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Introduction

The Horticulture Research Center on Green Mountain Drive in South Burlington is a horticultural field research laboratory for the College of Agriculture and Life Sciences. Over the years it has been popularly called the Hort. Farm; hereafter it is referred to by that name.

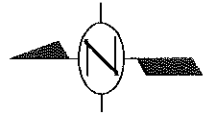
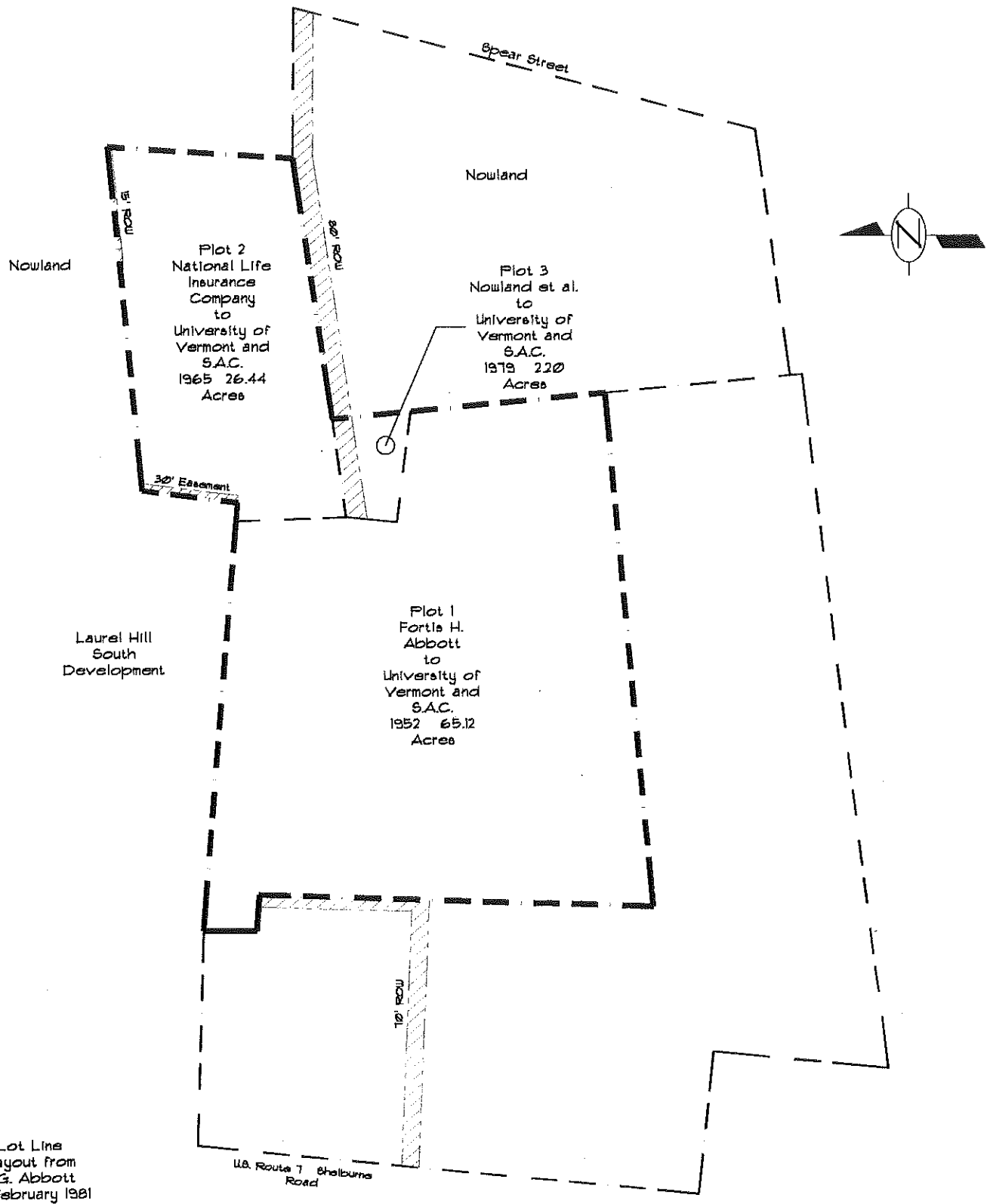
The idea for this publication started when I reviewed the Hort. Farm records in the files of horticulture Professor Bertie Boyce. I thought these records were worthy of preservation for the future and started what I thought would be, a short document of a few pages. However, as the project started, I came to realize that many people had contributed significant effort through the Hort. Farm, resulting in horticultural and personal benefits. I hope to have captured a sense of history and the many contributions in this document.

