotting the plants apparently does no harm as long as the roots are not disturbed. Some are more responsive to pruning than others. None of the insect pests commonly found in greenhouses have attacked these plants. Disease has not been a problem but there are indications that Air Pollution is.

10:00 Recess

10:15 Culture of the Hawaiian Silversword (Argyroxyphium sandwicense) Under Glass. 219
Armstrong, R. J., Longwood Gardens, Kennett Square, Pennsylvania.

Argyroxyphium sandwicense, the rare Hawaiian Silversword, endemic to volcanic craters on the Hawaiian Island of Maui is being successfully cultivated under glass at Longwood Gardens. A mixture of sand, surfase, and peatmoss with a pH of around 6 and a very low fertilizer level seems to be the best growing medium. The plants require full sun, low humidity, cool temperatures and plenty of air movement over the plants. Propagation has been successful from both cuttings and seeds. The common greenhouse insect pests do not bother these plants. However, under humid, warm, low light conditions, the plants do weaken and become susceptible to rots which develop in the crowns of these plants and if these conditions are not corrected the plants die.

10:30 Characteristics and Adaptability of Species and Cultivars of Shade and Ornamental Trees with Emphasis on Street and Highway Landscape Use. 220

To fill a long recognized need for a scientific and comprehensive evaluation of new tree introductions for the North Central U.S., a project was begun in 1966 at the Ohio Agr. Res. and Dev. Center. One phase of the project involves a completely randomized planting of 8 plants each of over 70 species and cultivars of shade and ornamental trees. Data on several characteristics and growth factors are taken throughout the year with the project scheduled to continue for ten years.

A second phase is concerned with evaluation of 52 existing street tree selections under varying environmental conditions at several sites in five Ohio cities. Although many variables will not permit an objective comparison, case histories will be developed through annual recording of growth data and environmental observation. These will provide a more knowledgeable basis for landscape recommendations in urban and suburban situations.
10:45 Salt Tolerance and Suitability of Various Grasses for use on Roadside Areas. 221
Hughes, T. D. and J. D. Butler, University of Illinois, Urbana.

Annual salt applications of 80 tons per lane mile are typical on expressways in Chicago, Illinois. Conductivities of saturation extracts in excess of 20 mmhos/cm have been found on bare soil areas. Conductivities as high as 12 mmhos/cm have been found under clumps of Nuttall alkali grass.

NaCl applications of 2% to soil reduced the top growth of 'Merion' Kentucky bluegrass, Perennial ryegrass, Western wheatgrass and Crested wheatgrass by more than 50% under greenhouse conditions. The top growth of Nuttall alkali grass, however, was reduced by less than 50%. Germination of grasses was delayed at high salt levels and some stimulatory effects on growth at low salt levels were noted.

11:00 Effect of Turf Fertilizer Ratio and Formulation on Growth Response of Grass Within the Range — over Stimulation to Non-contact Foliare Burn. 222

Bahiagrass *Paspalum notatum* Flugge, Pensacola; bermudagrass *Cynodon dactylon* (L.) Pers. *C. transvaalensis* Burtt-Davy, Tifgreen and St. Augustinegrass *Stenotaphrum secundatum* (Walt.) Kuntze, Floratine were grown in St. Lucie fine sand under greenhouse conditions. Ten applications of fertilizer were made at recommended rates during a 4 month growth period. Six commercially available turf fertilizers which varied in soluble nitrogen from 8% to 30% and which represented different ratios and formulations were used. Bermudagrass was clipped weekly at 1.9 cm, St. Augustinegrass at 4.4 cm and bahiagrass at 7.6 cm. With all three grasses highest clipping, sod and root yields and best quality resulted from treatments of 16-5-11 containing 14% soluble nitrogen. Except for a non-treated check lowest clipping, sod and root yields and poorest quality resulted from treatments of 38-0-0 containing 11% soluble nitrogen.

11:15 Effects of Four Warm Season Turf Grasses on Growth and Development of Four Shrub Species Maintained at Three Levels of Competition. 223
Dean, Stanley G., Jasper N. Joiner and Carl E. Whitcomb, University of Florida, Gainesville.

Four shrub species — *Pittosporum tobira*, *Lantana camara* 'Gold Rush', *Pyracantha coccinea* var., and *Juniperus chinensis* 'Humphreys Pride' were maintained with 3 degrees of buffers around bases, no clearing, 18” and 36” buffer zone kept void of all vegetation with 4 turfgrasses — St. Augustine (Floratine), centipede, bermuda (Ormund), and bahia (Argentine).

Lantana top growth was equally suppressed by all grasses when no Grass—shrub buffer zone was maintained. However, where buffer zones were present, Lantana responded most to 36 inch clearing of bermuda followed by bahia and centipede, with no difference between 18 and 36 inch buffers for St. Augustine. Juniper gave no consistent response to any grass or buffer zone size. Pittosporum decreased in growth when bermuda and centipede buffer zones were maintained while St. Augustine and bahia had no effect. Pyracantha responded positively to buffer zones in all cases except bahia.

11:30 Comparison of Temperatures Within and Under Three Warm Season Turfgrasses Grown Under Controlled Conditions. 224

Equipment suitable for remote automatic temperature measurements above, within and below turf was assembled utilizing copper constantan thermocouples, a Leads and Northrup recorder and a Dayton Automatic timer. Twenty temperature tracks were made, each from a different location monitored hourly. The following three turfgrasses grown in solution culture in the greenhouse were used in this study: bahiagrass *Paspalum notatum* Flugge, Pensacola; bermudagrass *Cynodon dactylon* (L.) Pers. *C. transvaalensis* Burtt-Davy, Tifgreen and St. Augustinegrass *Stenotaphrum secundatum* (Walt.) Kuntze, Floratine. The three grasses differed in temperatures recorded within and below the turf indicating texture of foliage and thickness of sod (clipping height) are effective in insolation of crowns and roots. Bermudagrass turf allowed more radiation to reach the crown during daylight hours and also allowed more radiation to escape during the nighttime.

11:45 Effects of Roots of Dormant Trees on Establishment and Growth of Four Cool Season Grasses. 225
Whitcomb, Carl E., University of Florida, Gainesville.

Four cool season grasses were seeded to containers with or without established roots of 2 dormant tree species and either in tree shade or full sun. Establishment of Kentucky bluegrass was not significantly influenced by treatments; however, establishment of *Poa pratensis* was significantly reduced by both silver maple and honeylocust tree roots. Establishment data for perennial ryegrass and creeping red fescue are inconclusive.

Weekly foliar yields of checks (no tree roots, sun or shade) were significantly higher immediately following N & K fertilization than where either silver maple or honeylocust roots were present. However, as time progressed, all treatments became not significantly different until fertilizer was again applied. This was the general response pattern of all four grasses.

Data suggest a significant nutrient competition between “dormant” deciduous trees and cool season grasses and that each grass species varies in its sensitivity to tree root competition.

(24) FLORICULTURE: ENVIRONMENTAL AND CULTURAL FACTORS
Imperial B

Presiding: H. C. Kohl, University of California, Davis

8:30 Correlation of Environmental Factors with Growth and Development of *Dianthus Caryophyllus*, L. 226
Haun, J. R. and A. J. Lewis, III, Clemson University, Clemson, South Carolina.

Greenhouse studies were conducted to determine the effect of environmental factors on growth and development. Quantitative morphological stages of leaf development were identified and recorded on a daily basis until buds developed. Bud development was recorded by direct measurements of expansion. These cumulative data were transformed into growth rates.
Soil moisture, air temperature, humidity, and solar radiation were recorded.

Lags in the effect on growth of each environmental factor were obtained by simple correlation analyses of growth rate and each environmental factor for a period of seven days preceding the observation. Multiple correlations were made using the growth rate as the dependent variable and the environmental data with appropriate lags as independent variables.

8:45 The Effect of Three Soil Moisture Regimes and Other Cultural Practices on the Development and Severity of Oedema in Pelargonium hortorum. 227


Two cultivars of Pelargonium hortorum, Ait. were used to determine the effect of some environmental conditions and cultural practices on the formation of oedema. High light intensity, low nutritional levels and high soil moisture content increased susceptibility of leaves to oedema. Severity increased when plants were subsequently exposed to environmental conditions that favored water absorption rather than transpiration. A study of stomatal behavior of oedematous leaves showed greater diffusion resistance compared with normal leaves. Excess water in leaf tissues caused hypertrophy of some cells in the leaf which led to a plugging of the sub-stomatal cavity. Sometimes there was an increase in the size of epidermal cells adjacent to guard cells forcing them to close. Sometimes the entire stomata was collapsed as a result of hypertrophy of surrounding cells. The differences in the susceptibility of the 2 cultivars to oedema under high soil moisture were shown to be due to differences in internal structure and stomatal behavior.

9:00 Responses of ‘Red Perfection’ Geraniums to Slow-release Fertilizers at Several Temperatures in the Phytotron 228

Biamonte, Richard L., North Carolina State University, Raleigh.

Cultured rooted cuttings of geraniums (Pelargonium hortorum) whose fertilizer treatments consisted of Osmocote 14-14-14 and 3M ‘Cap’ 25-0-0 fertilizer were grown in the Phytotron. To bring the levels of phosphorus and potassium in 3M ‘Cap’ up to Osmocote, 26% superphosphate was initially incorporated into the soil medium and weekly applications of 60% potassium chloride were made. At 34°C D–30°C N, meristematic growth turned yellow, then white, and these plants died after 5 weeks. At 30°C D–26°C N, meristematic growth turned yellow, and these leaves remained a light green. At 18°C D–14°C N, temperatures appeared too cold. Chlorotic plants were produced in the Osmocote treatment. The plants treated with 3M ‘Cap’ were a darker green.

This study was conducted from February until May and the data includes time of bloom and nutritional content by foliar analysis.


Two cultivars of Pelargonium hortorum Ait. were exposed to 3 soil moisture regimes for 10 weeks. There were significant differences in stomatal density and diffusional resistance of the 2 cultivars exposed to the same moisture regime. 'Dark Red Irene' leaves had fewer stomata per unit and had greater resistance than did 'Princess Irene'. Increase in water content promoted the differentiation of stomata in early stages of leaf development. As the leaves matured and increased in size the number of stomata per unit area became inversely related to soil moisture content due to increase of the leaf area of plants grown with high soil moisture content. The stomatal resistance determined by diffusion porometer in young leaves of both cultivars was highest for plants grown in soils with high moisture and lowest in plants grown with medium moisture. In old leaves the two cultivars responded differently.

9:30 Effect of Three Soil Moisture Regimes on the Growth and Anatomy of Stems, Petioles, and Leaves of Pelargonium hortorum. 230


‘Dark Red Irene’ and ‘Princess Irene’ geraniums were subjected to low, medium and high soil moisture regimes in the greenhouse for 10 weeks. A system was devised to maintain constant moisture levels. Plant height, leaf area and dry weight increased as soil moisture increased. There also was an increase in the diameter of petioles, stems and thickness of leaves as soil moisture increased. Number of xylem elements per unit area increased considerably in stems and petioles of plants grown in the high moisture regime, while phloem tissue was greater in plants grown in medium moisture. In leaves, more vascular bundles were differentiated per unit area as soil moisture decreased. ‘Princess Irene’ had fewer xylem and more phloem elements than ‘Dark Red Irene’, especially in plants grown in high soil moisture.

9:45 Transpiration of Anthirrinum majus Under Greenhouse Conditions. 231

Rutland, Rufus B., University of Georgia, Athens.

Transpiration of snapdragons in the greenhouse, as determined by continuous weighing, increased directly with radiant energy (0.2 to 1.0 cal/cm²/min). Daily transpiration was proportional to daily radiation in the range 150–375 cal/cm²/day. In the growth chamber, transpiration increased as temperature increased from 20°C to 35°C, as vapor pressure deficit increased from 10 to 30 mb, and as soil temperature increased from 10°C to 25°C. Soil temperature apparently had the most profound effect on maintaining turgidity and open stomates. Transpiration was not reduced by decreasing incident radiation by 50%. It was progressively decreased at CO₂ concentrations of 500, 700, 900 ppm. Plant factors of importance are leaf age (rate of young leaves was 140% of old leaves) and stomatal density (rate of cultivar with 170 stomates/mm² was 130% of one with 135).

10:00 Recess

10:15 Determining the Effective Period for Lighting Greenhouse Carnations for Flower Initiation and Development. 232

Elstrodt, Charles J. and James B. Shanks, University of Maryland, College Park.

Four plantings of carnations in 1968 were given 6 hours (9 PM–3 AM) of supplemental lighting from fluorescent or incandescent sources at either the 1st. 5 weeks after planting; the 2nd 5 weeks after planting; or from planting to flowering in studying the effectiveness of light on stem length and the time of flowering of greenhouse carnations. Stem elongation was influenced by both light sources during all lighting periods. Earliness of flowering
resulted primarily from the use of incandescent light during the 1st 5 weeks after planting. In 1969 plants were lighted for 3 periods with 8 hours incandescent light to observe the effect of lighting on a 2nd crop. Light applied near the time of first crop flowering proved most effective in inducing early flowers on the 2nd. crop. Further work was conducted to determine the flowering response of young carnation plants to low temperature and light. Data indicate a hastening effect on flowering from light applied at low temperatures.

10:30 An Analysis of Low Temperature Induction of Floral Initiation in Poinsettia. 233
Hackett, Wesley P. and Anton M. Kofranek, University of California, Davis.

It was found that the floral initiation response of 'Paul Mikkelsen' poinsettia to low temperatures under non-inductive photoperiods was saturated after exposure to constant temperatures of 60°F for 10 days. This response to temperatures was perceived by the shoots but not the roots. The promotive effect of a constant temperature of 60°F under non-inductive photoperiods was completely negated by a weekly application of a 40 mg/1 GA₃ solution. In contrast, plants grown at constant 70°F and treated with Cycoel initiated floral primordia at a much lower node than untreated control plants. At 70°F light intensity and quality interacted with Cycoel to promote floral initiation. These findings will be discussed in relation to a possible mechanism by which low temperatures stimulate floral initiation in this short day plant.

10:45 The Effect of Various Chemicals and Pre-Soaking Times on the Germination of Petunia Hybrida sp. Pink Magic. 234
Carlson, William H., Michigan State University, East Lansing.

Petunia seeds of the variety 'Pink Magic' were soaked with Gibberellic acid, Simazine, N₆ Benzyladenine Potassium nitrate and water for various lengths of time from 0 to 72 hours. At temperatures of 65° to 72 hours. At temperatures of 65° to 70° Gibberellic acid and Simazine. Treated seed germinated in shorter period of time than water imbibed seeds. However, at temperatures above 70° seed imbibed for 72 hours in water germinated in the least amount of time.
Techniques for pre-soaking and number of seed to sow per flat for best display will also be discussed.

11:00 Alar and Folicate Sprays for Reducing Ozone Injury on Four Solanaceous Genera. 235
Knapp, Carol E. and Donald J. Fieldhouse, University of Delaware, Newark.

Ornamental species of four Solanaceous genera (Solanum, Browallia, Petunia, and Nicotiana) were treated with 2500 ppm of Alar (succinic acid 2,2 dimethyl hydrazide) and a 1 to 20 dilution of Folicate (a wax-base transpiration suppressant). These plants were fumigated with ozone concentrations of 10 ppm and 20 ppm at temperatures of 70, 80 and 90°F for time periods of 4 and 8 hours. Five days after fumigation, leaf injury indices were recorded for the treatments. Degrees of susceptibility between treated and untreated plants differed significantly at the 1% level. Folicate gave the best protection from ozone injury, while Alar protected to a lesser extent. Electrolyte leakage from leaf discs of treated and untreated plants was measured as an indication of damage to the cell membranes. The Folicate treated plants showed the lowest amount of electrolyte leakage, followed by the Alar and then the untreated plants.
1:00 Uptake and Translocation of $^{36}$Cl in Seedling Pecans [Carya illinoensis (Wang.) K. Koch]. 241
Hanna, J. D. and J. B. Storey, Texas A&M University, College Station.

Autoradiographs were made of Riverside seedling pecans which had been exposed to root absorption of radioactive $^{36}$Cl in a liquid nutrient media for a 30 hour period. Autoradiograph image intensity was correlated with uptake of $^{36}$Cl as measured by radioassay using a Geiger-Muller counter. Activity was also correlated with plant weight, stem weight, leaf weight and root weight. Control plants yielded no artifacts or pseudoautoradiographs, and counting yielded only background radiation. All plants exposed to the $^{36}$Cl tracer showed easily discernible patterns of accumulation. Image intensity varied greatly, indicating a great deal of variation in tracer uptake by individual seedlings. Radioassay counting verified the variance. Accumulation patterns of the autoradiographs indicate the greatest occurrence of the tracer in mature leaves.

1:15 Absorption and Translocation of Zinc in Pecan Trees [Carya illinoensis (Wang.) K. Koch]. 242
Wadsworth, Grady L. and J. B. Storey, Texas A&M University, College Station.

Radioactive $^{65}$Zn research indicated that fully expanded, mature leaves were ineffective in absorbing Zn from ZnSO$_4$ foliar solutions. Young leaves absorbed more Zn than mature leaves. Upper and lower leaf surfaces absorbed equal amounts of Zn. Translocation outside of the treated leaf was negligible. Autoradiographs and radioassays indicated considerable variation from plant to plant with respect to rate of root-Zn absorption, indicating that some seedlings from open pollinated pecans from the same tree absorbed Zn better than others. When $^{65}$Zn was placed in the cambial region under a bark flap on the stem, thus bypassing the roots, the quantities of Zn translocated to the youngest, physiologically active tissues were very consistent. The uniformity of results in the bark flap experiments contrasted to lack of uniformity in the root absorption treatments lend support to the Zn ion selectivity expressed by seedling pecan root systems.

1:30 The Analysis of Pecan Leaves by Atomic Absorption Spectroscopy. 243
Smith, Morris W. and J. B. Storey, Texas A&M University, College Station.

The development of a relatively fast and accurate method of analyzing plant tissue has been made possible with the advent of the atomic absorption spectroscopic techniques. Three hundred samples per hour may be analyzed for one element by this technique after digestion and dilutions have taken place. Analyses for seven elements can be made from one sample. Zn, Fe, and K can be analyzed from the original sample. One dilution allows analyses for Ca and Mg. A third dilution allows P analysis.

1:45 Diffusion of $^{59}$Fe from Several Formulations Through Cuticles of Citrus Leaves. 244

Diffusion of different $^{59}$Fe formulations through isolated cuticles from citrus leaves were measured. Cuticles were isolated by incubating 2 cm dia. leaf discs from freshly harvested leaves in the dark at 26±2 C for 72 hours in a solution consisting of 4% pectinase, 0.1% of each of cellulase and hemicellulase, and 0.2 M EDTA in 2 N 9:1 acetic acid and sodium acetate (pH 3.8). The cuticles were used as a partition between two small chambers. The $^{59}$Fe formulations were placed in one chamber and distilled water placed in the other. Samples were taken from the distilled water to test for diffusion through the cuticle.

Each of several $^{59}$Fe formulation was tested on both upper and lower cuticle. Using this technique, the best penetration of $^{59}$Fe through citrus cuticles was obtained with $^{59}$FeEDTA.

2:00 Iron Chlorosis Patterns in Some Horticultural Plants. 245
Wallace, Arthur, University of California, Los Angeles.

Iron chlorosis has been more difficult to correct on citrus in California than on some other crops and the phenomenon appears to be related to the complex of interactions which induce the chlorosis. In Yolo loam soil, for example, chlorosis on both trifoliate orange seedlings and 'rough' lemon seedlings (to a lesser extent in the latter) has been induced by either making the soil calcareous or by acidifying the soil. The latter results in greater uptake of copper, nickel, cobalt, and other heavy metals. This acid-induced chlorosis is more difficult to correct with iron chelates than the lime-induced chlorosis. The sodium salt of DTPA induces chlorosis in plants under some conditions and again the effect is that of increasing uptake of heavy metals other than that of iron. In contrast the sodium salt of EDDHA increases iron uptake by plants with little interference with other heavy metals. Means of correcting iron chlorosis will be discussed.

2:15 The Effects of Varying N Rate and Time of Application of N or K on the Performance of Nucellar 'Valencia' Orange Trees on Two Stocks. 246
Smith, Paul F., USDA, Orlando, Florida.

A study on the effect of time of application of N and K on orange trees in a young orchard was made from 1963 to 1970. The trees were planted in an acid, sandy soil in 1957 in a split-plot formation, one-half on 'rough' lemon (C. limon [L.] Burm. f.) stock and half on 'Cleopatra' mandarin (C. reticulata, Blanco). Ammonium nitrate was applied once a year at two different rates and at three different seasons. One-third of the trees received N in October, one-third in February, and one-third in July. The rates were increased each year to compensate for tree growth but ranged between 1 and 2 lb of N per tree. Potash was applied semi-annually, annually, or biennially at a uniform rate to all trees. Overall, tree condition was excellent with no obvious reflection of differential treatment. N rate had the greatest effect on yield and fruit quality while timing effects of both N and K were almost negligible.
TUESDAY AFTERNOON

2:30 Curvilinear Relations Between Phosphorus Level in 'Valencia' Orange Leaves and Yield, Fruit Quality, Levels of Macronutrients in Leaves, and Tree Growth.

Embleton, Tom W. and Winston W. Jones, University of California, Riverside.

By varying rates and frequency of soil-applied P in an 11-year experiment, a range of P in 'Valencia' orange leaves from 0.11 to 0.21% was achieved. Curvilinear regressions between the independent variable (% leaf P) and all dependent variables (stated below) were significant at the 0.1% level. Low yields were associated with the lower leaf P levels. Highest yields occurred between 0.130 and 0.165% P. As leaf P increased, fruit size, total acid and ascorbic acid in juice, and % leaf N and K decreased; while % juice, TSS/ton of fresh fruit, ratio TSS/acidity, & % leaf Ca and Mg increased. Generally, the above decreases or increases were greater in the lower ranges of leaf P than in the higher ones. Trunk growth was greatest in the intermediate levels of leaf P and was positively associated with yield.

2:45 Effects of Foliar Applied Mg on Yield, Fruit Quality and Macronutrients of 'Washington' Navel Oranges.

Jones, Winston W., Tom W. Embleton and Karl W. Opitz, University of California, Riverside, University of California, Riverside, and University of California, Reedley.

Where Mg deficient ‘Washington’ navel orange trees were sprayed with Mg(NO₃)₂ 6H₂O leaf Mg was increased from a deficient to an optimum level in the first year of application. However, it was not until the fourth year of application that a yield increase occurred. This required at least two sprays annually. There was an increase in total soluble solids in the juice as a result of the sprays but no other consistent effects on fruit quality. Magnesium in the feeder roots was increased by the foliage sprays. Leaf K was decreased by the Mg sprays. One year after cessation of the sprays the leaf Mg was again in the deficiency range.

3:00 Adjourn for PLENARY SESSION (32), President’s Message and ASHS Business Meeting, Carillon Room.

TUESDAY AFTERNOON

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3:00 Adjourn for PLENARY SESSION (32), President’s Message and ASHS Business Meeting, Carillon Room.

1:15 Relationship of Electrophoretic Zymograms to Apple Fruit Acidity.

Quamme, Harvey A. and Cecil Stushnoff, University of Minnesota, St. Paul.

Polyacrylamide gel disc electrophoresis of water soluble proteins and several enzymes was used to try and correlate fruit acidity with isozyme banding patterns in several cultivars and hybrids of one cross. Previous workers have shown that quantitative malic enzyme activity could be correlated with acidity of the fruit. This study showed that qualitative banding patterns for malic enzyme could also be correlated with fruit acidity in the hybrids studied and in several cultivars. No association was found with malic dehydrogenase, peroxidase, glucose-6-phosphate dehydrogenase, alkaline phosphatase or total proteins and level of acidity.

Malic enzyme patterns from fruit extracts were found to be similar to those found in the leaf and shoot supporting the hypothesis that electrophoretic zymograms may be used as a pre-selection tool.

1:30 Enzymological Studies of Organic Acid Production in Citrus Fruits.

Buslig, Bela S. and John A. Attaway, Florida Citrus Experiment Station, Lake Alfred.

Bittersweet and sour oranges of different physiological ages were examined for their acidity content and the enzymes, citrate synthase (E.C.4.1.3.7.) and isocitrate dehydrogenases (E.C.1.1.1.41. and E.C.1.1.1.42). Results indicate that in part the accumulation of citric acid in sour citrus fruits may be due to differences in enzyme levels and asynchrony between citrate producing and degrading enzymes.

1:45 Determination of Carotenoids in Citrus.

Stewart, Ivan and T. Adair Wheaton, Florida Citrus Experiment Station, Lake Alfred.

A new procedure has been developed for the determination of carotenoids. The methods consist of using high pressure liquid chromatography which gives high resolution and fully instrumented analyses. The technique has been used to determine the carotenoids in various types of citrus fruit.
2:00 Evaluation of H₂S as a Citrus Root Toxicant Using a Solution Circulating System.  
Culbert, David L. and Harry W. Ford, Florida Citrus Experiment Station, Lake Alfred.

A solution-circulating system was devised to maintain a controlled flooded anaerobic environment in the root zone of 4-month-old citrus seedlings. In tests of 6 days duration, 0.1 ppm of H₂S at pH 6 (an oxygen deficient solution) did not result in significant feeder root injury whereas solution concentrations of 3.0–4.0 ppm, as measured in the exhaust line after 30 hours, killed the entire root system. Root injury was proportional to duration of exposure. The presence of H₂S in tap roots was observed by staining with p-aminodimethylaniline. Rough lemon was more tolerant to H₂S than sour orange or 'Cleopatra' mandarin. 2,3,5-triphenyl-2H-tetrazolium chloride was found to be unsuitable as a method for indicating feeder root viability after exposure to H₂S.

2:15 Factors Influencing Runner and Flower Formation in Everbearing Strawberries.  
Kender, Walter J., New York State Agricultural Experiment Station, Geneva.

A series of greenhouse and biotron studies were conducted using 'Geneva', 'Ozark Beauty', and 'Superfection' everbearing strawberry plants to determine factors involved in runner formation. Evidence has been found that activity of endogenous promoting and inhibiting substances may be associated with runner and flower production, respectively. Effects of light intensity, temperature and growth regulators will be discussed.

2:30 The Role of CO₂ in Germination and Tube Growth of Pollen.  
Sfakiotakis, Evangelos M., David R. Dilley and David H. Simons, Michigan State University, East Lansing.

The percentage germination and tube growth of pollen in a continuously ventilated system is enhanced by increasing the CO₂ concentration in the gas stream. Gas mixtures containing between 1 and 5% CO₂ resulted in maximum germination. No influence of ethylene was observed on germination nor was ethylene production detected in either ventilated or closed culture systems. Difficulties encountered in working with pollen of differing germinability will be discussed.

2:45 Ethrel, Boron, Sucrose, and Cellulase Effects on Peach Pollen Germination.  

The effects of ethrel, boron, sucrose, and cellulase on the germination of pollen of Prunus persica cv. Early Amber were studied in vitro. Both 10% and 15% sucrose resulted in good germination and good pollen tube growth. Boron at 10 ppm increased the germination at both levels of sucrose by about 15%. The presence of ethrel in the medium resulted in increased germination in the absence of boron. However, 10 ppm boron masked completely the effects of ethrel. This was also true when the pollen were exposed only to the gaseous phase of ethrel. Results with cellulase indicate some effect on pollen germination.

3:00 Adjourn for PLENARY SESSION (32), President's Message and ASHS Business Meeting, Carillon Room.
2:00 Manganese Enrichment of Tomato and Onion Seed.  
Traverse, Ross J. and Jerald W. Riekels, University of Guelph, Guelph, Ontario.

Soaking tomato and onion seed in one molar manganese sulfate (3ml. per 50 seeds) for one week enhanced the growth of tomato seedlings but had no effect on the growth of onion seedlings. Using manganese treated seed, tomato plants were grown for 48 days in manganese deficient solutions before symptoms of manganese deficiency appeared. Seeds treated at 30° C retained more manganese than seeds treated at 0, 10, or 20° C. Active metabolic accumulation apparently accounted for 15% and 35% of the manganese retained by tomato and onion seed, respectively, since this fraction could not be removed by washing and desorption treatments. The amount remaining in the seed after desorption was greater with each increase in temperature during the initial soaking period.

Riekels, Jerald W., University of Guelph, Guelph, Ontario.

Onion maturity and yield as influenced by nitrogen, applied at seeding or at various intervals throughout the season as a top dressing, was evaluated at the Bradford Marsh in Ontario, Canada for 5 years beginning in 1965. During dry seasons with no irrigation, 120 pounds or more of nitrogen per acre applied to onions at planting resulted in substantial reductions in yield but had no effect on maturity. Yield and maturity were not affected by lower rates of nitrogen. During rainy seasons or with regular irrigation, onion growth was increased and maturity was earlier with each increment of nitrogen applied at planting or as a top dressing. Plants grown with irrigation generally matured later than those grown with less water. Sprouting in storage occurred later in onions grown with high moisture and low nitrogen levels.

2:30 Influence of Tobacco Mosaic and Potato Y Viruses on Elemental Content of Pepper Plant Parts.  
Ferretti, Peter A., Ernest L. Bergman, and John S. Boyle, Pennsylvania State University, University Park.

Certain symptoms of tobacco mosaic (green and yellow isolates) and potato Y virus diseases in leaf, terminals and fruits of *Capsicum annuum* L. were found to be associated with an interaction between the virus strain and certain of the eleven elements tested (i.e. P, K, Ca, Mg, Mn, Fe, Cu, B, Al, Zn, and Na). Virus infected plants showed a decrease in nutrient content of certain elements in the leaves, but an increase in the fruits, when compared with noninfected plants. Important differences in element content, yield, and symptom expression were found between greenhouse and field experiments. Fruit tissue was found to be superior to leaf tissue as a source of inoculum for testing on virus indicator plants.

2:45 Effect of Surfactant on MnSO₄ Penetration in Leaves of Plants Differing in Surface Wax and Cuticular Thickness.  

Experiments were designed to determine the extent that a surfactant will overcome the outer wax layer and the cuticle as a barrier to foliar sprays of Mn. Leaf wax alone did not adequately account for the observed differences in Mn absorption since it acted as a barrier only in the absence of a surfactant. Mn absorption was independent of the wax deposition when a surfactant was added to the spray solution. The evidence suggested that the major barrier to Mn absorption may be attributed to differences in cuticular thickness.

3:00 Adjourn for PLENARY SESSION (32), President’s Message and ASHS Business Meeting, Carillon Room.

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**(29) VEGETABLES: BREEDING AND GENETICS**

Empire Room

Presiding: F. W. Zink, USDA, Salinas, California.

1:15 Resistance to *Aphis gossypii* Glover in *Cucumis melo* L.  
Kishaba, A. N., G. W. Bohn and H. H. Toba, USDA, ARS, Entomology Research Division, Riverside, California and USDA, ARS, Crops Research Division, La Jolla, California.

Muskmelon LJ 90234, an inbred from a single plant of P.I. 175111, was resistant to melon aphid in a naturally infested field trial at Irvine, Calif. The parent plant was free from aphids in an earlier naturally infested planting at La Jolla. Muskmelons from other sources, including that used to develop aphid resistant cultivars in the Southeast, were susceptible at Irvine.

Greenhouse trials confirmed that muskmelons resistant to eastern biotypes of aphid were susceptible to western biotypes. Aphids placed on those hosts produced large numbers of offspring in a few days.

Resistance in LJ 90234 was confirmed in the greenhouse. Aphids placed on it often died. The few survivors were scattered and reproduced slowly. Progenies from other *C. melo* selections from P.I. 175111 were susceptible. That was not surprising because the original importation included a mixture of seeds of *C. melo* and *C. sativus*.

1:30 Multiple Insect Resistant Tomatoes.  
Stoner, Allan K. and Ralph E. Webb, USDA, Beltsville, Maryland.

The evaluation of numerous cultivated tomato varieties and foreign *Lycopersicon* introductions has revealed resistance to 6 important insect pests; two-spotted-and carmine spider mites, leaf miners (*Liriomyza* spp.), potato aphids, tobacco flea beetles, Colorado potato beetles and greenhouse whiteflies. Within *L. esculentum*, high levels of resistance were found to spider mites, potato aphids and leaf miners, and lesser but usable levels of resistance were found to the other 3 insects. Fourteen lines possess resistance to both spider mites and leaf miners, and 1 line possesses high levels of resistance to spider mites and aphids. Nine *L. hirsutum* lines were tested and with few exceptions were highly resistant to all 6 insect species; however, lines of *L. pimpinellifolium* and *L. glandulosum* tested were highly susceptible. *L. peruvianum* plants were susceptible to 5 of the insect species studied and resistant to the potato aphid.
1:45 Association of Abnormal Seedlings with Turnip Mosaic Susceptibility and Downy Mildew Resistance in Lettuce.

Zink, F. W. and James E. Duffus, University of California, Davis, and USDA, Salinas, California.

A dwarfed and distorted seedling appeared in F2 progenies of crosses between TuMV-susceptible, mildew-resistant, and TuMV-resistant, mildew susceptible parents. The F1 progeny was normal seedling, TuMV and mildew resistant. Resistance to TuMV and mildew are each controlled by a single dominant gene, and are linked with a cross over value of 12.5%. In the F2 population the abnormal seedlings appeared to be predominantly of the phenotype TuMV-susceptible, mildew-resistant. This suggests a second linkage between genes for abnormal seedling and the genes for TuMV-susceptibility, mildew-resistance.

2:00 The Inheritance of Brassica Seedlings to Plasmidophora brassica Wor.

Vriesenga, J. D. and Shigemi Honma, Michigan State University, East Lansing.

The resistance to Brassica seedlings to races 1 and 3 of Plasmidophora brassica (clubroot) was investigated. Three specific phenotypic classes were observed: club free (class I), clubs on lateral roots only (class II), and club on main root (class III). Evaluations made at 60, 67 and 74 days showed a segregation of 9:4:3 (class II, class I, class I), suggesting 2 genes with class III dominant. An interaction between classes I and II was observed at 81 days. A segregation of 9:3:4 (class III: class II: class I) was observed. Evaluation of class I and class II transplants at 100 days showed a 30% transfer of class II to class I, and a 7% transfer of class I to class II. Three percent of the class II plants showed a reversion to the class III phenotype. Changes of the class II plants to the class I type may be accounted for by the disappearance of clubs due to rotting and the slow process of new root generation and subsequent club formation. Breakdown of class I is probably due to a slowed reaction of one of the genes for susceptibility.

2:15 Cytoplasmic Male Sterility in Brassica oleracea from a B. nigra Cross.

Pearson, Oscar H., Cornell University, Ithaca, New York.

From B. nigra x B. oleracea, amphidiploid reduced to the diploid level through recurrent backcrossing, two male sterile types have been derived, 1, petaloid, and 2 vestigial anther. Maintainer lines for the petaloid condition have been isolated, but this form does not develop nectaries, and the ovaries are often malformed, though fertile. As yet no homozygous maintainers have been isolated for vestigial, although segregation data indicate that it is also maternally inherited and that the two systems are not independent in that the petaloid system overrides the vestigial anther system.

2:30 Brassica nigra Koch x B. Oleracea L. and Its Derivatives.

Pearson, Oscar H., Cornell University, Ithaca, New York.

This F1 was converted to the amphidiploid equivalent to B. carinata, and reduced to the diploid level through backcrossing by broccoli as the recurrent parent. Recovery of fertility and the broccoli phenotype was complete. Preliminary results indicate that flavor components of the derived n = 9 broccoli are not the same as those in standard types. Typical cabbage types have been isolated from a similar recurrent program. A vigorous, stable, fully self fertile type was derived from the amphidiploid, with n = 17, and B. nigra cytoplasm, differing from B. carinata in isothiocyanate components.

2:45 The Statistical and Genetic Analysis of a Character Influenced by Two Genetic Loci.

Legg, Paul D. and Glenn B. Collins, ARS-USDA, Lexington, Kentucky, and University of Kentucky, Lexington.

The inheritance of alkaloids in Nicotiana tabacum L. is used as an example to demonstrate the statistical and genetic analysis of a character controlled by two genetic loci. After we established that the level of percent total alkaloids in burley tobacco is controlled by two loci, the nine possible genotypes for a two-locus model were developed and evaluated. Data on alkaloids were analyzed according to procedures for a factorial experiment with the linear and quadratic contrasts equated to additive and dominance factors. Additivity accounted for much of the variation, but some dominance and epistasis were present. The dosage effects of the two loci were considerably different.

3:00 Adjourn for PLENARY SESSION (32), President’s Message and ASHS Business Meeting, Carillon Room.

(30) ORNAMENTAL PLANTS: SELECTION AND BREEDING

Imperial A


1:15 Ornamental Proteas in Hawaii.

Parvin, Philip E., University of Hawaii, Honolulu.

Fifty-two species of Proteaceae were seeded at the Maui Branch, Hawaii Agricultural Experiment Station in 1965–66. Evaluations were made in 1969–70 for use as cut flowers or foliage, based on keeping quality and production, and landscape use based on general growth characteristics. Although 11 species are recommended as cut flowers, Leucospermum cordifolium shows greatest promise as a commercial crop. Isopogon aemomentifolius and Leucospermum reflexum display outstanding cut foliage characteristics, and 3 Banksias, 6 Leucadendrons, 6 Leucospermums, 9 Proteas and 1 Telopea can be recommended for consideration as nursery items.