Many people have contributed to this document. I am grateful to Professor Boyce for the inspiration, personal memories, photos, and his records of 1950's hand-drawn maps of plantings, fertilization records, moisture records, and soil tests. Other photos were provided by Lorraine Berkett, Leonard Perry and Marguerite Ashman from the Extension System files. Shirley Adams, through her efforts on behalf of the Friends of the Hort. Farm, compiled information about property transfers and agreements between the University and South Burlington. Helen Blasberg, wife of Professor Charles Blasberg who was instrumental

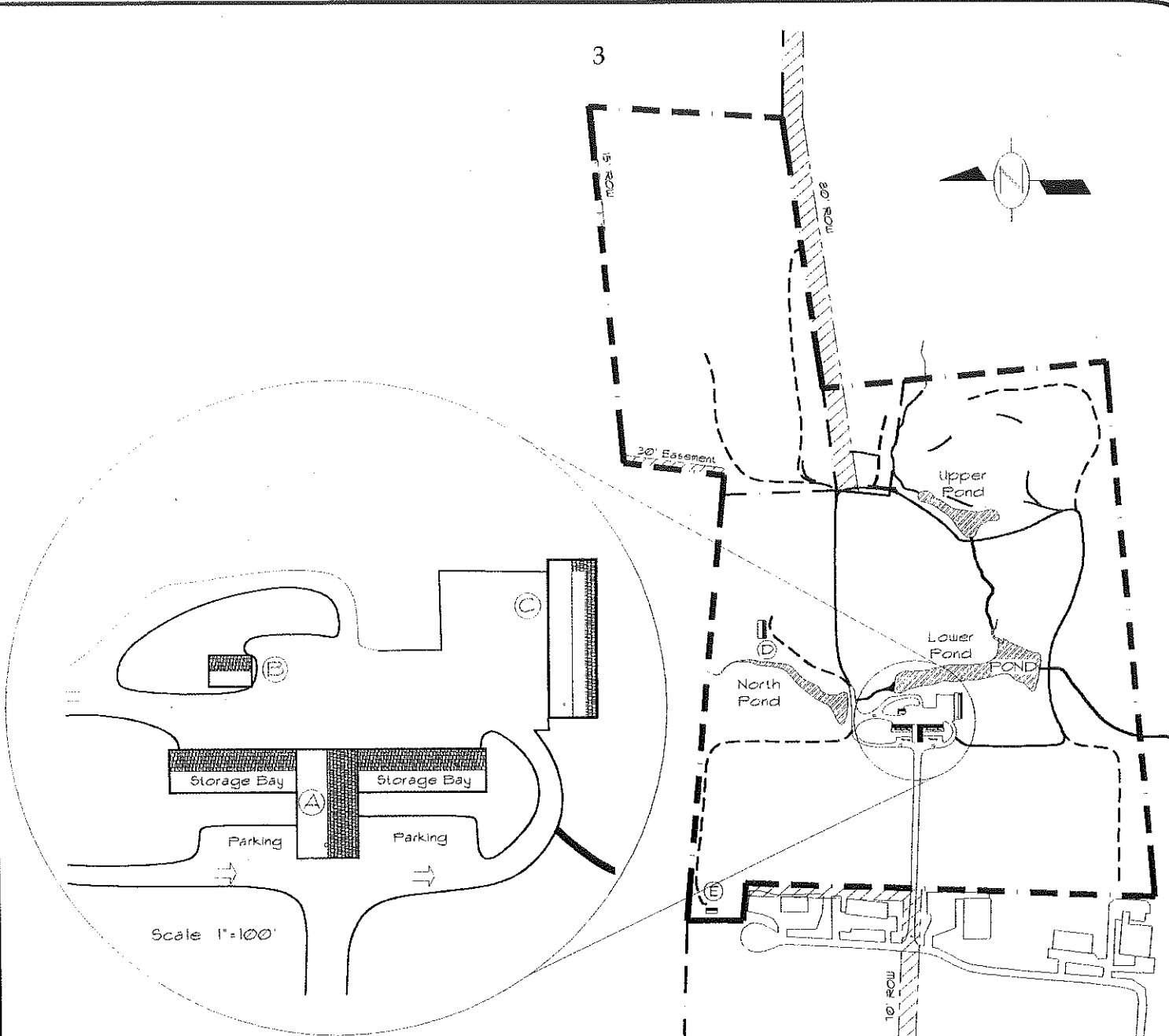
in founding the Hort. Farm, provided her memories of the beginning years of the farm. Professor Samuel Wiggins gave information based on his many years of directing the Hort. Farm and provided helpful reviews of the manuscript. Alice Beisiegel also provided helpful comments in review of the manuscript. Paul Brody of T. J. Boyle Associates Landscape Architects prepared the maps of the Hort. Farm. Others who contributed information include: Harris Abbott, Kristina Bielenberg, Lorraine Berkett, Ed Bouton, Dennis Bruckel, Margaret Calahan, Mary Calahan Cheney, Jon Clements, Joseph Costante, Gregory Eurich, Dean Evert, Harrison Flint, Alan Gotlieb, David Heleba, Susan Hopp, Fred Magdoff, George MacCollom, Leonard Perry, Vern Tuxbury, Kenneth Varney, and Glen Wood. Special thanks to my wife, Dorothy, who reviewed the manuscript and answered my numerous queries about punctuation.