Many proteas have very hard seed coats and commercially available seed yield low germination percentages. Of 18 species tested, only Protea longiflora and P. lepidocarpodendron had better germination without acid treatment. Fresh, local seed in combination with 5-minute soak in concentrated sulfuric acid produced best results on most Protea spp. Soaking for 60 minutes yields highest germination on Leucospermum spp.
plants flowering the first year generally had parents with a prolific late summer bloom.

1:45 Breeding Ornamental Mountain Laurel.  273


Interesting and horticulturally valuable selections of mountain laurel have been known for over a century. These are not generally available commercially because they are difficult to propagate asexually and open pollinated seedlings from the selections are variable. Controlled crosses show that some of the important characteristics are determined by one or a few genes. For instance, the banded flower (fusca), the five petaled flower (polypetala), and a compact growth type appear to be determined by single genes. The red budded flower trait can also be fixed so that by selecting the proper parents all the offspring will be red budded. True breeding lines of several laurel selections are being developed.

2:00 An Investigation of Factors Related to Male Sterility Expression in Pelargonium x hortorum Bailey.  274

Cohan, S. M. and R. Craig, Penn. State University, University Park.

Geranium anther ontogeny was studied in male fertile, partially fertile and male sterile lines. Phenotypic expression of the genetic male infertility was characterized as nonfunctional anthers which were in a degenerated state. Early microspore development was observed to be normal within male sterile anthers thereby discrediting a meiotic disruption as a primary causal mechanism. Anatomical observations indicated abnormal tissue ontogeny among male sterile anthers which appeared to correlate with subsequent degeneration of these anthers. Free amino acid analyses indicated abnormal accumulations of threonine, phenylalanine, and tryptophan within male sterile anthers from buds .50 to .95 cm in length. Amino acid deficiencies in male sterile anthers included gamma-aminobutyric acid, asparagine, and proline. Based upon the analyses, it appears that the gene action associated with geranium male infertility is manifested as a physiological disruption at an intermediate stage of bud development (.50-.95 cm).

2:15 Analysis of Tetraploid and Cytochimeral Daylilies Created by Colchicine Treatment.  275

Arisumi, Toru, USDA, Beltsville, Maryland.

Histological and cytological studies of tetraploid and cytochimeral daylilies derived from colchicine-treated shoots showed that complete tetraploids remain unchanged over many years of vegetative propagation. The 2-4-4 and 4-2-2 periclinal cytochimeras were relatively stable. These cytochimeras had only 2 ploidy changes over a period of 8 years. Periclinal cytochimeras having ploidy difference between the 2 internal histogenic layers, L-II and L-III, were unstable because L-III was replaced by L-II within a short time. Only rarely was L-II displaced by L-III. Sectorial cytochimeras were the least stable and the tetraploid tissues were lost during the first 2 years or recovered as periclinal cytochimeras. The shoot meristems were analyzed by indirect and direct methods.

2:30 Laboratory Breeding of Gladiolus.  276

Wilfret, Gary J., Gulf Coast Experiment Station, Bradenton, Florida.

Flower spikes of Gladiolus were harvested in tight bud and placed in vases containing either water, 600 ppm 8-hydroxyquinoline citrate plus 2% sucrose (8-HQC + S), modified Hoagland's solution, or a combination of the previous materials. Florets were hand-pollinated following removal of the anthers, tepals, and bracts. Fruit were harvested after 30 days. The 8-HQC + S increased the fresh weight of the fruit, increased the average seed weight, and increased the relative size (length x maximum diameter) of the fruit. The modified Hoagland's solution decreased the fruit weight, decreased the weight of the seed, and decreased the relative size of the fruit. The addition of Hoagland's solution decreased the effect of 8-HQC + S. No difference in number of seed per fruit was observed.

2:45 Chemical Induction of Haploidy Using Toluidine Blue.  277

Rogers, Owen M. and Salih Al-Yasiri, University of New Hampshire, Durham, and College of Agriculture, Abu-Ghraib, Iraq.

Earlier references reported that toluidine blue would prevent the division of the generative nucleus division in developing pollen tubes. The authors suggested that a concomitant event might be stimulation of the embryo without fertilization resulting in the practical production of haploid seed. A test of this premise in tomatoes and corn is described. Haploids were not produced in excess of spontaneous levels probably because fertilization of the endosperm to provide an embryo food supply could not occur.

3:00 Adjourn for PLENARY SESSION (32), President's Message and ASHS Business Meeting, Carillon Room.

(31) FLORICULTURE:
GROWTH AND DEVELOPMENT

Imperial B


1:15 The Influence of Elevated Soil Temperatures upon Development of Cuttings and Seeds of Tropical Indoor Foliage Plants.  278

Poole, Richard T. and Will E. Waters, Univ. of Fla., Apopka.

The influence of soil medium temperatures on production of several species of tropical foliage plants from both seeds and vegetative cuttings was investigated. Media temperatures, maintained with electric heating cables in transite benches were: 75 degrees F, 85 degrees F and ambient bench temperature. Samples were removed periodically to determine progress in root and shoot development.

In general, the elevated medium temperatures, with few exceptions, greatly accelerated development—thereby reducing time required for propagation up to 50% in some instances. Generally, plants held at 75 degrees F responded as well as those held at 85 degrees F.

1:30 Correlation of Carnation “Little Leaf Necrosis” with Low Foliar Potassium.  279

Paul, Jack L., Harry C. Kohl, Jr. and Anton M. Kofranek, University of California, Davis.

A disorder of carnations characterized by necrosis of the first pair of leaves below the flower is associated with low potassium (K)
content of these leaves. Affected leaves have K contents as low as 0.25%. Measurement of K content of these leaves during flower bud development showed that K was being depleted and when K reached a level of 0.5% or lower severe necrosis was noted. Healthy leaves underwent K depletion also but their K content remained higher than affected leaves. Phosphorus also decreased during flower bud development, but concentrations were similar in affected and normal leaves.

1:45 The Influence of Cultural Conditions on the Chemical Composition of Six Tropical Foliage Plants. 280
Waters, Will E. and Jasper N. Joiner, Univ. of Fla., Apopka, Univ. of Fla., Gainesville.

The chemical composition of six tropical foliage species produced under varied commercial nursery conditions was determined during three seasons. Tissue samples from Dieffenbachia sp ‘Exotica’ stock plants, Monstera delicosa stock, Philodendron oxycardium stock and rooted cuttings, and Sanseveria zeylanica small and mature plants, Scindapsus aureus stock and rooted cuttings, and Syngonium podophyllum ‘Green Gold’ stock and rooted cuttings were analyzed for N, P, K, Ca, Mg, Cu, Fe, Mn, and Zn. Satisfactory levels of these elements for normal growth were established for each species.

2:00 Influence of Photoperiod and Nutrition on Flowering of Annual Statice (Limonium sinuata). 281
Raulston, J. C., Gulf Coast Experiment Station, Bradenton, Fla.

In a factorial experiment 6 cultivars of statice were grown under short-day (SD = 8 hours), natural-day (ND = 10.5 – 13 hours), and long-day (LD = 24 hours) photoperiod regimes with 2 nutrient levels consisting of 8 or 24 oz of 20-20-20/100 gal applied weekly.

LD plants came into flower an average of 31 days earlier than ND plants, and ND plants flowered an average of 19 days earlier than SD plants. LD plants produced 13 times more inflorescences during the first 150 days of the experiment than did SD plants, with individual cultivars producing from 4 to 100 times more inflorescences under LD conditions.

Plants fertilized with 24 oz. 20-20-20 produced more inflorescences than those grown with 8 oz. Under ND and LD conditions most cultivars fertilized with the high level of fertilizer came into flower earlier than those grown with the low level. Response of nutrition on earliness of flowering under SD conditions varied with cultivar.

2:15 Flowering and Growth of Bromeliads Influenced by Ethrel.
Humphrey, Wesley A. and Tok Furuta, University of California, Anaheim, Univ. of Calif. Riverside.

Ethrel induced flowering of several species of Bromeliads when applied as a foliar spray with most of the spray directed into the “cup”. Twenty-four (24) mg. of Ethrel applied to each 22-month-old plant of Aechmea fasciata induced flowering of all treated plants. The time of year did not influence the flowering response of these plants. Flowering was induced in plants of Aechmea fasciata as young as six months. Not all treated six-month-old plants flowered. Elongation of the leaves was temporarily retarded by Ethrel on younger plants. Growth reduction was not observed with mature plants. In addition to Aechmea fasciata, the following species were induced to flower with Ethrel: Ananas comosus varegatus, Guzmania monostachia, Neoregelia carolinae tricolor, Nidularium innocenti, Tillandsia lindeniana and Viensia speciosa.

NOTICE - IMPORTANT
Members of ASHS who receive a copy of this Program & Abstracts Section by mail prior to the Annual Meeting are encouraged to bring it with them if they attend the meeting; otherwise, additional copies available at the meeting will cost $1.00 per copy.
for military service with the U.S. Army Air Force during World War II. Graduate studies leading to the PhD degree in 1948 were with a major in pomology and minors in plant physiology and soils.

During his undergraduate years, he was employed summers at the National Agricultural Research Center and at the U.S. Plant Industry Station at Beltsville. During the school year, he worked as an hourly laborer for the Department of Horticulture at the University of Maryland doing custom pruning and other horticultural jobs. At Cornell, he held both teaching and research assistantships while engaged in graduate studies.

Upon completion of graduate work in 1948, he was appointed Assistant in Horticulture at the Ohio Agricultural Experiment Station. He progressed through the academic ranks of Assistant Professor, Associate Professor, and Professor at that institution. During these years, his research program related to the nitrogen and mineral nutrition of tree fruits and grapes, the culture and management of the grape, and the reclamation of strip-mine spoil banks for the production of fruit crops. Jim's research emphasized the utilization of quantitative leaf analysis in the diagnosis of nutritional deficiencies.

On January 1, 1963, he was appointed Assistant Director of the Ohio Agricultural Experiment Station, and on July 1, 1969 became Associate Director of this institution, now known as the Ohio Agricultural Research and Development Center.

He is a member of Alpha Zeta, Phi Kappa Phi, Sigma Xi, and Gamma Sigma Delta. He joined the American Society for Horticultural Science in 1948 and has since attended all but two of the Society's annual meetings. In 1968, he was elected a Fellow of ASHS. Jim is also a member of the Ohio State Horticultural Society, the American Institute of Biological Sciences, and the American Association for the Advancement of Science.

The Beatties have two sons. James S. is a 1967 graduate of the College of Commerce of The Ohio State University. Following two years in the armed forces of the United States, including service in Vietnam, he and his wife now reside in Columbus, Ohio. William C. is presently a sophomore in the College of Engineering at The Ohio State University.

4:00 Business Meeting, American Society for Horticultural Science
Carillon Room
Presiding: James M. Beattie, President

ANNUAL BANQUET
AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE

Tuesday, November 3
Carillon Room
6:30 p.m.
Wednesday Morning, November 4
Seven Concurrent Sessions

(33) SYMPOSIUM:
VEGETABLE SEED QUALITY
Carillon Room

Sponsored by: ASHS Vegetable Breeding and Variety Committee
Presiding: W. L. Hollis, National Canners Association, Washington, D. C.

8:30 The Necessity for High Quality Vegetable Seed. 286
J. F. Harrington, University of California, Davis.

9:10 The Effect of Physiological Seed Quality on Plant Establishment. 287
B. M. Pollock, National Seed Storage Laboratory, Fort Collins, Colorado.

10:00 Recess

10:15 Genetic Aspects of Vegetable Seed Quality. 288
J. L. Morris, Rogers Brothers Co., Twin Falls, Idaho.

10:50 Handling Seed to Insure High Seed Quality. 289
D. J. Thompson, Ferry-Morse Seed Co., San Juan Bautista, California.

11:25 Adjourn.

(34) FRUIT:
CULTURAL PRACTICES
Baroque Room

Presiding: D. P. H. Tucker, Florida Citrus Experiment Station, Lake Alfred.

8:30 A System Approach for Mechanical Harvesting of Pecans. 290
Aldred, William H., Price Hobgood and Tom E. Denman, Texas A&M University, College Station, Texas A&M University, College Station, and Tarleton Experiment Station, College Station, Texas.

Stationary cleaner designed by the Texas Agricultural Experiment Station removed 87 to 98 percent of the foreign materials with a capacity of up to 2000 lbs. per hour. Modification of cultural practices is necessary for successful mechanical harvesting and the removal of foreign material from pecans.

8:45 Effect of Mechanical Harvesting on Quality of Florida Citrus Fruit During the 1969–70 Season. 291
Rackham, Robert L. and W. Grierson, University of California, Riverside, and Florida Citrus Experiment Station, Lake Alfred.

‘Hamlin’, ‘Pineapple’, and ‘Valencia’ oranges and ‘Marsh’ grapefruit were harvested by hand and with either the limb shaker, foliage shaker, or vacuum tube picker’s aid. Harvesting trials were combined with test of abscission sprays, pre- and postharvest fungicides, and simulated fresh fruit marketing tests. All shaker harvesting increased losses from cuts and punctures, but “plugging” was so reduced that percentage of sound fruit sometimes did not differ significantly from that in the hand picked controls. Mechanical harvesting increased decay during simulated fresh fruit marketing. However, decay was not significantly higher in ‘Hamlin’ oranges treated with TBZ as compared with hand harvested controls treated with diphenyl only. Mechanically harvested fruit from trees sprayed with Benlate always had less decay than hand harvested fruit without the Benlate spray. Abscission sprays were helpful only for crops intended for cannery use. Long stems on mechanically harvested fruit remain a problem.

9:00 Comparative Hand and Mechanical Harvesting of Highbush Blueberry Cultivars and Breeding Lines. 292
Galletta, Gene J. and Charles M. Mainland, North Carolina State University, Raleigh.

The continued cost-price squeeze and the decreasing labor supply threatens to make mechanical harvesting of blueberries mandatory, even for fresh marketing. It thus becomes important to know which varieties can be mechanically harvested and what problems may be associated with mechanization.

This study reports two years’ findings on the comparative hand and hand vibratory harvesting of 14 Northern and Southern highbush blueberry varieties. Methods derived for evaluating mechanical harvesting response were the 1) fruiting shoot shakability (% ripe fruit removed, % green fruit removed and % net or ripe minus unripe fruit removed), and 2) average grams force required to remove ripe fruit. By the % ripe, % net or gram force criteria the varieties ‘Morrow’, ‘Croatan’, ‘Wolcott’, ‘Murphy’, ‘NC 697’ and ‘Collins’ can be mechanically harvested readily. Ten of the 14 varieties demonstrated a shift toward earlier peak harvesting with machine harvesting. On the average, mechanical harvesting resulted in reduction of: 25% in total yield, 45% in fresh market yield, 11% in fruit color and 15% in shelf life compared to hand harvested fruit.

9:15 Pre-harvest Cultural Treatments for Mechanically Harvested Blackberries. 293
Morris, Justin R. and A. A. Kattan, University of Arkansas, Fayetteville.

The development of a mechanical blackberry harvester created many unanswered questions on the best varieties and cultural methods for production. Five varieties, four irrigation treatments and five pruning treatments have been investigated. Results indicate
that there was no yield advantage of hand pruning and removal of old canes vs. mechanical pruning without old cane removal for a two year production period. A hedge row mechanically pruned to 36 inches gave higher yields than a hedge row mechanically pruned to 48 inches. This yield increase was a result of increased branching induced by maintaining a hedge height of 36 inches. Variety performance and response to irrigation will be discussed. (A 16-mm film of the University of Arkansas blackberry harvester operating in these research plots will be shown).

9:30 A Mechanized System for Harvesting of Strawberries for Fresh Use. 294
Stang, E. J. and E. L. Denisen, Iowa State University, Ames.

A mechanized system for harvesting strawberries with minimal damage to fruit is proposed. Cultural requirements involve placing plastic or fiber mesh netting over the beds before growth of leaves and inflorescences begins, permitting leaves and fruit to develop above the netting. The prototype machine developed for the system mows off leaves, raises the netting, cuts off pedicels of fruit supported on the netting and delivers the fruit to a conveyor and bulk box before rolling up the netting for storage. The harvester is supported under and can readily be adapted to most conventional garden tractor designs. Results of 1970 tests of the system are presented.

9:45 Observations Following Commercial Usage of Cycloheximide (Acti-Aid) Applied to Early and Midseason Oranges as a Chemical Abscession Agent. 295
Wilson, William C. and James R. Buttram, Florida Citrus Experiment Station, Lake Alfred, and The Upjohn Company, Lakeland, Florida.

An experimental label for use of cycloheximide (Acti-Aid) was approved by FDA and USDA for application at the rate of 20 ppm to Florida oranges for processing. A series of 16 tests, each of an acre or more, were established. Excellent fruit abscission was obtained in all treatments.

Under Florida conditions, cycloheximide was particularly effective on early and midseason oranges during December and January. Citrus trees are normally dormant at this time, and excellent fruit loosening with little or no leaf drop was obtained with dilute sprays. However, when tree dormancy broke and young flush and blooms appeared, the trees became extremely sensitive to cycloheximide at abscission-producing concentrations, and its application resulted in considerable phytotoxicity. Phytotoxicity also resulted when trees in a weakened growth state were sprayed with 20 ppm cycloheximide.

10:00 Recess

10:15 Facilitated Harvest of Sweet Cherries (Prunus avium L.) with 2-Chloroethylphosphonic Acid. 296

Foliar sprays (500 and 1000 ppm) of 2-chloroethylphosphonic acid (CEPA), applied 6 to 14 days before harvest, resulted in a significant decrease (40–50%) in force required to remove the fruit (FRF) from its pedicel. Both increased duration of exposure and concentration were related to lower FRF in ‘Windsor’ and ‘Emperor

10:30 Promotion of Berry Abscission in ‘Concord’ Grape with 2-Chloroethanephosphonic Acid. 297
Hull, Jerome, Martin J. Bukovac and Gordon S. Howell, Michigan State University, East Lansing.

2-chloroethanephosphonic acid (Ethrel) was applied to ‘Concord’ grape vines September 18, 1969 at concentrations ranging up to 1600 ppm. Berry removal force was reduced 5% at 25 ppm to 50% at 1600 ppm within 4 days. Eight days following treatment, the berry removal force had decreased 10 to 80% depending upon concentration. Reduction in berry removal force occurred more rapidly at higher Ethrel concentrations. Treatments had no measurable effect upon percent soluble solids, juice pH or total acid content. Spraying vines with 400 ppm at 4 day intervals from September 17 to September 29 indicated a greater response to Ethrel during periods of warmer temperature.

10:45 Mechanical Pruning of Hedgerow Apples with a “Slotting Saw”. 298
Cain, John C., New York State Agricultural Experiment Station, Geneva.