Vermont Agricultural Experiment Station and Extension Service publications provided some of the early history of agricultural research at the University. Other information for this document was gathered from University of Vermont faculty and staff yearbooks and academic catalogs. Endnotes at the end of the publication are used to reference citations.

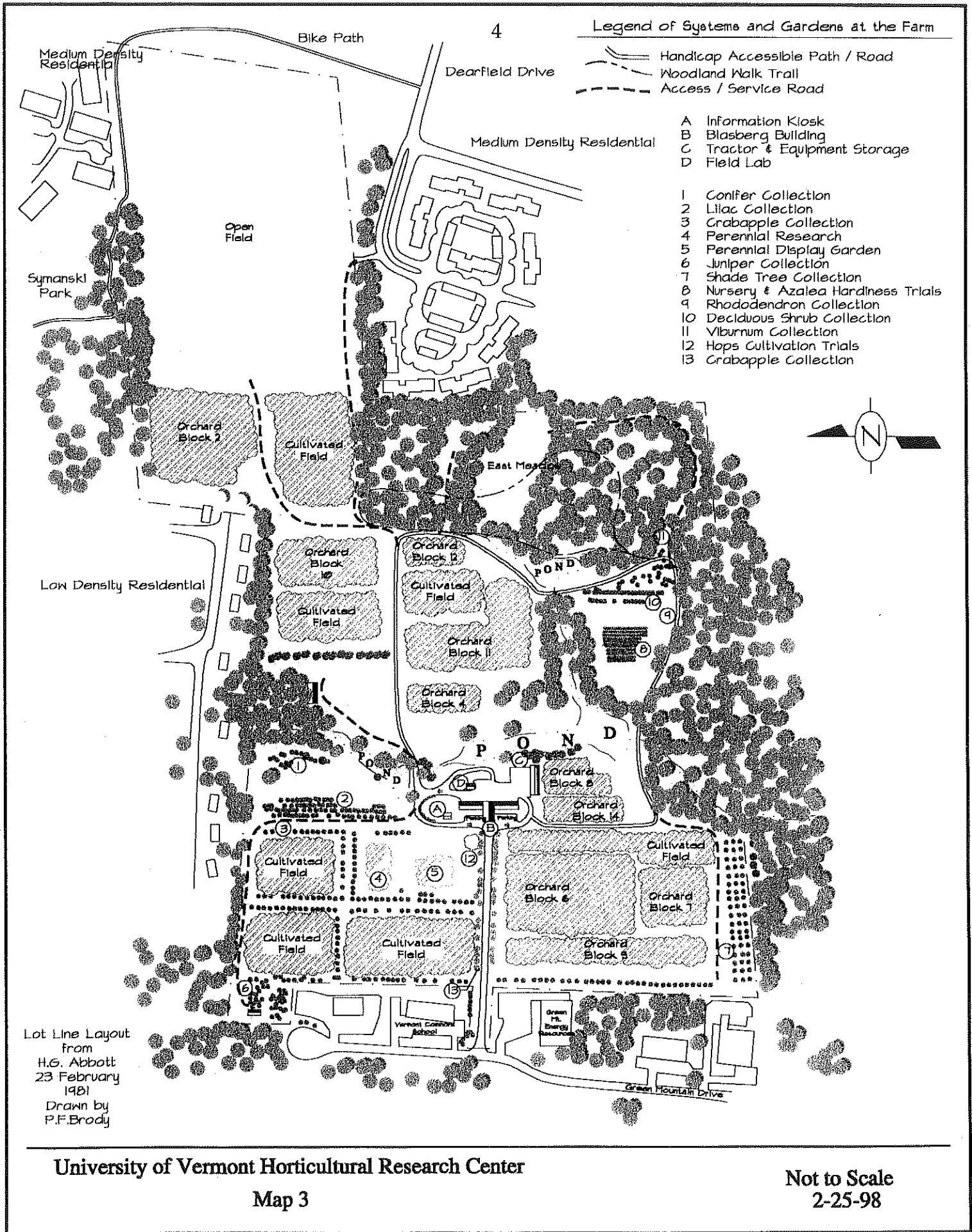
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Lot Line
Layout from
H.G. Abbott
23 February 1981
Drawn by
P.F. Brody



- (A) Blasberg Building
- (B) Field Lab
- (C) Tractor and Equipment Shed
- (D) Fertilizer Shed
- (E) Green Barn



Beginning of agricultural research

Vermont Senator Justin Smith Morrill authored the Morrill Land Grant Act of 1862 which provided for the establishment of colleges to benefit agriculture and mechanic arts in the states and territories. The Vermont Legislature on November 9, 1865 passed a bill creating the University of Vermont and State Agricultural College. This occurred after the University of Vermont Board of Trustees agreed to accept the College of Agriculture¹.

The Vermont Agricultural Experiment Station is the research arm of the University of Vermont College of Agriculture and Life Sciences. The Agricultural Experiment Station was founded by an act of the state legislature on November 24, 1886 and granted an appropriation of \$3,500 a year for two years². The Station was to be "in connection with and under control of the University of Vermont and State Agricultural College". The Hatch Act, passed by the U. S. Congress in 1887, provided funds annually for each state to support an agricultural experiment station under the direction of the land grant college in that state to conduct research related to agriculture and rural life.

The Purnell Act of 1925 and the Bankhead-Jones Act of 1935 along with the Hatch Act provided a major source of funds for agricultural experiment stations³. The Bankhead-Jones Act required matching state funds. Funded primarily with state and federal sources over the years, the scientists have carried out research and demonstration

on subjects of value to farmers, families and communities with special emphasis on local concerns.

In 1996, Hatch funding is supplemented by other USDA funds and other grants. The University of Vermont and State Agricultural College's farms for agricultural field research include the Hort. Farm, the Paul Miller Research Center (dairy farm) on Spear Street, South Burlington, the BioResearch Center on Spear Street, South Burlington, and the Procter Maple Research Center in Underhill. The farms also serve to educate students and the public by providing classroom material and on-site public tours and meetings.

Prior to the Hort. Farm, horticulture research plots were located on the campus on the site of the present University Heights. This area was used for research, teaching and demonstration of fruit and vegetable crops. Apples, vegetables and strawberries were the primary research crops in the 1940's. This location became increasingly unsatisfactory for research because of campus development and home construction in the area. Increased thievery of fruit and vegetables from research plots made data collection unreliable. Lack of irrigation and poor soils contributed to the poor suitability of this site for research.