The principal fruiting of apples is on spurs or short shoots borne on wood three years of age or older. Annual hedging to limit tree spread prevents the formation of new fruiting wood and develops a thick outer shell of new shoots which shade internal spurs and reduces production.

A hydraulic “slotting saw” mounted on a boom to penetrate the tree hedges a 16 in. band. By suitable cycling the hedged bands, one position is hedged every four years. This permits the regeneration of fruiting wood and sufficient penetration of light to maintain fruiting on interior spurs.

Experiments begun in 1968 on 4 varieties indicate suitable maintenance of fruiting wood, more fruiting of interior spurs and control of tree spread to a radius of about two feet greater than the hedged surface. The cultivars ‘McIntosh’ and ‘Rome’ appear to be more suitable for this type of mechanical pruning than ‘Spy’, with ‘Macoun’ intermediate.

11:00 The Fruitfulness of Kniffin-Train ‘Concord’ Grapevines. 299
Shaulis, Nelson J. and Robert G. D. Steel, New York State Agricultural Experiment Station, Geneva, and North Carolina State University, Raleigh.

A 1960–1966 study in New York of the effect of a wide range of cultural practices on the size of vine and the crowding of shoots within the canopy showed that the latter had a dominant effect on the fruitfulness of Concord grapevines. That effect, although dominant, was not exclusive. Within that general relationship and especially where there is a near-minimum amount of crowding, the nitrogen level and the extent of weed control affected fruitfulness.

Severity of crowding affected the fruitfulness components berry number per cluster and berry size more than the number of clusters produced per retained node.
11:15 Increasing the Number and Crotch Angles of Primary Branches of Apple Trees with Cytokinins and Gibberellic Acid. 300


Cytokinins and gibberellins applied to dormant buds on young apple trees significantly increased the number of growing buds and the angle between the main trunk and the new shoot. Total shoot growth on treated trees was nearly double that of control trees. The first year in the orchard, nursery trees treated with growth regulators several weeks before planting produced branches with wide crotch angles from which good permanent primary scaffold limbs could be selected.

11:30 Time of Pruning Peach Trees Affects Short Life. 301

Horton, Billy D. and Victor E. Prince, SE Fruit and Tree Nut Research Station, Byron, Georgia.

November and December have been shown to increase tree death from short life symptoms over other pruning times of January which was intermediate and February which had only 1 tree to die.

11:45 Postharvest Application of Growth Regulators to Increase Spur Formation and Subsequent Flowering and Fruiting of Young Apple Trees. 302

Williams, M. W., USDA, Wenatchee, Washington.

The postharvest application of 2 chloroethylphosphonic acid (Ethrel) alone and in combination with succinic acid 2,2, dimethyl hydrazide (Alar) reduced terminal vegetative growth and promoted spur development in the tree during the year following treatment. The induction of spur formation resulted in an increase in bloom the second season after application. Data on the effectiveness of spring vs fall applications will be reported.

(35) FRUIT:
BREEDING AND GENETICS

Silver Chimes East

Presiding: C. Jack Hearn, USDA, Orlando, Florida

8:30 Monoploid Peaches, Prunus persica Batch. Description and Meiotic Analysis. 303

Hesse, Clarion O., University of California, Davis.

Two monoploid peaches are described. Analysis of meiosis of one showed that the chromosomes were distributed at random in the first meiotic division, but that some irregularities occurred because chromosomes are occasionally excluded from the spindle. But one bivalent was observed in over 200 MI—AI plates. The second division was normal, regardless of the first division distribution. Due to varying orientation of the second division spindles approximately 10% dyad spores formed, which evidence indicates are normal haploid gametes. Germinated pollen was observed.

8:45 Selection of F1 Hybrids of Peach and Almond Resistant and Immune to Root Knot Nematodes. 304

Kester, D. E., C. J. Hansen and B. F. Lownsberry, University of California, Davis.

Resistance or immunity to the root-knot nematode Meloidogyne incognita (Kofoid and White) Chitwood and M. javanica (Treub) Chitwood has been incorporated into F1 hybrids of almond (Prunus amygdalus Batsch) x peach (Prunus persica L.) The almond parents were nematode susceptible almond clones — "Almond B", "Nonpareil", 'Ne Plus Ultra' and 'Texas' (Mission). The peach parents were 'Bokhara', 'Okinawa' and several unnamed clonal selections. The nematode reaction conferred by resistant or immune peaches to peach x almond hybrids was the same as that conferred by the peaches to crosses with susceptible peaches. Vegetative propagation of selections immune to both nematodes has been achieved. With some combinations seed production of hybrids should be possible.

9:00 Graft-Compatibility of Almond Seedling Populations to 'Marianna 2624' Plum Rootstock. 305

Kester, D. E., University of California, Davis.

Seedling populations resulting from crosses utilizing graft-compatible ('Texas', 'Merced') and graft-incompatible varieties ('Nonpareil', 'Sel. 5A-3', 'Kapareil') as parents were budded to 'Marianna 2624' plum rootstock. The inheritance pattern of graft-incompatibility observed at the end of four years showed a continuous range of reaction from highly compatible to highly incompatible. There was a close association between the relative compatibility of 'Marianna 2624' among the almond clones used as parents and the range of compatibility of their respective offspring. It is likely that the difference between compatibility and incompatibility of almond to this rootstock is quantitative rather than qualitative.

9:15 Growth in vitro of Tissue of Almond, Almond Hybrids and Some Other Prunus. 306

Kester, D. E., University of California, Davis.

Growth patterns and responses to various factors are described for tissues of almond, almond hybrids and some other Prunus grown in vitro. Growth was influenced by the clone, the particular part of the clone used as a source and culture conditions. Kinetin, NAA and thiamin appear essential in the basal medium for continuous growth. In some instances, persistent variability developed among callus lines even with growth medium, clone and source part constant.

9:30 Measures of Inbreeding Potential in Cultivated Polyploid Blueberries. 307

Galletta, Gene J., North Carolina State University, Raleigh.

Inbreeding of polyploid blueberries would be desirable to test parent potential, to induce homozygosity for certain characteristics, and to breed toward seed-propagated cultivars. Pollination and seed germination studies of 19 highbush blueberry cultivars (tetraploid) showed an average percent set on selfing equal to that of intervarietal highbush cross pollinations. Seventeen rabbiteye blueberry (hexaploid) cultivars averaged the same percent set as that of intervarietal rabbiteye cross pollinations. Self-fruitfulness varied with the clone used as a parent. Selfing and sib crossing reduced the seed count per berry markedly in both species compared to
outcrossing. However, inbred seed progenies showed reasonable germination and all inbred progenies had some seedlings of high vigor. The success of a blueberry inbreeding program would appear to depend largely on the initial choice of parents because of variation in self-fruitlessness.

9:45  Chromosome Associations at First Meiotic Division in Tetraploid Clones of *Vaccinium corymbosum* L. 308

Jelenkovic, Gojko and L. Fredric Hough, Rutgers University, New Brunswick, New Jersey.

The analysis of chromosome pairing at diakinesis and metaphase I in PMC of 'Elizabeth', 'Darrow' and 'Murphy' revealed that the overwhelming majority of chromosomes were paired as bivalents. On the basis of proximity, co-orientation and visible material connection, the bivalents were classified as independent (those not involved in any association), and pseudo-multivalents (those forming groups of 211, 311, etc.). As a rule, the bivalents which were associated in pseudo-multivalents were paired side-by-side with each other at metaphase I. Pseudo-quadrivalents and pseudo-hexavalents were most frequent. The frequency distribution for the number of independent bivalents per cell within each of the three genotypes was different. Thus the largest number of independent bivalents was found to be 7, 15 and 18 for 'Murphy', 'Elizabeth' and 'Darrow' respectively.

10:00 Recess

10:15 Developmental Morphology of Interspecific Hybrid Blueberry Seed. 309


Morphological development of blueberry seed was investigated for Florida 4-15, Florida 4-71, and 'Bluegem'. Germination of pollen tetrad appeared normal and pollen tubes required 4–7 days to grow from the stigma to the ovule. Endosperm development always preceded embryo development. Cell wall formation began after the 4-free-nuclei stage, but more than 4 free nuclei were observed in some embryo sacs. Endosperm became filled with food storage bodies and rapid embryo development followed, but endosperm was the predominant seed tissue at fruit ripening.

10:30 Relationship Between Original Seedling Performance and Subsequent Performance of Strawberry Selections. 310

Brinthurst, R. S. and Victor Voth, University of California, Davis.

We have reported reasonably high heritability values for the most important economic traits in strawberries: yield, fruit size and firmness. However, subsequent testing conditions are somewhat different, although the original seedling tests are designed to simulate the standard summer planting system of California. To evaluate the problem, original seedling data for yield, fruit size and firmness for about 50 selections from 17 progenies were compared with three tests of the same selections. The results show that performance as represented by the above economic traits was very similar in the two types of tests and that they were acceptable close for two test sites. Differences were logical and may be accounted for in terms of the physiological conditioning that preceded the tests.

10:45 Evaluation of Factors Determining Fruit Size in the Strawberry. 311

Moore, James N., Gerald R. Brown and Elvin D. Brown, University of Arkansas, Fayetteville.

The relative decline in fruit size "down" the inflorescence of large-fruited clones was much greater than for small-fruited clones. Large-fruited clones produced fruit with more achenes and larger achenes than did small-fruited clones. Fruit weight was positively correlated with total achenes per fruit, developed achenes per fruit, mean weight of total and developed achenes, and fruit weight per developed achenes. These results lead to the conclusion that fruit size differences among strawberry clones are due to the combined effects of developed achenes number, developed achenes size, differential activity of achenes in producing growth hormones and differential sensitivity of receptacular tissue in responding to growth hormones.

11:00 Unexpected Ploidy Levels in Citrus Hybrids. 312

Esen, Asim and Robert K. Soost, University of California, Riverside.

Extensive chromosome counts show that tetraploid hybrids regularly occur from crossing diploid by tetraploid citrus. The frequency varies with the ovule parent. Production is not caused by an unusually high number of triploid male gametes nor by slow pollen tube growth of diploid pollen. However, delayed pollination in diploid by diploid crosses has produced triploids, indicating that the chromosomes of the egg may reduplicate, if fertilization is delayed.

11:15 Isoenzyme Indicators of Genetic Relationships Among Citrus Species. 313

Warner, Robert M., Mahesh D. Upadhya and James L. Brewbaker, University of Hawaii, Honolulu, Central Potato Institute, India, and University of Hawaii, Honolulu.

Peroxidases, leucineaminopeptidases, esterases and other enzymes from saline extracts of citrus shoot meristems were electrophoresed and stained on starch gels at pH 8.3. Bands so distinguished were referred to as "isozymes" and were used as protein fingerprints in a study of Citrus species and varietal relationships. Peroxidase zymograms were distinguished for most of the species studied. Major relationships were indicated by the presence of certain distinct bands. One cathodal peroxidase band appeared consistently in Citrus *reticulata*, *C. aurantiifolia*, *C. paradisi*, *C. sinensis* and *C. jambhiri* but was absent in gels of *C. medica*, *C. grandis*, *C. aurantium*, *Citropsis gilletiana* and *Fortunella margarita*. Hybrids within a species show band contributions from 1 or both parents. In *C. reticulata* 3 hybrids of 'King' × 'Willowleaf' (Medit.), the 'Kinnow', 'Wilking' and 'Honey' all showed 1 band distinctive of 'Willowleaf' but only 'Wilking' produced 1 band distinctive of 'King'.

11:30 Induction of Lycopene Accumulation in Citrus Fruits. 314

Coggins, Charles W., Jr., Henry Yokoyama and Gilbert L. Henning, University of California, Riverside, USDA, Pasadena, California, and University of California, Riverside.

We have reported recently that 2-(4-chlorophenylthio)-triethylamine hydrochloride (CPTA) causes lycopene to accumulate in the
fruits of many citrus cultivars and in certain other carotenogenic tissues that normally do not accumulate the pigment. In citrus fruits, lycopene accumulation has occurred in the flavedo, the albedo, parenchyma cells of vascular bundles, and to a limited extent in the endocarp. This discovery provides the carotenoid investigator with a tool to study carotenoid biogenesis and gene control mechanisms. Since lycopene is responsible for the pink or red color in certain grapefruit varieties, it is possible that the response will be of commercial value in the culture of these varieties under conditions where lycopene does not accumulate to the desired level. Colorless carotenoid precursors accumulate in mature grapefruits. We speculate that CPTA causes the tissue to convert these precursors into lycopene.

11:45 Macadamia Nut Cultivars in Hawaii.


Tree and nut characteristics of 5 leading clonal varieties Macadamia integrifolia grown commercially for nut production are discussed, analyzed and described in detail.

(36) VEGETABLES: PHYSIOLOGY

El Dorado Room

Presiding: George H. Collins, Horticultural Experiment Station, Vineland Station, Ontario, Canada.

8:30 Potato Protein Crystals: Isolation and Characterization.

Sosa, Mario, Johan E. Hoff and Charles M. Jones, Purdue University, Lafayette, Indiana.

Cubical crystals, known for more than a century to occur in potato tubers, have for the first time been isolated and characterized by conventional chemical and biochemical methods. The crystals are composed of sub-units reminiscent of phytosiderin and are mainly composed of a protein with a uniquely high lysine and a very low if any cysteine/cystine content. In gel electrophoresis the protein separates into two fractions which have a tendency to associate into multiple forms under the proper conditions.

No physiological activity can so far be connected with the protein, although, containing small amounts of iron, a tentative role of iron storage may be ascribed to it. The possible origin, functions and occurrence of the protein are discussed.

8:45 Kinetics of Cuticular Penetration.

McFarlane, James C. and Wade L. Berry, University of California, Riverside.

The cuticle of a plant leaf has three chemically different layers (epicuticular wax, cutin, and suberin). By using pectinase, ZnCl in HCl and hexane, cuticles from the upper (nonstomatous) surface of apricot leaves were prepared which represented various combinations of these layers. Using a continuous flow diffusion cell, specifically designed to reduce the boundary layer, the permeability coefficients were calculated for Li, Na, K, Rb, Ca, and Mg. Biological variation was eliminated by making all measurements on the same cuticle. The effect of the various components of the cuticle were measured, thus defining some of the various resistances in foliar absorption. Rates of permeation through the cuticle were demonstrated to be substantially greater than previously reported.

9:00 Relation of Internal Plant Water Stress to Fruit Growth of the Greenhouse Tomato.

Kretchman, Dale W. and H. J. Mederski, Ohio Agricultural Research and Development Center, Wooster.

Continuous and simultaneous measurement of internal plant water status and fruit growth were made using the Beta ray gauging technique and a linear displacement transducer. Results revealed that fruit growth was maximized under conditions of minimum plant water stress. As the leaf water content decreased, fruit growth rate decreased and finally ceased under high stress conditions. This occurred before apparent plant wilting. As leaves became wilted and high water stress was indicated by the Beta ray gauge recording, a reduction in fruit size occurred. An elimination of plant water stress by irrigation resulted in a rapid initial increase in fruit size followed by continued growth at a slower rate as the water status within the plant returned to normal. Fruits on water-stressed plants did not attain the size of those on plants grown continuously under conditions of more favorable water status.

9:15 The Physiological Effect of Sudden Wilt on the Muskmelon Plant.


A serious disorder of muskmelons grown in northern areas which results in a very rapid wilting and often death of the vines just prior to harvest has been termed "sudden wilt." Our observations indicate that wilting plants also exhibit symptoms of a mosaic virus. Apparent photosynthesis is lower and dark respiration is higher in leaf tissue of wilting compared to control plants resulting in a reduction of sugar content of wilted tissue.

Root growth and water uptake of plants infected with cucumber mosaic virus was significantly reduced and roots exhibited a yellow restricted area near their tips which is associated with the virus infection. Water stress applied to plants caused infected plants to wilt at lower osmotic pressures. It is postulated that the restricted root growth due to virus infection, coupled with the increased water requirement of fruiting plants results in the wilting and eventual death of plants in the field.

9:30 Formation of Callus and Roots on Excised Tomato (Lycopersicon esculentum) Ovaries.

Whitwood, Walter N. and M. LeRon Robbins, Iowa State University, Ames.

Flowers of Lycopersicon esculentum 'White Beauty' and 'Big Boy' were excised 8 days before anthesis. Ovaries were placed on an agar medium containing sucrose, mineral salts, vitamins and auxin; and cultures were maintained in a growth chamber. Temperature was regulated at 26°C day and 21°C night; lighting was supplied by fluorescent tubes producing about 2000 Lu/m² outside the test tubes. Callus tissue developed on several ovaries, and roots were initiated from the base of a 'White Beauty' ovary after 3 weeks in culture.

9:45 The Relationship of Light to Nitrate Accumulation in Vegetable Crops.

Cantliffe, Daniel J., New York State Agriculture Experiment Station, Geneva.

The effect of light on NO₃⁻ accumulation was investigated in various vegetable crops. Little NO₃⁻ accumulated in spinach under
high to medium light intensities. As the intensity was dropped below 1200 ft-c, NO$_3^-$ began to accumulate even at low soil N levels.

The effect of the time of the light period that the plants were harvested on the accumulation of NO$_3^-$ was most pronounced with radishes. Snap bean fruit failed to accumulate NO$_3^-$ and spinach was generally unaffected.

Accumulation of NO$_3^-$ decreased in table beets with increasing photoperiod up to 20 hours of light. Accumulation was greatest under an 8-hour photoperiod and high soil N rates.

10:00 Recess

10:15 Effects of Day Length and Temperature on Sprouting Broccoli. 322

Reynolds, Charles W., University of Maryland, College Park.

Green sprouting broccoli was grown in growth rooms under controlled temperatures and day lengths. Temperatures were 85, 75, and 65°F during the day and 10° lower at night. Day lengths of 16 and 12 hours were used with each temperature.

The number of days from planting to appearance of flower heads decreased with both shorter days and lower temperatures. At 65°F and a 12-hour photoperiod, 81 days were required from seeding until 50% of the plants had visible heads. At 85° and a 16-hour photoperiod, 124 days were required to reach the same stage of development.

Quality of broccoli was poor at the 85° temperature due to excessive leafiness of heads and to browning and abscission of flower buds. Heads of desirable type were produced at both the 75 and 65°C temperatures.

10:30 Response of Tomato (Lycopersicon esculentum) to Photoperiod. 323

Aung, L. H. and Max E. Austin, Virginia Polytechnic Institute, Blacksburg.

The effects of photoperiods on vegetative growth and flowering of tomato cultivars differing in growth habits were investigated. Results indicated that the cultivars responded differentially in vegetative (leaf area, stem length, no. of axillary buds) and reproductive (flower no. per inflorescence, size of inflorescences) developments to the photoperiodic treatments. Development of some of the cultivars was promoted by a short (8-hour) photoperiod, while others by a long (14 to 16-hour, or dark-interuption) photoperiod. The implication of these findings in relation to the earliness or yield responses of tomato cultivars grown on different planting dates or locations will be discussed.