When the Hort. Farm started

The University of Vermont and State Agricultural College purchased 66.12 acres of the Fortis and Sadie Abbott

dairy farm in South Burlington on January 30, 1952⁴. This farm was named the Horticultural Research Center.

The University of Vermont decided to build faculty housing (University Heights) in the 1950's on the site of the horticultural research plots on campus. Charles Blasberg, then chairman of the Horticulture Department and C. Lyman Calahan, Extension horticulturist, began looking for property near the campus that would benefit students. They searched for a farm with suitable soils and good air drainage which would be useful for horticultural crops and Extension horticulture activities. Fortis Abbott approached Professor Calahan



Professor Charles Blasberg arranged the purchase of the Hort. Farm in 1952.

about the University's interest in purchasing the Abbott farm located on the east side of highway 7 in South Burlington. Calahan observed that since alfalfa grew on the farm, the soil would be suitable for apples. Calahan and Blasberg decided the Abbott parcel would fit the University needs for horticultural research. Some doubted the suitability of the site for horticultural research since the loamy sand soils were unrepresentative of most soils of the state. Abbotts asked \$25,000 for the parcel. However, the University administration approved the purchase, but only provided \$17,500. An arrangement was made to purchase a portion of the Abbott farm for the lesser amount. Thus, the University missed the opportunity to own all the land to Shelburne Road. This first Hort. Farm purchase is hereafter referred to as the Abbott section to distinguish it from parcels purchased later (map 1, page 2).

Who uses the Hort. Farm

Many people benefited from the research, teaching and extension activities at the farm. Research at the farm defined the best new and common vegetables, fruits, ornamentals and turf grasses and the cultural practices best suited for the Vermont climate. University students, through their classes and special projects, enhanced their education at the farm. Extension agents and master gardeners received training there. Many organizations held short courses and tours at the farm. During the 1990's, the Friends of the Hort. Farm in cooperation with the Department of Plant and Soil Science, sponsored many educational programs.

Groups using the Hort. Farm over the years include garden clubs, the Vermont Tree Fruit Growers (formerly Vermont State Horticulture Society), the Vermont Association of Professional Horticulturists, (formerly Vermont Plantsmen's Association), the Vermont Small Fruit and Vegetable Growers, the Hardy Plant Club, the Friends of the Hort. Farm, the Vermont Chapter of the American Society of Landscape Architects and the Green Mountain Rose Society.

The Blasberg building classroom has frequently been used by the Burlington Garden Club for lectures, workshops, and flower shows. The University of Vermont Board of Trustees has held summer meetings at the Farm. The Vermont Vocational Agriculture program, Future Farmers of America, held their annual horticulture judging contest at the Farm for more than 25 years. Public school classes frequently visit the farm. Many other groups have held meetings at the Hort. Farm classroom. Foreign and U. S. horticultural scientists have visited the Hort. Farm.

Hort. Farm development

The present entrance to the Hort. Farm is located 1125 feet east of U.S. highway 7 (Shelburne Road) on Green Mountain Drive. The deed from the Abbotts granted a straight 70 foot wide right-of-way to where the present entrance is located. However, the entrance to the Farm during the 1950's was on the northwest corner, adjacent to the present juniper collection. The driveway from highway 7 turned north

near the the west property line and extended to an entrance at the northwest corner.

The Abbott farm house and outbuildings were just west of that corner, but not on the Hort. Farm property. A fire destroyed the farm house several years after the Hort. Farm was established. The existing building on the northwest corner was one of the outbuildings near the farm house (map 2, page 3). It may have been used as a home for hired farm workers as evidenced by a toilet on the second floor and a central chimney in the building. During the early years of the Hort. Farm this building was used for office and storage of tools and supplies.