10:45 The Influence of Light Intensity on Growth and Water Consumption of Bean Plants. 324

O'Leary, James W. and George N. Knecht, University of Arizona, Tucson.

Red kidney bean (Phaseolus vulgaris L.) plants were grown in nutrient solution, which was changed every day, plant growth chambers at light intensities of 2000, 4000, 6000, and 8000 fc. Growth data were collected after a 20-day growing period, and water usage was measured daily. The collected data were subjected to statistical analysis. Leaf area was reduced significantly at 8000 fc. Fresh weight (FW) and dry weight (DW) were highest at 4000 and 6000 fc. Both FW and DW were significantly less at 2000 fc, but only FW was significantly less at 8000 fc. The water consumption under 2000 and 8000 fc was significantly less than at the two intermediate levels.

11:00 The Effect of Light Intensity on Stomate Number and Density in Bean Plants. 325

Knecht, George N. and James W. O'Leary, University of Arizona, Tucson.

Stomate density and leaf area were determined for 4 groups of Phaseolus vulgaris L. (Red Kidney Bean) plants, which had been grown at 2000, 4000, 6000 or 8000 fc light intensity. The plants were grown in nutrient solution in growth chambers with all other conditions held constant. Measurements were made from the third trifoliate leaf after a 20 day growing period in the chambers. Variance analysis revealed those plants grown at 2000 fc had a significantly greater leaf area than those grown at 4000, 6000, or 8000 fc. The plants grown at 8000 fc had significantly less stomate area than those grown at 4000 or 6000 fc. The stomate density was significantly greater for those plants grown at 8000 fc and significantly less at 2000 fc compared to the 2 intermediate light levels. However, the total stomate number per trifoliate leaf did not vary significantly among the 4 light levels.

11:15 Potato Tuber and Blossom Yields as Variable Responses to Near-Ultraviolet Irradiance. 326

Nilsen, Karl N. and Darrel R. Bienz, Washington State University, Pullman.

Diploid potatoes (P.I. 5279.15) were grown in a large growth chamber which was compartmentized into four or six identical sections. Individual section uniqueness existed primarily in near-ultraviolet irradiance. This was achieved through placement of filters (between lamps and plants) which individually possessed unique near-ultraviolet transmission properties and/or by direct near-ultraviolet supplementation within the section.

Blossom yield was substantially enhanced with those plants receiving near-ultraviolet supplementation by means of BL (black-light) fluorescent lamps.

Tuber yield appeared as a conversely-effected response as greater yield (in both numbers and individual size) was from those plants grown under Plexiglas-filtered irradiance which is consequently deficient in wavelengths shorter than 340 nm. This potato clone clearly reveals remarkable growth and development plasticity in response to variable near-ultraviolet irradiance.

11:30 Bulbing of Onions as Influenced by Near-Ultraviolet Irradiance. 327


Onions were grown in a quartered growth chamber with each section differing from the others only in the translucent filter between the light source and the plants. The four filters differed primarily in wavelength transmission within the near-ultraviolet.

Most rapid early growth as measured by total plant weight occurred under the polyvinyl chloride filter which permitted passage of all wavelengths longer than 300 nm. and under the polyethylene filter which transmitted a part of all wavelengths in the near-ultraviolet. Least growth occurred under Mylar and Plexiglas filters which permitted passage of wavelengths longer than 315 and 340 nm. respectively. Initial bulbing response, determined by the bulb diameter to neck diameter ratio, was greatest under the polyvinyl chloride filter.

Supplementing the normal growth chamber light with higher intensities in the red and far-red areas of the spectrum also increased growth and bulbing.
Penetration of 14C-SADH into primary bean leaves (Phaseolus vulgaris L.) was established using a leaf disk method. Rate of penetration was constant over 12 hr and proportional to SADH conc. both in light (600 ft. c.) and dark. Penetration in light was about twice that observed in dark. Penetration increased with increasing temperature (5–35°C), and Q10 values observed were 1.80 (20–30°C) and 2.50 (25–35°C). Minimizing the cuticular barrier by using leaf strips (250 µm wide) suspended in a buffered (0.01 M, MES + KOH, pH 6.5) medium containing 5 X 10⁻⁴ M CaSO₄ and 2 X 10⁻⁸ M 14C-SADH, changed the uptake pattern. Uptake by leaf strips increased with time (up to 6 hr) and was identical in light and dark. Maximum uptake occurred at 30°C, the Q10 was 2.10 (20/30°C). Leaf strips accumulated SADH against a conc. gradient. On a leaf area basis, the rate of uptake by strips was at least 10 times the rate of penetration through the cuticle.

(37) VEGETABLES: CULTURE
Empire Room

Presiding: George A. Bradley, University of Arkansas, Fayetteville.

8:30 The Influence of Crown Orientation on Crown Growth Patterns in Asparagus officinalis L. 329
Souter, Frank D., James I. Stillman, and Frank H. Takatori, University of California, Riverside.

The influence of orientation of asparagus crown transplants on the mode of growth and the vertical movement was studied. One-year-old crowns were planted in four different positions in an 8-inch-deep furrow. The location of each crown was identified with a transit measurement at planting and the vertical movement was determined each fall. The position in which crowns were planted did not affect the survival of the plants, but a significant reduction in yield was obtained from crowns planted upside down and from crowns laid on their sides. Vertical movement occurred in all treatments, however, crowns planted upside down and on their sides showed considerably more vertical movement than did the other treatments. The growth characteristics of the plants were affected by the orientation of the crowns.

8:45 Direct-Seeding of Asparagus for Mechanical Harvesting 330
Sims, William L., University of California, Davis.

Direct seeding of asparagus has increased plant populations, total yield, and given as much as two weeks earliness in harvest with the variety UC 72 when compared to the conventional crown planting. This is necessary in order to economically mechanically harvest asparagus with either a non-selective or a selective system. Twin rows (12” apart) on 5 foot beds have proven satisfactory. Plants 3 to 4 inches apart within the row for a plant population of 40,000 to 60,000 plants per acre gave better spear size than those at closer in-row spacing.
WEDNESDAY MORNING

Commercially grown broccoli and cauliflower are usually harvested a multiple of times and seldom subjected to a single harvest. Future crop harvest mechanization will likely be dependent on a single harvest procedure and in order to be effective an estimate of when to make the single harvest will be necessary. A sequential method of harvesting was used to effectively arrive at such crop yield optimums.

10:00 Recess

10:15 Effect of Plant Spacing on Maturity, Spear Weight, Incidence of Hollow-Stem and Yield of Single-Harvested Broccoli. 335

Cutcliffe, Jack A., Research Station, Charlottetown, Prince Edward Island, Canada.

Several broccoli cultivars were grown at ten plant spacings and three rates of nitrogen in systematic fan designs. Single-harvest yields increased to approximately 9 metric tons per hectare as spacing was reduced to 40 cm x 40 cm. Further decreases in spacing to approximately 28 cm x 28 cm had very little effect on yields. As spacing was decreased from 28 cm x 28 cm to 20 cm x 20 cm yields were progressively decreased. Spear weight and incidence of hollow-stem decreased and crop maturity was delayed as distance between plants decreased. Yields increased as rates of applied nitrogen increased. Within wide limits, plant spacing had only a slight effect on concentration of maturity. The yield of marketable spears increased as much as 0.45 metric tons per hectare per day during the 4 to 6 day period prior to the optimum harvest time.

10:30 Spacing-Pruning Effects on Yield and Fruit Size Distribution of Trellised Tomatoes. 336

Konsler, T. R., North Carolina State University, Raleigh.

Spacing-pruning experiments were conducted two years with ‘Manapal’ tomato grown on trellises. In-row spacings ranged from 3 inches to 24 inches apart with plants pruned to 1 leader or to 2 leaders.

Yields of marketable fruit increased with plant population over the range of spacings used. Under the conditions of the experiment, plant spacing and stem spacing had approximately equal effects on total yield; however, at a given stem population, the single stem per plant pruning technique resulted in increased early yields.

Average fruit weight decreased with increasing plant population. At comparable stem populations, the single stem pruning technique resulted in more marketable fruit of a given size than the double stem system.

10:45 Effects of Cultural Practices and the Environment on the Yield of Pickling Cucumbers. 337

Nicklow, Clark W. and Jose M. Fernandez, Michigan State University, East Lansing.

Supplemental nitrogen applied when the flowers began to appear had little influence on the yield of fruits per acre at plant populations less than 100—125,000 plants per acre. However, at higher plant populations nitrogen became the major factor limiting the production of pickling cucumber for once-over harvest. There is evidence to suggest that dips in photosynthetic rate during fruit development may play an important role in the production of misshapen fruits, which resulted in a significant decrease in crop value.

“Misting” during periods of high atmospheric stress increased the total number of fruits, the usable yield, and the dollar value per acre, principally in the low and intermediate plant populations, compared with the conventional irrigation used to maintain soil moisture.

11:00 Relationship Between Cultural Practices and Morphological and Physiological Changes in Plant Communities of Pickling Cucumber. 338

Fernandez, Jose M. and Clark W. Nicklow, Michigan State University, East Lansing.

Results indicated that supplemental N levels applied to several gynoecious pickling cucumber varieties increased the leaf area per plant and the percentage of gynoecious plants. As the plant population increased, the need for N increased suggesting that N was the most important nutrient under conditions of high plant populations. Irrigation by “misting” during periods of high atmospheric stress increased the internode length and the leaf area per plant, principally in the low and intermediate plant populations compared with conventional irrigation used to maintain soil moisture. Under conditions of high plant population, the competition for light at the end of the growing season had a marked detrimental influence on the gross photosynthetic rate. An MSU experimental cucumber was shown to be more adaptable to high plant populations because of certain morphological and growth characteristics.

11:15 Rooting Cucumber (Cucumis sativus, L.) Cuttings. 339

Shanmugasundaram, S., and Howard L. Adams, University of Wisconsin, Madison.

Vegetative propagation by rooted cuttings is useful in the breeding of cucumbers. Apical stem cuttings with a minimum of 3—4 nodes were rooted in water, Hoagland’s solution, vermiculite or moistened paper towels. Rooting cuttings in water at 22—24°C in brown vials proved to be the most efficient since it minimized the soft rotting of cuttings rooted by misting in sand, vermiculite or towels. Application of Rootone powder to the cuttings, Hoagland’s solution, or aeration of the liquid did not appreciably enhance rooting. Light on the lower end of the cutting completely inhibited root initiation; thus, opaque containers were required for cuttings rooted in liquid. Cuttings from senescing plants were unsuitable for propagation.

11:30 Growth, Development and Plant Geometry of Cabbage. 340

Kinbacher, E. J., Ralph E. Neild and Hamdy M. Eisa, University of Nebraska, Lincoln, and University of Arizona, Tucson.

Three cabbage varieties with a wide range in maturity were employed, namely ‘Golden Acre’ (64 days) ‘Bonanza’ (80 days), and ‘Wisconsin Hollander’ (115 days). In 1968 and 1969, transplants were placed 50.8 cm apart in rows spaced 50.8 cm apart. The growth pattern of the varieties was determined by harvesting plants periodically from June to September. ‘Hollander’ exhibited the fastest canopy development, since ‘Hollander’ leaves completely covered the soil between the rows about a week before the other varieties. ‘Hollander’ leaf area developed at the same rate or at a faster rate than the other varieties. In 1969, ‘Hollander’ exhibited the greatest leaf area by mid-June. The greatest total plant dry weights were produced by ‘Hollander’. ‘Hollander’ produced the greatest leaf dry weight per plant, while ‘Golden Acre’ produced the maximum head dry weights both years. The heads of ‘Golden Acre’ developed significantly earlier than the other two varieties.
11:45 Plant Population Studies with Pickling Cucumbers. 341

Miller, C. H., North Carolina State University, Raleigh.

Plant populations, varying between 9,000 and 103,000 per acre, were established using a monoecious cultivar 'Galaxy' and a gynoecious cultivar 'Southern Cross'. Plots were hand-harvested 14 to 17 times in each of 3 years. Highest yields were from the gynoecious plots. Most rapid increases in productions occurred in populations up to 25,000 per acre with further increases up to 60,000 to 75,000 plants per acre. A distinct trend toward earliness of production was noted as plant populations increased.

10:00 The Effects of a Chemical Preservative and its Components on the Respiration Rate, Solution Uptake, Fresh Weight Changes, pH Changes and the Visual Appearance of 'Red American Beauty' Roses During Senescence. 344


A preservative solution consisting of 5% sucrose, 50 ppm silver nitrate, 50 ppm calcium nitrate and 200 ppm 8-hydroxyquinoline sulfate (8-HQS) enhanced the vase-life 2 to 3 days as compared to the distilled water control. The chemical treatment increased the respiration rate, maintained higher fresh weights, retarded flower opening and maintained the red color of the rose petals. No significant effect on solution uptake was observed. Sucrose used alone or in various combinations with the other chemicals gave similar results. In contrast, the 200 ppm 8-HQS solution decreased the respiration rate, maintained lower fresh weights, decreased the solution uptake and had no beneficial effect on the visual appearance of the roses. Calcium nitrate or silver nitrate used alone or in combination had no significant metabolic or visual effect on the roses. Sucrose represented the major component of the preservative solution which increased the keeping quality of the roses.

10:15 Some Characteristics of Water Flow Through Isolated Rose Stem Segments. 345

Durkin, Dominic, Rutgers University, New Brunswick, New Jersey.

Cut rose flowers undergo an increasing resistance to water flow beginning at harvest. To study this phenomenon experimentally, 20 mm. stem sections were removed from flowering shoots and placed under a water head pressure of 100 cm. Resistance to flow was calculated as the inverse of water conduction per hour.

The following results were obtained in experiments repeated at least four times:
1. Resistance to flow (R) increases from time of harvest at a rate which is described by the equation, log R = a + bx.
2. The rate of blockage (b) is similar at pressures of 15, 51, and 97 cm. of water.
3. The rate of blockage (b) is similar at segment lengths of 30, 60, 90 and 120 mm.
4. The rate of blockage increases tenfold when water extracts (15 minutes) of rose stem slices are substituted for distilled water.

Implications of these and other results will be discussed.

10:30 The Production of Ethylene by 'Red American Beauty' Roses During Senescence. 346


A technique was devised to follow the daily pattern of ethylene (C2H4) production from one rose flower. All experiments were...
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conducted for a period of 7 days and each treatment within an experiment was replicated 4 times. Results from the in vitro versus in vivo study indicated that roses in vivo produced significantly less C2H4 than did roses in vitro at the same stage of development. Results from several chemical treatments indicated that a significant increase in C2H4 production was observed for a preservative solution consisting of 2% sucrose and 200 ppm 8-hydroxyquinoline sulfate (8-HQS). Sucrose used alone had no significant effect on C2H4 production, whereas 8-HQS used alone significantly increased the C2H4 production. The keeping quality was improved by those solutions containing either sucrose or a combination of sucrose and 8-HQS, whereas roses held in only 8-HQS showed no increase in keeping quality. From these results, it seems that C2H4 production from 'Red American Beauty' roses may not be a controlling factor in cut-flower senescence.

10:45 The Effect of Various Concentrations of Ethylene on the Respiration Rate, Water Uptake, Fresh Weight Changes, pH Changes and the Visual Appearance of 'Red American Beauty' Roses During Senescence.


Freshly cut roses were continuously exposed to the desired ethylene (C2H4) concentration for a period of 7 days. An C2H4 concentration of 26 ppb had no significant metabolic or visual effect on the roses. Similar results were obtained for an C2H4 concentration of 60 ppb. However, significant metabolic responses were observed when the C2H4 concentration was increased to 205 ppb. At this concentration the respiration rate was increased, fresh weights were decreased and the roses absorbed less water. Although this concentration had no effect on the color of the roses, slight petal drop was noted on day 5 of the experiment. Roses exposed to C2H4 concentrations of 612 ppb and 1,130 ppb exhibited metabolic and visual responses similar to those same responses reported for a 205 ppb concentration, but petal drop occurred earlier. A significant increase in respiration was not observed for roses treated with a concentration of 4,950 ppb although roses at this concentration absorbed significantly less water and had lower fresh weights. Visually, this concentration of C2H4 did not affect the color of the rose petals, but complete petal drop occurred on day 5. It was concluded from these experiments that a threshold amount of C2H4 was needed to trigger metabolic and visual responses in 'Red American Beauty' roses.

11:00 The Influence of Controlled Atmospheres During Cool Storage on the Subsequent Flowering of Easter Lilies and Bulbous Iris.

Stuart, Neil W., Chester S. Parsons and Charles J. Gould, USDA, Beltsville, Maryland, and Washington State University, Puyallup.

Iris and Easter lily bulbs tolerated atmospheres of 100% N2 at storage temperatures of 50°, 40°, and 32° F, for as long as 12 weeks without apparent injury. Easter lily bulbs that were stored in atmospheres maintained at 0.25% O2 produced less CO2 than similar bulbs that were stored at the same temperature in air or in 100% N. When bulbs were shifted from N2 to air, or from air to N2 the rate of CO2 production increased very rapidly during the first week, exceeding the rate for bulbs that had been continuously in air. Thereafter the rate decreased steadily until the end of the test. Absence of or low concentration (0.25%) of O2 lessened the action of cool temperatures in accelerating flowering. Flowering responses were more closely related to amount of cool storage and concentration of oxygen in the storage atmosphere than with production of CO2 during that period.

(39) ENVIRONMENTAL TECHNIQUES OF STANDARDIZATION AND OPTIMIZATION

Imperial B

Presiding: Donald T. Krizek, USDA, Beltsville, Maryland.

10:15 An Unconventional Growth Chamber.


Originally conceived as a growth chamber for use in space, a new type of growth chamber will be described which will permit research in negative gravity, alternating pressures, low temperature growth under long-wave U.V. light, fluctuating light with simple equipment. Can be used as a conventional growing unit. For greenhouse bench use, increases space utilization by a factor of four to ten times. Functions as a closed system for possible use in polluted atmospheres. Five prototype units, used in sales tests, increased plant sales in mass merchandise outlets eight times over previous records.

10:30 Experimental Design Considerations In Growth Chamber Studies.


Growth chambers have provided precision environmental control that was previously impossible. Many researchers have thus assumed that experimental design is not important in growth chamber studies.

Measurements have indicated that temperature and light intensity gradients exist in 8 x 12 feet walk-in growth chambers. Empty chambers set at a temperature of 60°F have shown as much as +3.75°F variation in certain parts of the chamber. There was a 20% reduction in light intensity as one moved from the center to the walls of the chamber. Visual observations have noted differential air movement and water loss of plants near the walls as compared to those in the center of the chamber. Therefore, if the real potential of a precision environment for experimental studies is to be realized, experimental designs to account for these sources of "unwanted" variation becomes most important.

10:45 Carbon Dioxide Measurement and Control for Extended Periods in Growth Chambers.