In 1965 Professor Samuel Wiggans, chairman of the Department of Plant and Soil Science, was asked by University President Lyman Rowell if the National Life Insurance Company property of 26.4 acres east of the Hort. Farm could be useful. Rowell arranged for the University to buy this land and it was added to the Hort. Farm⁵. In November 1965, the University acquired this parcel from the National Life Insurance Company (hereafter referred to as the National Life section, map 1). The National Life Insurance Company had purchased their property in December 1952 and tried to buy the Hort. Farm for their headquarters site which was later built in Montpelier.

The University acquired a third parcel of 2.2 acres (Nowland section) on the eastern side of the original farm from the Nowland family in March 1979

to provide a straightened boundary line in the Abbott section of the farm⁶ (map 1). An agreement between the city of South Burlington and the Nowland family provided the city with an 80 foot right of way along the northern side for a potential future street, however this street was never developed. The National Life and Nowland property acquisitions resulted in a total Hort. Farm area of approximately 95 acres.

The University, in 1991, deeded a 15 foot wide by 500 foot long strip along the north side of the National Life section to South Burlington for a bicycle path (map 3, page 4). The city, in exchange, relocated the chain link fence and allowed a right of way for a service entry to the farm through a gate on the south side of the National Life section. This entrance is currently used as an entrance for farm equipment traveling between the Paul Miller Research Center on Spear street and the Hort. Farm.

Facilities development

Boundaries, infrastructure and water courses:

Horticulture Professors Charles Blasberg, C. Lyman Calahan and Richard Hopp laid out the original plots and roads in 1952 and established the first plantings in that year. The early layout of roads and plots still exists, 46 years later, in nearly the same configuration. The present entrance was established in 1961 when the Blasberg building was constructed.

Several years after the Abbott section

was purchased, an eight foot high woven wire fence was built around the property to keep deer from browsing the research plantings. Deer, however, sometimes got in, either through an open gate or under the fence in ravines. Usually they were killed since it was difficult to chase them out. Professor Bertie Boyce remembers when he and two other people chased three deer out the front gate. Under the direction of



Professor Blasberg examining apple trees in his research plots, ~1958.

Professor Samuel Wiggans, this fence was gradually replaced with the present chain link fence which was purchased through the sale of apples grown on the Farm. Wiggans said new fences were to "keep out two and four-legged animals".

Professor Blasberg recognized the importance of irrigation for achieving good crop yields. When the Hort. Farm was purchased, a small pond with a dam on the south side was located where the present north pond is situated (map 2). During the first year, this pond was enlarged with the aid of a dragline excavator. Within the next few years, water availability for irrigation was increased substantially by the creation of new ponds.

Annual maps of facilities and plantings were drawn for the first ten years of the Hort. Farm. The 1954 map designates the present picnic area and shows three ponds constructed as a water source for sprinkler irrigation. The 1956 map shows five ponds with two near the present upper pond (map 2) and two near the present irrigation pond. The 1958 map shows three smaller ponds where the present upper pond is located with two at the site of the present irrigation pond. The 1961 map shows that the three upper ponds had been merged into one larger pond. No maps were found for the farm from 1963 through 1966.

A 1967 map shows the present irrigation pond east of the Blasberg building in place of the two smaller ponds. In the mid-1960's, Professor Wiggans made an agreement with Howard Cranwell, developer of Laurel Hill South, to allow a drainage ditch through the north boundary of the Hort. Farm into the north pond with overflow going to the irrigation pond behind the Blasberg building. A new

dam was built at the south end to enlarge the irrigation pond. This larger pond has since been used to provide most of the irrigation water.

The University signed a license agreement November 5, 1991 with the city of South Burlington to allow drainage onto the Hort. Farm. A 30 foot wide, 437 foot long drainage ditch was constructed on the northwest corner of the National Life section to allow discharge of storm water runoff from the rear of properties on Yandow drive and Sebring road to the north of the farm (map 2).

In 1983, a sewer line was connected from the Blasberg building and the field lab building to the city sewer system. Previously, a septic tank and leach field had been used for sewage disposal.

The ponds were dredged out in the 1960's, 1970's and several times later because of siltation. The development of surrounding properties into housing increased the amount and velocity of rainfall runoff resulting in faster siltation of the ponds. The dredged silt was hauled away and the pond edges were sloped.