Tibbitts, T. W. and Michael Read, University of Wisconsin, Madison.

Carbon dioxide has been effectively controlled in reach-in growth chambers for periods up to one month. A single infrared gas analyzer for CO2 has been used to control separate CO2 levels in two growth chambers. Carbon dioxide levels were maintained at desired levels between 300 and 2,000 ppm CO2. The analyzer output was connected through a relay to two recorder-controllers and a timer alternated the air sampling and CO2 control between the two chambers - 2½ minutes on, 2½ minutes off. Carbon
dioxide levels were increased by additions of pure CO₂ from pressurized cylinders and decreased by bubbling a quantity of the chamber air through an 8 liter solution of 40% NaOH.

11:00 A Propagation Unit for Accelerating Growth of Seedlings and Cuttings. 352

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

A specially designed propagation unit was constructed to increase germination uniformity and accelerate seedling development. We fabricated a fluorescent lamp bank consisting of twelve 2-lamp strip fixtures, using 1500 ma, 72-inch lamps in an inverted V shape to provide 2000–2500 ft·c over a 3- x 12-foot growing area. Incandescent light of up to 20% wattage is available when desired. The photoperiod is controlled by a 24-hour timeclock. The temperature and humidity are nominally controlled at 80°F day and 70°F night, and 30–40%, respectively, by use of an air conditioner and strategically placed fans. CO₂ is maintained at a minimum of 400 ppm by means of an infrared analyzer and controller system. Watering and fertilizing are accomplished with an automatic watering system or manually as the occasion demands. Many types of seedlings and cuttings have been grown successfully in this unit.

11:15 Comparison of Natural and Chamber Environments. 353

Gerber, John F., University of Florida, Gainesville.

Growth chambers are used to simulate the natural environment. Examination of the natural environmental parameters and the chamber parameters indicates that simulation in both a quantitative and qualitative sense is difficult and rarely achieved. Spectral shifts in light and energy fluxes are the most apparent differences. Methods for measuring the parameters in a meaningful manner will be presented as well as the requirements for "natural" simulation.

11:30 Problems Associated with Programming Naturally-Occurring Environments in an Environmental Growth Chamber. 354

Young, Roger, George Horaníc and Ascension Peynado, USDA, Orlando, Florida, USDA, Orlando, Florida, and USDA, Weslaco, Texas.

Young fruiting trees of 'Valencia' orange (Citrus sinensis [L.] Osbeck) were exposed, in a growth chamber, to programmed temperature and humidity conditions which occurred in South Texas, in December 1961 and January 1962. Light intensity was maintained between 1500 and 2000 ft·c. with fluorescent and incandescent lamps, and day-length was maintained at 12 hours. Temperature variation in the center of the chamber at plant height was ± 0.5 °F or less, while humidity variation usually did not exceed ± 4%. Leaf temperatures during day cycles were up to 3° F warmer than chamber air and 10° warmer than field air. Fruit, trunk, and soil temperatures lagged behind air temperatures, but tended to be cooler to air temperatures in the chamber than in the field. A 4-day freeze killed trees in both chamber and field climates, but ice-nucleation in leaves in the two climates occurred at different times during the freeze. Tissue temperatures, particularly those of the fruit, during the freeze tended to be colder in the chamber than the field.

Differences between plant responses in growth chamber and field environments will be used to emphasize the need for adequate description of experimental conditions when reporting studies of this nature.

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WEDNESDAY AFTERNOON

(41) POSTHARVEST HORTICULTURE:
FRUIT
Baroque Room

Presiding: W. Grierson, Florida Citrus Experiment Station, Lake Alfred.

1:00 Respiratory Response of Lemons to Ethylene. 359
Craft, Charles C., USDA, Pomona, California.

Green and yellow lemons responded to ethylene treatment with a 2-3-fold increase in O₂ uptake. Maximum rates of O₂ uptake were reached about 20 hr after treatment at 25°C. The continued presence of ethylene was required. Following removal of ethylene, O₂ uptake declined in 2 days to a level approaching the rate before treatment. Upon retreatment with ethylene, the fruits again responded with a 2-3-fold increase in O₂ uptake. Ethylene stimulated the O₂ uptake of lemons in 5 and 10% O₂ even though the rates of O₂ uptake of these fruits were already reduced by the low levels of O₂. The presence of high levels of CO₂ during ethylene treatment did not suppress the ethylene-induced respiratory increase. 2-Chloroethan phosphonic acid (Ethrel) stimulated the O₂ uptake of lemons more effectively than ethylene.

1:15 Ethanol and Carbon Dioxide Production by Oranges in Nitrogen. 360
Craft, Charles C., Shirley M. Norman and David C. Fouse, USDA, Pomona, California.

Citrus fruits produce CO₂ and ethanol in the absence of oxygen. At 20°C the rates of CO₂ and ethanol production in nitrogen increased for 8 to 10 days after which CO₂ production declined and ethanol continued to increase until the fruit was irreversibly injured. At no time did the ethanol/CO₂ ratio approach unity in the uninjured fruit. Treatments with ethylene or by peeling that increase aerobic CO₂ production also increased anaerobic CO₂ and ethanol production. Ethanol production like CO₂ production by oranges in nitrogen was localized predominantly in the rind tissue, where the rate was 6 times greater on a unit weight basis than for the whole fruit. The juice sacs were relatively inert.

1:30 Preharvest Sprays with 2-Chloroethylphosphonic Acid (Ethrel) to Degreen ‘Robinson’ and ‘Lee’ Tangerine Fruit. 361
Young, Roger, Otto Jahn, W. C. Cooper and J. J. Smoot, USDA, Orlando, Florida.

Ethrel, applied at 50 to 200 ppm as a preharvest spray, showed considerable promise in degreening Robinson and Lee tangerine fruit. The preharvest degreening resulted in less postharvest degreening time required for acceptable color and less fruit decay during storage. Ethrel concentrations between 100 and 200 ppm caused abscission of some old leaves, but had no apparent effect on external appearance other than color.

1:45 Effects of Washing on the Degreening Response of Citrus Fruits. 362

Tests were made to compare the rate of color development in fruit washed before degreening with the conventional procedure of washing fruit after degreening. Studies on ‘Hamlin’ oranges, ‘Robinson’ tangerines and ‘Marsh’ grapefruit did not show any effect of washing sequence on the rate of chlorophyll loss. In some tests washing before degreening reduced the incidence of stem end decay in ‘Hamlin’ oranges. With ‘Robinson’ tangerines washing before degreening gave more consistent control of stem end decay. Fruit washed before degreening averaged 25% decay compared to an average of 66% with the conventional system, when held for 2 weeks at 70°F. The chemical treatments used were much less effective for decay control on this variety than was washing.

2:00 Ethylene Diffusion Through Citrus Leaf and Fruit Tissues. 363

The diffusion of ethylene through citrus leaf cuticles and citrus fruit was investigated. Studies with enzymatically isolated leaf cuticles revealed that the lower cuticle was the primary site of ethylene diffusion. The rate of diffusion through the upper cuticle was less than that of the intact leaf. The apparent reduction in permeability in relation to the intact leaf will be discussed. The primary diffusion route of internal ethylene through the citrus fruit is the point of stem attachment. The flavedo and the intact fruit pericarp was an effective diffusion barrier. The albedo did not offer significant resistance to diffusion.

2:15 Nucleosides and Nucleotides in Citrus Juice. 364
Biggs, Robert H., Jerzy Makowski and James E. Pollard, University of Florida, Gainesville.

Several methods of extraction and purification of nucleosides and nucleotides from sweet oranges were conducted to establish a reliable technique for the rapid assay of these components from fruits and processed products. Briefly outlined are the procedures that worked best with citrus products. Extraction with perchloric acid, absorption of nucleosides and nucleotides on activated charcoal, desorption with 80 percent ethanol, and ion exchange chromatography for initial separation, with subsequent separations by thin-layer and gas chromatography.

Using the above system of extraction and separation, AMP, CMP, GMP, UMP, ADP, UDP, ATP and GTP have been tentatively identified as components of citrus juice with AMP, ADP, and GTP there in much greater quantities than the others. GTP levels are quite high in fresh fruit and decline markedly during storage. Ethylene degreening alters the pattern of nucleotides present, with GTP again showing drastic changes. Comparative analyses between juice and pulp residues indicate that most of the nucleosides and nucleotides are located in the juice. Total nucleosides and nucleotides in the juice are present at levels that could play a major role in nutrition and modifying flavors.

2:30 Orange Peel Topography as Affected by a Preharvest Plastic Spray. 365
Albrigo, L. Gene and G. Eldon Brown, Florida Citrus Experiment Station, Lake Alfred.

Mature ‘Valencia’ and ‘Hamlin’ orange trees were sprayed 2 months prior to harvest with a 1 or 3% solution of Pinolene, a plastic film former. Fruit from plastic sprayed ‘Valencia’ trees were greener at harvest, but had less weight loss and better appearance than control fruit after 9 weeks of storage. Sections of ‘Hamlin’ peel from control and treated fruit were observed with a scanning electron microscope at harvest. The surfaces of control fruit showed considerable variation in wax which occurred in platelets. Some areas had essentially no epicuticular wax while other areas were
completely covered with platelets. Plastic increased the surface covering and often partially masked the wax platelet edges. On control fruit, the openings to the outer stomatal chambers were usually unobstructed but the pores were often plugged. The openings to the outer stomatal chambers of sprayed fruit were partially or completely obstructed with plastic.

2:45 A Tissue Culture Technique for Studying Chilling Injury of Tropical and Sub-Tropical Fruits.  366

Vakis, N. I., W. Grierson and J. Soule, University of Florida, Gainesville, Florida Citrus Experiment Station, Lake Alfred, and University of Florida, Gainesville.

The possibility of using tissue cultures in postharvest physiology studies of fruits was examined with particular emphasis on the reliability of this technique in chilling injury studies. Discs from 'Lacatan' bananas, 'Key' lime, 'Persian' lime and 'Taylor' avocado held in tissue culture media at chilling and non-chilling temperatures responded similarly to whole fruits, as indicated by visual observations and respiration data.

3:00 Recess

3:15 The Influence of Ethylene on 'Lula' Avocados in Controlled-Atmosphere Storage.  367

Hatton, T. T., Jr. and William F. Reeder, USDA, Orlando, Florida, and USDA, Miami, Florida.

Storage of 'Lula' avocados in controlled atmosphere (CA) of 2% O₂ and 10% CO₂ at 50°F for 30, 45, and 60 days resulted in more acceptable fruit than storage in air at like temperature and durations. The removal of evolved ethylene by scrubbing with KMnO₄ further increased the percentage of acceptable fruit. Weight loss of avocados during CA storage was less than in similar fruit during air storage. Less weight was lost from fruits stored without ethylene than from those stored with ethylene. CA-stored avocados, when placed in air at 70°F, softened more slowly than similar fruits stored in air, and those stored with ethylene removed softened more slowly than those stored with ethylene. Weight loss during the softening period was greatest in fruit stored in CA with ethylene removed, followed by those stored in CA with ethylene and those in air. Anthracnose decay was the primary factor affecting acceptability, especially during the softening period at 70°F.

3:30 Sampling Methods for Determining Peach Quality and Maturity.  368

Sims, E. T., Jr., Clemson University, Clemson, South Carolina.

The effect of chemical thinners on peach yield and subsequent maturity has presented problems in ascertaining their influence on quality not directly associated with maturity. Several sampling methods for determining the influence of chemical treatments on fruit quality and maturity were studied. Attributes considered were firmness, size, undercolor, overcolor, flesh color, soluble solids, pH, total titratable acidity and the soluble solids-acids ratio. Data obtained when harvesting the fruit at a single date were more indicative of treatment effects on maturity and uniformity than on quality. Fruit harvested by plots at a pre-selected maturity, not necessarily on the same date, more adequately expressed the direct influence of treatments on quality. The common use of firmness and undercolor as co-indices of peach maturity is unsatisfactory with those treatments which enhance color development without a parallel influence on firmness.

3:45 Control of Blue Mold and Scald of Eastern-Grown Apples During Storage.  369

Spalding, Donald H. and Robert E. Hardenburg, USDA, Beltsville, Maryland.

Heated suspensions of benomyl or thiabendazole used as postharvest dips (3 minutes at 113°F) effectively controlled development of blue mold rot in inoculated Golden and Red Delicious apples during 2 months at 32° followed by 1 week at 70°. Comparable tests with heated tap water (113°F) did not control decay. The heated fungicides were equally effective at concentrations of 100 and 500 ppm. Heated fungicides controlled decay in either punctured or bruised apples, whereas unheated fungicides controlled decay only in punctured apples. Both fungicides at concentrations of 1000 ppm were compatible with scald-inhibitors (2700 ppm Ethoxyquin or 2000 ppm Diphenylamine). No injury was observed on 'Red Delicious' or 'Stayman' apples dipped in any combination of fungicide and scald-inhibitor and stored for 5 months at 32° followed by 1 week at 70°. Effectiveness of fungicide and scald-inhibitor was not altered when combined.

4:00 Storage Disorder of 'Jonathan' Apples in Relation to Tree Nutrition and Other Factors.  370

Stebbins, Robert L. and Donald H. Dewey, Michigan State University, East Lansing.

The development of fruit functional disorders during storage was correlated with mineral composition of the leaves and fruit for 'Jonathan' from each of 4 trees in 12 orchards for 2 years. Water core and internal breakdown were negatively correlated with fruit K and Ca in both years. A high incidence of breakdown in one year occurred in fruit produced on trees with high leaf Mn, particularly in one orchard. Core browning in CA storage was negatively correlated with leaf K, B, P, and Ca, and positively with leaf N and fruit size. There was great variation in the incidence of breakdown for years and trees. Light crop loads, large fruit size, delayed time of harvest, and a high incidence of water core were verified as favorable to the development of internal breakdown during storage.

4:15 The Respiratory Climacteric in Cranberries and the Effect of Ethrel Upon It.  371

Bramlage, William J. and Robert M. Devlin, University of Massachusetts, Amherst.

Ethrel applied at a rate of 5 lbs. per acre 1 month before harvest produced earlier coloring of 'Early Black' cranberries. Periodic sampling of berries and determination of CO₂ production by infrared spectrophotometry during subsequent periods showed that ripening berries underwent a classical respiratory climacteric, and that the time of appearance of this climacteric was unaffected by the Ethrel application. Thus, Ethrel seems to have enhanced anthocyanin synthesis of cranberries independently of any general effect on ripening rate.

4:30 Respiratory Quotients of Irradiated Fruits.  372


An automatic sampling system for monitoring O₂ uptake and CO₂ evolution of fruits maintained under a continuous air flow was used. Firm ripe 'Tioga' strawberries, one-day breaker 'Floradel' tomatoes and 'Valencia' oranges were exposed to doses of 0, 150
and 300 Krad of $^{137}\text{Cs}$ gamma rays.

Respiratory quotients (R.Q.) of control and irradiated fruits were less than 1. Irradiated strawberries and tomatoes demonstrated higher R.Q. values immediately following treatment, but their R.Q. values approached that of the non-irradiated fruits 24 and 36 hours after irradiation, respectively. Irradiated 'Valencia' oranges exhibited higher R.Q. values over a 7-day period as compared to control fruit. However, slow declines in the values occurred with time.

4:45 An Objective Test for Measuring Blueberry Firmness. 

Ballinger, Walter E. and Leaton J. Kushman, North Carolina State University, Raleigh, and USDA, Raleigh, North Carolina.

An objective method of measuring firmness of blueberry fruits was needed to study varietal differences and the effects of harvesting, handling and packaging. Fruits were compressed 25% of their diameter at 1 cm/min on an Instron Universal Testing Machine. Firmness, expressed as g/.01 mm of fruit compression, decreased with ripening and handling, and did not increase with chilling in ice water or cold air as believed by some in the trade. Varieties differed considerably in firmness and the differences correlated positively with firmness scores estimated from mastication. This compression test appears to provide a useful, objective measure of firmness.

(42) FRUIT: CULTURAL PRACTICES

Silver Chimes East

Presiding: C. H. Hendershot, University of Georgia, Athens.

1:00 Evaluation of a Promising Fruit Thinner for Hard-to-Thin Peach Cultivars. 

Keil, Harry L. and H. W. Fogle, USDA, Beltsville, Maryland.

(Unsym-bis-dimethylthiocarbamoyl dimethyl hydrazide) (ER 3952), in preliminary field tests during 1968 and 1969, satisfactorily thinned peaches without excessive foliar damage. ER 3952 was first evaluated on peaches in the greenhouse for control of bacterial spot (Xanthomonas pruni). It caused systemic phytotoxicity when applied as either a drench or foliar spray, which led to its evaluation as a fruit thinner. At 300–400 ppm concentrations ER 3952 thinned 'Earlired,' a very early-maturing cultivar not affected by commercial materials such as the combination of 2-(m-chlorophenoxy)-propionamide +2-(m-chlorophenoxy)-propionic acid (Fruitone CPA) and dimethyldeleamine (Penntin). It also thinned satisfactorily 'Rio-Oso-Gem' and other hard-to-thin cultivars. However, 300 ppm concentration over-thinned 'Ranger' a variety successfully thinned by 150 ppm of CPA. This suggests that on easy-to-thin cultivars lower concentrations also should be tested.

1:15 Peach Thinning with Ethrel and ER-3952. 

Martin, George C., University of California, Davis.

Ethrel and ER-3952 were applied as foliar sprays to mature, bearing clingstone peaches at petal fall, 4 mm and 8 mm ovule length. The resultant thinning action was based on the percent fruit set determined after June drop. Ethrel induced both over and under thinning at each application period. Favorable results occurred at 4 mm and 8 mm with 150 ppm. ER-3952 thinned well at the 4 mm stage at 500 ppm and the 8 mm at 250 ppm. A minimum of over and under thinning was induced by ER-3952. With ER-3952 application there was a slight advancement in maturity without reduction in harvest size. Phytotoxicity was greater in Ethrel than ER-3952 treated trees, however, in no case was any tree damage incurred.

1:30 The Evaluation of Various Chemical Compounds as Fruit Thinning Agents for North Florida Peaches. 

Aitken, James B., North Florida Experiment Station, Quincy.

Ethrel (2-chloroethylphosphonic acid), dichlobenil (2,6-dichlorobenzonitrile), and NPA (N-1-naphthylphthalamic acid) were applied at concentration ranges of 30–500 ppm at full bloom and several post-bloom dates. Full bloom sprays of dichlobenil and NPA at 200 and 400 ppm on Armgold variety thinned the fruit as well as hand thinning. Ethrel applied at full bloom thinned excellently at 300 ppm but over-thinned at 500 ppm on both 'June Gold' and 'Maygold' varieties. Post-bloom sprays of Ethrel applied at cytokinesis and at the initiation of pit-hardening slightly over-thinned at 100 ppm but was also phytotoxic causing leaf drop. Rates of 30 and 60 ppm Ethrel thinned adequately with no apparent tree injury.

1:45 Peach Thinning with 3CPA and Ethrel During Cytokinesis. 

Buchanan, D. W., J. A. Blake, W. B. Sherman and R. H. Biggs, University of Florida, Gainesville.

Sprays of Fruitone, a commercial formulation containing 2-(3-chlorophenoxy)-propionamide and 2-(3-chlorophenoxy)-propionic acid (3CPA), at 200, 300, and 400 ppm of acid equivalents and ethrel 2-chloroethylphosphonic acid at 30, 60, and 100 ppm were applied to 'Early Amber', a short cycle (70 days), low-chilling (300 hours < 45 F) peach grown in Florida. Adequate thinning of fruits was obtained only over a 4-day interval during which the endosperm was changing from the free nuclear to the completely cellular stage. The most satisfactory concentrations of 3CPA and ethrel were 300 and 30 ppm, respectively.

2:00 Apple Nursery Stock Defoliation with Sequential Treatments of Alar and Ethrel. 

Cummins, James N. and Piero Fiorino, New York State Agricultural Experiment Station, Geneva, and University of Pisa, Italy.

Sprays of Alar, followed by Ethrel, were used to stimulate terminal bud formation and early leaf fall on apple nursery stock. The cultivar 'Mutsu' ceased growth more readily when sprayed with Alar than did 'Idared'. 'Mutsu' trees sprayed with Ethrel shed leaves early, whereas 'Idared' trees showed much less response. No differences were distinguished in comparisons among maiden trees of these 2 cultivars on the clonal rootstocks M.26, MM.106, and MM.111.

When 1000 ppm Alar was applied in early September, followed by 2000 ppm Ethrel sprays 10 and 20 days later, maximum shoot termination and subsequent leaf fall were observed. The combined treatment appears to have commercial promise.
2:15 Design Features of the Minnesota Precision Plot Irrigator.  

This paper is intended to acquaint the horticulturist engaged in irrigation research with the availability and use of equipment designed for precise applications of irrigation water to small experimental plots. Three plot irrigator models have been designed and field tested to ascertain optimum water distribution uniformity, adaptability to varying crop and plot-size conditions, and ease of operation.

Information and illustrations on the economics, design and description of the equipment will be presented. Also included is a discussion of the University of Minnesota experience in the operation of plot irrigators on its Sand Plain Irrigation Research Farm.

(43) MARKETING:  
FRUITS, VEGETABLES AND ORNAMENTALS  
Empire Room

Presiding: Kenneth M. Brink, Colorado State University, Fort Collins.

1:00 Optimum Number, Size and Location of Green Pea Freezing Plants to Serve the U. S. Market. 380

A mathematical model was developed for the green pea freezing industry in the United States. The model was then solved to identify areas with competitive advantages to serve the U.S. market in 1970. Cost inputs included: (1) procurement costs, (2) raw product costs, (3) economies of scale in freezing and freezer storage, (4) labor wage rates, (5) local, state and federal taxes, (6) fuel and electrical costs, (7) allocation of overhead costs, (8) transportation costs to market and (9) regional per capita consumption. The model included 48 demand regions (states) and 10 supply regions. The solution yields the optimum number, size, and locations of plants (by counties) to serve the U.S. market at minimum costs.

1:15 Pricing Performance—The Marketing System for Fresh Winter Vegetables. 381
Bohall, Robert W., MED-ERS, USDA, Washington, D.C.

The paper will present results of an analysis of pricing performance in the marketing system for fresh winter lettuce, carrots, and tomatoes. Weekly prices at various f.o.b. shipping points and 12 selected wholesale terminal markets moved together throughout the winter seasons of 1966–68. Gross margins or the difference between shipping point and wholesale terminal market prices were related to distance, the perishability of the vegetable, and the wholesale terminal market price.

At shipping point, weekly prices of vegetables were functions of the quantity available as expected. In addition temperature and rainfall variables as proxies for disease and size were significantly related to prices as was the quantity of vegetables marketed during the previous two weeks.

Some examples of poor pricing performance will also be covered.

1:30 Costs and Efficiencies in Farm Packing of Vine-Ripe Tomatoes in Arkansas. 382
Price, Carter and Lanny Bateman, University of Arkansas, Fayetteville.

Costs of packing tomatoes at the farm in small-unit manual operations were not reduced by the addition of conveying and sizing equipment. Total packing costs were estimated to reach a minimum of $0.598 per lug at manual model outputs of 13,200 and 15,400 lugs annually both of which are reasonable for a small, farm-size unit. Estimated costs for the mechanized model reached the $0.598 per lug minimum only at a 48,400 lug annual output, well outside the single-farm planning horizon. Mechanization reduced the labor requirements by 14 percent in that model input-output coefficients per 1000 lugs were: (1) mechanized—3.82 min. [ (a) dumping 0.15, (b) grading 1.03, (c) peeling 2.17, and (d) container construction 0.47]; (2) manual—4.48 min. [ (a) grading 1.56, (b) packing 2.45, and (c) container construction 0.47]. Cost estimates were made for packing models ranging in size from 2,200 to 15,400 lugs (manual) and 4,400 to 48,400 lugs (mechanized).

1:45 An Analysis of Regional Trade Advantage in Processed Tomato Products. 383
Sullivan, Glenn H. and Lee F. Schrader, Purdue University, Lafayette, Indiana.

Linear programming was used to determine the optimum shipping pattern and regional trade advantage attributed to transportation cost differences for five processed tomato products; canned whole tomatoes, catsup, juice, puree, and sauce and paste. Seventeen production regions and 48 consumption regions were included in the analysis. The results provide a basis for: (1) evaluation of production planning, (2) a guide to production levels, (3) development of market strategy, and (4) a guide to product mix selection at the regional and firm levels.

2:00 Bulk Handling of Tomatoes for Processing: An Economic Evaluation. 384
Sullivan, Glenn H. and Ronald Y. Uyeshiro, Purdue University, Lafayette, Indiana.

The comparative advantages of mechanical harvesting alone have not been sufficient to generate widespread geographic adoption throughout the tomato processing industry. Concurrent with industry adoption of mechanical harvesting is the need for development of an efficient system for bulk handling and transporting large quantities of raw product supplies from the field to the processing plant without appreciable loss in raw product quality.

Traditional methods of bulk handling tomatoes in pallet bins were evaluated and compared to handling in bulk trailer units. Substantially greater economic efficiency resulted from the bulk trailer system of handling. The costs per ton to handle and transport mechanically harvested tomatoes in pallet bins averaged $4.59 compared to average per ton costs of $1.86 under the bulk trailer system.
WEDNESDAY AFTERNOON

2:15 The Effects of Market Selection on Pricing Efficiency—The Blueberry Case. 385
Mathia, Gene A., North Carolina State University, Raleigh.

This study deals with the effects of spatial market selection and allocation of specified volumes of blueberries on pricing efficiency. It presents daily derived demand relationships for 10 major terminal markets for blueberries produced in North Carolina, New Jersey and Michigan. These derived demand relationships are used to compare the efficiency of current marketing practices on market selection with efficiency of other possible pricing practices.

Market allocations made during the 1969 season are compared with computed allocations among markets using average revenue and marginal revenue pricing objectives. Preliminary results of the study suggest that the 1969 market allocation practices were inefficient relative to what could have been achieved using either the systematic average or marginal revenue pricing schemes. The marginal revenue scheme used in price discriminating situations was not greatly superior to the systematic average revenue pricing procedure.

2:30 Grades and Standards and Consumer Preferences Relevant to Pot Chrysanthemums. 386
Sherwood, Charles H. and James D. Kelley, Iowa State University, Ames.

Grades and Standards for Horticultural Crops have been proposed upon the premise that worthwhile grades must be both easily understood and readily determined. We have tested this on the assumption that value is ultimately related to differences between factors which the consumer considers important. Several statistical approaches provided similar results with ranking on the basis of preference selected; using all possible combinations in groups of three proved to be the most useful.

Differences among potted chrysanthemums from representative Iowa growers, three-dimensional plastic models and photographs of live plants were found to be detectable and were significant at the 1% level when the differences in such factors as plant height or width, flower number or total flower area, vertical or horizontal plant shape and number of buds approached μ 10% or greater.

The problem of selecting grade factor combinations to be used as criteria for previously ungraded plants is discussed as it relates to consumer preferences. However, unknown factors mask the results of grading using the above parameters.

2:45 An Economic Analysis of Cost and Pricing of Retail Floral Products. 387
Williams, F. W. and David E. Weisenborn, University of Georgia, Athens.

This report will be based on a project to be completed during the Summer of 1970. Case studies will be made of the cost and pricing structure of three representative retail florists located in Georgia. Detailed cost data will be collected and analyzed for all variable cost items, including delivery, as well as fixed overhead items. It is anticipated that the results of this analysis will provide policies and to increase operational efficiency.

3:00 Marketing and Related Economic Information for Commercial Floriculture in the United States and Canada — 1970. 388
Fossum, M. Truman, Florists' Transworld Delivery Ass'n., Detroit, Michigan.

The intent of this paper is not that of ultimate publication in the Journal. Printed material to be made available during the presentation will provide basic marketing and related economic information pertaining to commercial floriculture for use by the Special ASHS Committee on Marketing of Horticultural Crops. Information for the United States will have direct application to the report of the 1968 Joint Task Force of the U.S. Department of Agriculture and the State Universities and Land Grant Colleges for a National Program of Research for "Plants to Enhance Man's Environment." Data upon which the report is based is derived from publications of the United States Bureau of the Census and the Dominion (of Canada) Bureau of Statistics.

WEDNESDAY AFTERNOON

(44) HERBICIDES:
FRUITS, VEGETABLES AND ORNAMENTALS

Imperial A

Presiding: W. E. Waters, Florida Ridge Ornamental Horticulture Laboratory, Apopka.

1:30 Ammonium Nitrogen in Pasteurized Soil. 389
Kothe, J. S., O. Nowashelski and A. Burkowicz, University of Connecticut, Storrs, and Instytut Warszawicki, Skierniewice.

In an experiment conducted at Skierniewice, Poland the ammonium nitrogen level in a composted soil was 35 mg/l. At 6 to 10 days following pasteurization, the NH₄-N levels increased to about 120 mg/l. Introduction of sucrose (83 g/m²) or a suspension of field soil (100 g/m²) or an Arthrobacter sp. (10⁶ cells/m²) failed to reduce the build-up of NH₄-N. Furthermore, the NH₄-N levels did not gradually decline after 10 days as normally predicted for pasteurized soils but remained high for 43 days. Sucrose increased bacterial counts 8-fold and decreased nitrates from 190 to 160 mg/l. Since ammonium toxicity begins at approximately 150 mg/l, tomato and lettuce plants transplanted to portions of the test plots at 0 days showed no toxicity. Another group transplanted into this soil at 9 days showed insipient root tip browning at 13 days in some treatments but subsequent growth was normal.

1:45 Some Effects of Dichlobenil and its Neutralization with Activated Carbon in Ornamental Plants. 390
Smith, Elton M., Ohio State University, Columbus.

The effects of high rates of dichlobenil and its neutralization with activated carbon on weed population plant growth and leaf damage of several ornamental plants were studied.

Ten months after treatment there were no weeds in the 18, 30 and 60 lbs. A.I.A. dichlobenil plots and 6 to 10 weeds/sq. ft. in plots of dichlobenil plus activated charcoal at 1,800, 2,700, 4,500 and 9,000 lbs./A.

Marginal chlorosis, browning and interveinal yellowing occurred with dichlobenil above 12 lbs. A.I.A. Activated carbon reduced the severity of leaf damage to the ornamentals treated with dichlobenil.

Growth in height of the ornamentals was consistently higher in activated carbon treatments.
2:00 Influence of 5 Herbicides on Weed Count and Damage Rating of Container Grown Woody Ornamentals.

Jones, Harold C., Carl E. Whitcomb and Charles A. Conover, University of Florida, Gainesville.

Five herbicides each at 3 rates and 2 times of application were tested in Florida on commercially available liners of Hibiscus Rosasinensis, Ilex vomitoria, Buxus harlandii and Juniperus chinensis 'pfitzer blue'. Plants were grown in full sun in 1 gallon containers in a soil mix by volume of 50-50 Canadian peat-native soil.

Karmex, Herban, Treflan, Planavim and Eptam were applied as 100 milliliter soil applications.

Treflan and Planavim gave acceptable weed control at higher rates of Karmex provided good weed control with slight damage, but higher rates caused severe damage. Herban at all rates caused severe damage to all plants except juniper. Eptam gave poor weed control and caused severe damage to juniper and hibiscus.

2:15 Differential Response of Cucumber Varieties to Experimental Herbicide CP49814.

Maitland, Austin E., Robert D. Sweet and Philip A. Minges, Cornell University, Ithaca, New York.

Experimental Herbicide CP49814 (p- nitrobenzene sulfonyleurea) ethanolamine salt, is a selective postemergence herbicide for cucumbers. However conflicting results have been reported as to the degree of crop tolerance. This investigation showed that a principal source of variation is varietal response. Ashley, Gemini, and Pioneer were relatively tolerant whereas Tablegreen —65 and Marketmore were relatively susceptible. There was a correlation between mallow resistance and tolerance to CP49814 as well as between mosaic resistance and susceptibility to CP49814. No work was done to determine if either of these correlations were casual.

Temporary quantitative decreases in chlorophyll were readily correlated with degree of susceptibility to the herbicide. Damage to cucumbers was less from sprays at the cotyledon stage than those applied at later stages. In contrast, weeds were highly susceptible at the cotyledon stage and resistant at the older stages.

2:30 The Effect of 2,4-D, Picloram, and Dicamba on the Endogenous Gibberellin Content of Germinating Seedlings of Phaseolus vulgaris.


Seeds of snap bean (Phaseolus vulgaris var. Contender) were germinated in solutions of three "growth regulating" herbicides: 2,4-D, picloram, and dicamba. Seeds were harvested at two intervals and the endogenous levels of gibberellins in the root-hypocotyl were determined using two bioassay systems. Exogenously applied gibberellic acid tended to reverse the negative effect of the three herbicides upon elongating root-hypocotyl of bean seed, however, complete reversal to a normal growth was not achieved.

2:45 Chemical Weed Control in Bearing and Nonbearing Pecan Orchards.

Norton, Jack A. and J.B. Storey, Texas A&M University, College Station.

Significant growth and yield increases were obtained in pecan [Carya illinoensis (Wang.) K. Koch] orchards treated with 3.0 lb/A diuron (3,3,4(dichlorophenyl)-1,1-dimethyl urea) and 4.0 lb/A simazine (2-chloro-4,6-bis(ethyamino)-s-triazine). In orchards heavily infested with Johnsongrass (Sorghum halepense), dalapon (2,2-dichloropropionic acid) was used in combination with simazine for wide spectrum weed control. Residue analyses showed that less than .1 ppm simazine and less than .5 ppm dalapon accumulated in nuts collected from plots previously treated with these herbicides.

3:00 Influence of the Fluorinated Pyridazinones on Cranberry Vine Growth and Yield.

Devlin, Robert M., Irving E. Demoranville, University of Massachusetts, East Wareham.

The purpose of this study was to determine the tolerance of 'Early Black' cranberry vines to the fluorinated pyridazinones. Two compounds of this new group of herbicides provide very effective control of Cyperus dentatus (nutgrass), a weed which infests 80% of the Massachusetts cranberry bogs. The influence of SAN-6706 and SAN-9789 on vine growth, yield, berry size, dry weight, and anthocyanin development was observed. The effectiveness of these compounds as herbicides and their possible mode of action will also be discussed.

3:15 Plant Communities of Two Peach Orchards Under Five Different Herbicide Programs.

Walker, S. D., Jr. and Vernon J. Fisher, University of Delaware, Newark.

Where minimal disturbance of the natural flora was employed, the plant community consisted primarily of broad-leaf plants, both annual and perennial. The only grasses that competed well were the cool-season grasses. Introduction of an herbicide program greatly reduced species diversity and plant density, with warm-season grasses being established quickly. With prolonged use of the same herbicide, species diversity reached a low but stable threshold level, with communities being dominated by annual grasses. A change in herbicide program tended to renew the decline in species diversity.

(45) VEGETABLES: ENVIRONMENT

El Dorado Room


1:00 Agroclimatic Parameters Defining Vegetables Growing Seasons in the Great Plains.

Neild, Ralph E. and James K. Greig, University of Nebraska, Lincoln, and Kansas State University, Manhattan.

Irrigation development has resulted in an interest in commercial vegetable production in the Great Plains. Lacking long term experience, a procedure was developed for estimating time and length of growing and harvest season for a series of different crops. Comparisons are made between irrigated regions from Texas through North Dakota.
1:15 Estimating Probabilities of Freeze Damage to Frost-Sensitive Vegetables at Emergence. 398
Neild, Ralph E. and James K. Greig, University of Nebraska, Lincoln, and Kansas State University, Manhattan.

Earliness in planting is importantly related to the price received for fresh market vegetables and to certain economies in processing. Although vegetable plants are not usually vulnerable to light spring freezes until after they emerge, low temperature probabilities are customarily evaluated at planting times.

A procedure is suggested to evaluate spring freeze hazard after plants emerge. It is based upon indexes of germination rate and shows reduction in freeze hazard during seed germination for different crops.

1:30 Foam and Small Trench System for Freeze Protection. 399
Heilman, Marvin D. and Jon F. Bartholic, ARS-SWC, USDA, Weslaco, Texas.

A combination of materials has been found that, 2.5% by weight in water, will form a stable foam. The material insulates tender vegetables from freezing conditions and lasts 8 to 16 hours under field conditions. The material is economical, biodegradable, and nontoxic to plants on which it has been tested. A prototype field generator for producing stable foam has been built and tested. Expansion rates have been 1:60 or higher. This economical means of freeze protection ($0.001) per gallon of foam) kept foamed seedlings in small trenches 21°F warmer than non-foamed plants. The shallow, narrow trenches reduced the volume of foam required for plant coverage to about one-fourth that required in conventional bed planting. Increased durability of the foam was obtained by restricting it to the trench.

1:45 The Influence of Air Temperature on Growth and Water Consumption of Bean Plants. 400
Knecht, George N. and James W. O'Leary, University of Arizona, Tucson.

Red kidney bean (Phaseolus vulgaris L.) plants were grown in nutrient solution, which was changed every day, in plant growth chambers at air temperatures of 65, 75, and 90°F. Low intensity was 4000 ft-candles and relative humidity was 70% in all chambers. Growth data were collected after 20 days, and water consumption was measured daily. All data were subjected to statistical analysis. Leaf area, total fresh weight, and total dry weight increased significantly with increasing temperature. Water consumption also increased significantly with increasing air temperature. Although there was no difference between the root dry weight at 65 and 75, the root dry weight at 90 was significantly greater. The top dry weight did not differ between the 65 and 75 treatments or between the 75 and 90 treatments. However, the high temperature plants had a significantly greater dry weight than the low temperature plants.

2:00 Temperatures and Net Energy Gain in Normal and White-Washed Cantaloupe Fruits During Their Maturation. 401
Lipton, Werner J., USDA, Fresno, California.

The net energy gain (G) of a normal and a white-washed cantaloupe exposed to direct solar radiation was calculated from temperatures of nearly mature melons, where G = c ΔTΔt-1 cal g-1 hr-1 (c = specific heat of cantaloupes in cal g-1 OC-1; ΔT = change in mean temperature in °C during time interval Δt in hours).

During rapid warming G was 520 cal g-1 hr-1 for a normal melon and 350 cal g-1 hr-1 for the white-washed melon. Over the entire day, G of the white fruit was about 80% that of the normal fruit.

Values of G allow determination of the contribution of respiratory heat to G. They also permit better quantitative comparisons between protective treatments than temperatures alone, and they may permit prediction of heat injury.

2:15 Effect of an Asphalt Barrier on Soil Water, Yields and Water Use by Tomato and Cabbage. 402

An asphalt layer, approximately 1/8-inch thick, placed 24–27 inches deep in a Lakeland fine sand, increased water storage from 2 inches to approximately 3 inches in soil above it. With the barrier, yields of tomatoes and cabbage (2 and 3 seasons, respectively) were increased by 94 and 37 percent. Plant water stress, as indicated by water depletion rates lower than calculated potential evapotranspiration, was less frequent and less severe on barrier treated plots.

2:20 The Possible Role of Tuber Growth Rate and Stress Conditions on Hollow Heart in Irish Potatoes. 403
Crumbly, Isaac J. and Donald C. Nelson, North Dakota State University, Fargo.

Hollow heart of potatoes has been associated both with periods of stress and conditions favoring rapid tuber growth. Tuber growth rate studies were conducted with both susceptible and resistant varieties to hollow heart. Results of the studies indicated that fast tuber growth in susceptible varieties was important in the manifestation of hollow heart.

Effect of stress conditions on tubers was studied by injecting carbon-14 uniformly labeled sucrose into the perimelodary region of tubers attached to plants which had been pruned of all leaves. Autoradiographs of stolons, stem cross-sections and new developing leaves showed carbon-14 activity.

2:45 Two Physical Properties of Tuber Tissue and Their Relationship to Hollow Heart in Irish Potatoes. 404
Crumbly, Isaac J. and Donald C. Nelson, North Dakota State University, Fargo.

Hollow heart of the potato is a physiological disease which is characterized by a brownish internal cavity usually located in the center of the tuber. It is most often found in the northern potato growing states of the U.S. and more frequently in some varieties than in others.

Two physical properties of tuber tissue were tested in both susceptible and resistant varieties to determine if the occurrence of hollow heart was related to a physical or mechanical weakness. The
two physical properties tested to measure the mechanical strength of tuber tissue were resistance to bending and resistance to cutting. The study revealed that tuber tissues coming from resistant varieties were also high in resistance to bending. There was a positive but weaker relationship between the resistance to cutting of tuber tissue and susceptibility to hollow heart.

3:00 Recess

3:15 The Effect of Row Spacing on Light Utilization, Growth Characteristics and Yield of Two Dry Bean (Phaseolus vulgaris) Varieties Under Tropical Conditions.

Wien, H. C., Roger F. Sandsted and Donald H. Wallace, Cornell University, Ithaca, New York.

Phaseolus vulgaris cvs. Red Kidney and Great Northern UI #61 were grown during the cool season and at the beginning of the warm season in the tropical lowlands of the Philippines. Identical spacing treatments for both plantings consisted of 25, 50 and 75 cm row distances, with the constant between-plant spacing of 10 cm in the row. Light measurements above and below the crop canopy at 4-day intervals during the growing season were related to dry matter accumulation by the plants. From 55 to 73 percent of the total incident light between emergence and maturity was intercepted by the plants. Of this intercepted light energy, 2.42% was converted by photosynthesis into plant dry weight during the cool season when lower light intensities prevailed, and 2.07% during the summer warm season. Yields averaged 1790 kg/ha during the cool season and 1160 kg/ha during the warm season. These data will be compared with similar data for 'Red Kidney' and 'Black Turtle Soup' beans, grown at Ithaca, New York.

3:30 Temperature Effects on Pollen Tube Growth and Fruit Set in the Tomato.

Dempsey, Wesley H., Chico State College, Chico, California.

Flowers were removed from male-sterile tomato plants, pollinated, and then incubated at temperatures ranging from 50 to 40°C. Pollen tube growth was measured using UV microscopy. Germination occurred after 40 minutes at 35°C and increased to 20 hours at 5°C. At 37°C, pollen germinated in 30 minutes but grew abnormally and ceased growth while still in the stigma. At the lower temperatures, the growth rate was inversely related to temperature with pollen tubes entering the micropyle after 7 hours at 35°C but 34 hours at 10°C. Fruit-set and seed-set results from whole plants in constant temperature chambers showed reductions at temperature extremes.

3:45 Minigardening with Vegetables and Flowers.

Wester, Robert E., USDA, Beltsville, Maryland.

Artificial light, artificial soil, portable containers, midget flowers, and midget vegetables now make it easy and simple to grow plants in class rooms, school yards, on outdoor steps, sidewalks, apartment house balconies, penthouses, and other crowded areas.

With our evermore crowded cities, limited space, and leisure time, minigardening offers the young, middle-aged, and senior citizens opportunities to beautify their cities with flowers and with vegetables to eat.

This is a preview of a movie on “Minigardening with Vegetables and Flowers,” prepared by Walter Klein, Ltd., in cooperation with Burgess Seed Co. and U.S. Department of Agriculture.
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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 more than 3,000 in the USA and 69 other countries. In 1916, the constitution was amended to change the name to “American Society for Horticultural Science,” but the name now 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 that 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 (La.) 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; and to F. S. Howlett, R. E. Marshall, H. M. Munger, and J. R. Magnes for their extended periods of devoted service as indicated in the following lists.

President
*L. H. Bailey 1903-07
*S. A. Beach 1911
*W. T. Macoun 1912
*U. P. Hedrick 1913
*L. C. Corbett 1914
*W. L. Howard 1915
*M. A. Blake 1916
*T. C. Johnson 1917
*C. A. McCue 1918
*J. W. Crow 1919
*W. H. Alderman 1920
*W. H. Chandler 1921
*J. C. Blair 1922
*J. H. Gourley 1923
*M. J. Dorsey 1924
*H. C. Thompson 1925
*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. Magnes 1934
*H. H. Zimmerley 1935
Alex Laurie 1936
A. J. Heinicke, Sr. 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. Emeweller 1950
*A. F. Yeager 1951
*Kenneth Post 1952
S. H. Yarnell 1953
F. P. Cullinan 1954
E. S. Haber 1955
M. B. Davis 1956
L. D. Davis 1957
W. T. Pentzer 1958
F. S. Howlett 1959
H. A. Rollins, Sr. 1960
V. T. Stoutemyer 1961
F. S. Jamison 1962
Walter Reuther 1963
R. E. Larson 1964
*L. P. Batjer 1965
H. J. Carew 1966
H. M. Munger 1967
N. W. Stuart 1968
W. A. Frazier 1969
James M. Beattie 1970

Secretary-Treasurer
*S. A. Beach 1903-07
*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

Executive Director
Cecil Blackwell 1965-present

Editor of the Proceedings
and the Journal
*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. Magnes 1959-66
S. H. Yarnell 1966-69
T. W. Whinitaker (Editor) 1970-present

Editor of HortScience
Cecil Blackwell 1965-69
T. W. Whinitaker 1969
G. W. Bohn (Co-Editor) 1969
Jules Janick 1970-present

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 through 1969 are listed below. Those elected Fellows in 1970 will be honored during the Society's annual banquet November 3, 1970 at the Carilion Hotel, Miami Beach, Florida.

W. H. Alderman 1965 M. E. Gardner 1967
F. W. Allen 1965 V. R. Gardner 1965
*L. P. Batjer 1966 Laurence Greene 1965
James M. Beattie 1968 Elmer Hansen 1968
Charles J. Bishop 1968 Paul L. Harding 1967
V. R. Boswell 1965 John D. Hartman 1968
H. John Carew 1967 Irvin C. Haut 1968
Robert L. Carolus 1966 A. J. Heinicke, Sr. 1965
Ernesto H. Casseres 1969 *A. H. Hendrickson 1965
Lewis C. Chadwich 1968 Melvin B. Hoffman 1968
Norman F. Childers 1968 Freeman S. Howlett 1965
E. P. Christopher 1967 Charles L. Isbell 1968
Lawrence L. Claypool 1968 F. S. Jamison 1965
H. L. Cochran 1966 *Stanley Johnston 1965
Lloyd Curtis Cochran 1968 Henry A. Jones 1965
I. J. Condit 1966 Winston W. Jones 1969
Edwin A. Crosby 1968 Wesley P. Judkins 1967
F. P. Cullinan 1965 Alvin L. Kenworthy 1968
T. M. Currence 1965 W. D. Kimbrough 1967
George M. Darrow 1965 J. E. Knott 1965
O. Wesley Davidson 1968 Russell E. Larson 1965
L. D. Davis 1965 Alex Laurie 1965
M. B. Davis 1965 J. W. Lesley 1965
M. J. Dorsey 1965 Oscar A. Lorenz 1969
Joseph B. Edmond 1968 Albert P. Lorz 1969
N. K. Ellis 1965 L. H. MacDaniels 1965
*S. L. Emeweller 1965 J. H. MacGillivray 1966
*A. T. Erwin 1965 John P. McCollum 1968
Donald V. Fisher 1968 John R. Magnes 1965
W. A. Frazier 1966 John P. Mahlstede 1969
Joseph R. Furr 1969 *Charles H. Mahoney 1965

*now deceased

*now deceased
LEONAR 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, 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:

<table>
<thead>
<tr>
<th>Year</th>
<th>Vegetable Crops</th>
<th>Floriculture</th>
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<tbody>
<tr>
<td>1945</td>
<td>P. W. Zimmerman &amp; A. E. Hitchcock</td>
<td>V. T. Stoutemyer</td>
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<td>1946</td>
<td>Charles M. Rick</td>
<td>G. A. L. Mehlquist</td>
</tr>
<tr>
<td>1947</td>
<td>William H. Lachman &amp; D. C. Kiplinger &amp; Glen Fuller</td>
<td>S. L. Emsweller</td>
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<tr>
<td>1948</td>
<td>Oned Shiffrs</td>
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<tr>
<td>1949</td>
<td>Russell E. Larson &amp; Sherman Paur</td>
<td>S. L. Emsweller &amp; Neil W. Stuart</td>
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<tr>
<td>1950</td>
<td>W. A. Frazier &amp; Robert K. Denneett</td>
<td>John G. Seeley</td>
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<tr>
<td>1951</td>
<td>M. L. Odland &amp; C. J. Noll</td>
<td>O. W. Davidson &amp; Sam Asen</td>
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<td>1952</td>
<td>H. Kihara</td>
<td>C. W. Fischer, Jr. &amp; J. R. Keller</td>
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<td>1953</td>
<td>A. N. Reath &amp; S. H. Wittwer</td>
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<tr>
<td>1954</td>
<td>R. W. Richardson, Jr. &amp; T. M. Currence</td>
<td>James B. Shanks &amp; Conrad B. Link</td>
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<td>1955</td>
<td>C. M. Geraldson</td>
<td>B. Lennart Johnson</td>
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<td>1958</td>
<td>Irvin L. Eaks &amp; Leonard L. Morris</td>
<td>J. P. Nitsch</td>
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<td>1959</td>
<td>Margaret M. Lesley &amp; J. W. Lesley</td>
<td>Sam Asen &amp; Neil W. Stuart</td>
</tr>
<tr>
<td>1961</td>
<td>J. R. Wall &amp; T. L. York</td>
<td>A. A. Piringer, Jr. &amp; H. M. Cathey</td>
</tr>
<tr>
<td>1963</td>
<td>M. L. Odland</td>
<td>Robert O. Miller</td>
</tr>
</tbody>
</table>

*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
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
1968 M. Allen Stevens and W. A. Frazier
1969 Leaton J. Kushman, Daniel T. Pope, and J. A. Warren

*Name of the award was changed to “The National Canners Association Award in Raw Products Research.”

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. Haney
1961 Abraham H. Halevy
1962 Makoto Kawase
1963 Jasper N. Joiner and Thomas C. Smith
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
1968 Willie E. Waters and Harold F. Wilkins
1969 Wesley P. Hackett and Roy M. Sachs

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
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
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
1968 Miklos Faust, Betty R. Chase, and Louis M. Massey, Jr.
1969 S. J. Leuty and Martin J. Bukovac
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
1968 Charles C. Doughty, Max E. Patterson, and Azni Y. Shawa
1969 Johan E. Hoff and Herbert C. Dostal

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
1968 William H. Carlson and Ernest L. Bergman
1969 Bruno C. Moser and Charles E. Hess

THE ASGROW AWARD IN VEGETABLE CROPS

Established in 1964 and sponsored by the Asgrow Seed Company, Orange, 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 Sidiki Sadik and Philip A. Minges
1968 C. F. Andrus and G. W. Bohn
1969 Hamdy M. Eisa and Henry M. Munger

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
1968 Kenneth L. Olsen, Harold A. Schomer, and Richard D. Bartram
1969 No Recipient

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
1968 A. N. Roberts and Lawrence T. Blaney
1969 Melvin N. Westwood and H. O. Bjornstad

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:
1967 Oyette L. Chamblish and Charles M. Jones
1968 Kenton C. Olson, T. W. Tibbitts, and B. Esther Struckmeyer
1969 Lucien Laferriere and Warren H. Gabelman

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
1968 Taze Leonard Senn
1969 Norman F. Childers
SUSTAINING MEMBERS
of the
AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE

The American Society for Horticultural Science serves as the professional organization for more than 3,000 horticulturists. Individual members at colleges and universities, at research stations, in industry, in the field of practice, and representatives of Sustaining Member Companies and organizations 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 1970 (as of July 15, 1970):

AmChem Products Inc. (B. H. Emerson), Ambler, Pennsylvania 19002

AMDAL Company, Div. of Abbott Laboratories (Norman E. Leffler), Abbott Park 14, North Chicago, Illinois 60064

American Cyanamid Co. (F. L. Stark), Agricultural Div., P. O. Box 400, Princeton, New Jersey 08540

American Potash Institute (J. Fielding Reed), 1649 Tullie Circle, N.E., Atlanta, Georgia 30329

**American Seed Trade Assn., Inc. (John I. Sutherland), Executive Bldg., Suite 964, 1030 15th St., N.W., Washington, D. C. 20005

Asgrow Seed Co. (John S. Rogers), 584 Derby-Milford Rd., Orange, Connecticut 06477

George J. Ball, Inc. (Burt S. Andrews III), Box 335, West Chicago, Illinois 60185

W. Atlee Burpee Co. (David Burpee), Hunting Park Ave. at 18th Street, Philadelphia, Pennsylvania 19132

**H. F. Byrd, Inc. (B. Beverly Byrd), P. O. Box 312, Berryville, Virginia 22611

California Canners and Growers (Scott McRitchie), 1200 S. 10th St., Richmond, California 94804

California Tomato Research Institute, Inc., (George A. Johannessen), 9036 Thornton Road, Stockton, California 95207

A. L. Castle, Inc. (Thomas Castle), P. O. Box 877, Morgan Hill, California 95037

**Chevron Chemical Co. (Robert K. Thompson), Ortho Div., 940 Hensley St., Richmond, California 94804

Bruce Church, Inc. (David M. Williams), P. O. Box 599, Salinas, California 93903

Crookham Co. (A. D. Taylor), Box 520, Caldwell, Idaho 83605

Del Monte Corp. (Charles E. Geise), Box 36, San Leandro, California 94577

Dessert Seed Co., Inc. (A. M. Dessert), P. O. Box 181, El Centro, California 92244

Diamond Shamrock Corp. (J. A. Ignatowski), Field Research & Tech. Serv., 300 Union Commerce Bldg., Cleveland, Ohio 44115

De Giorgio Fruit Corp. (J. Max O'Neill), P. O. Box 3574, San Francisco, California 94111

Eli Lilly & Co. (S. J. Parka), Elanco Products Company Div., Indianapolis, Indiana 46206

Geigy Agricultural Chemicals (J. J. Hood), Ardsley, New York 10502

Gerber Products Co. (James J. Pittman), Res. Bldg., Fremont, Michigan 49412

Gilroy Foods Inc. (Elmo W. Davis), P. O. Box 1088, Gilroy, California 95020

Green Giant Co. (J. G. Martland), LeSueur, Minnesota 56058

The Grower-Shipper Vegetable Assn. (E. James Houseberg), 512 Pajaro St., P. O. Box 828, Salinas, California 93903

H. J. Heinz Co. (Max D. Reeder), P. O. Box 57, Pittsburgh, Pennsylvania 19105

Massachusetts Horticultural Society (Carlton B. Lees), 300 Mass. Ave., Boston, Massachusetts 02115

Shig Muranaka Wholesale Flower Grower (Shig Muranaka), 5842 Lakeview Avenue, Yorba Linda, California 92686

Northrup, King & Co. (Iver Jorgensen), 1500 Jackson St., N. E., Minneapolis, Minnesota 55413

*Oyler's Fruit Farms, Fruit Grower & Packer (Thomas O. Oyler, Sr.), R.D. No. 3, Gettysburg, Pennsylvania 17325

**Robert B. Peters Co., Inc. (Robert B. Peters), 2833 Pennsylvania Street, Allentown, Pennsylvania 18104

The Procter & Gamble Co. (Harry S. Walker), Ivorydale Tech. Center, Cincinnati, Ohio 45217

**Shell Chemical Co., Ammonia Div. (D. R. Grant), 100 Bush St., San Francisco, California 94106

Stauffer Chemical Co. (C. O. Persing), Agricultural Research & Development, P. O. Box 760, Mt. View, California 94042

**Unilever Research Laboratorium Duiven, Postbus 7, Zevenaar, The Netherlands

United Fruit Co. (W. T. van Diepen), Box 770 Shenandoah Sta., Miami, Florida 33145


Washington State Apple Advertising Commission (Joseph T. Brownlow), P. O. Box 18, Wenatchee, Washington 98801

Arthur Yates & Co. Pty., Ltd. (D. Blazey), David Road, Castle Hill, N.S.W. Australia 2154

**Yoder Bros. Inc. (William Skou), P. O. Box 230, Barberton, Ohio 44203

NOTE: Companies and organizations printed in bold face type have been Sustaining Members for 10 years or more.

**Indicates Sustaining Membership for 5 to 9 years.

*Indicates new Sustaining Members for 1970.