During the 1960's, houses were built along the north boundary of the farm. Automobile dealerships sprung up along Shelburne road in the 1970's on land previously used as dairy pasture. Other businesses were established west of the Abbott section. Houses were built along the south boundary of the Abbott section in the early 1980's. Property east of the Abbott and Nowland sections was

developed with houses and condominiums in the mid-1980's. By agreement with the University, two retention ponds were built by the developers off-property to the east of the Abbott and Nowland sections to intercept rainfall runoff before it entered the Hort. Farm. Because the ponds were improperly engineered to handle heavy rains, siltation occurred as the runoff drained into the upper Hort. Farm pond. This pond was dredged by the developer in 1986 and 1989 to remove silt. Heavy siltation remains a problem because of inadequate systems for controlling runoff from adjacent properties.

Structures and buildings:

The early 1950's maps show a building where the present fertilizer shed is located (map 2). A portion of this building may have been present on the Abbott farm. The 1954-1959 maps show a structure in the northwest region of the Abbott section which Professor Bertie Boyce says was a 3 1/2 foot high root cellar with stone walls. This cellar, which formerly may have been a cistern, was used as underground winter storage for dormant plants such as young fruit trees. This storage served for wintering bare root plants until the new field lab building was built in the early 1970's.

The Blasberg building was built in 1961 (map 2). The structure included a central enclosed building with open bays for trucks and equipment extending north and south. The central building contained a classroom, office, two public restrooms, a one room apartment with

bath, and a machine shop. The two open storage bays south of the machine shop were later enclosed for storing small farm equipment and tools with a separate room for entomology research equipment. A separate open-sided storage building, named tractor and equipment shed, was built in 1978 to the southeast of the Blasberg building (map 2).

The Blasberg building was built under contract, but the finish work was done by the faculty and the farm manager. Professors C. Lyman Calahan, Richard Hopp, George MacCollom and manager, Bertie Boyce installed the electrical outlets, put up the wallboard and painted the inside.

The field lab building was built in the early 1970's to the east of the Blasberg building (map 2). The shell and underground storage were constructed first with Agricultural Experiment Station funds. Gradually the interior of the building was finished as Plant and Soil Science Department funds became available. Some of the laboratory benches came from the former Botany Department laboratories when Botany moved from the Hills building on the campus to the new Marsh Life Science building.

The finished field lab building included a cold temperature storage room for fruit, an underground storage for root stocks and dormant plants and a laboratory for taking data such as weighing and counting strawberries and blueberries to determine yield. Drying ovens, moved from the former

agronomy storage building (adjacent to the present Sheraton Conference Center), were installed for drying forage and other plant samples for nutrient analyses.

The present fertilizer shed was reconstructed in 1973 under manager, Dennis Bruckel's supervision (map 2). Separate rooms equipped with exhaust fans were constructed to U. S. Environmental Protection Agency standards for storage of insecticides, fungicides and herbicides.

A lean-to was built on the north side of the fertilizer shed in 1982 by manager Gregory Eurich and farm worker Jasper Rushford to increase storage for equipment. A caged area was built inside the fertilizer shed in 1983 to prevent raccoons, attracted by fertilizer salt, from destroying bags of fertilizer.

Experimental crop yield and plant growth data are scientifically expressed as dry weight. The drying of plant material requires a chamber which can maintain constant airflow and a controlled high temperature of 50 to 80 °C. (122 to 176 °F.). Two new plant drying rooms with precise temperature control and more capacity than the previous system were installed in the field lab building in 1992 by manager, Gregory Eurich and his staff. The drying rooms are used to dry large samples of corn and other forage for field research projects on Vermont farms.

Irrigation:

The loamy-sand soil at the Hort. Farm dries out quickly requiring

irrigation to successfully grow crops. Blasberg purchased portable irrigation systems during the first year, 1952. Included were gasoline-powered, portable pumps and portable aluminum pipes with sprinklers on risers that could be moved from one area to another. By the early 1960's, four portable pumps were used for irrigating the experimental plots. The pumps shut off automatically when a tank of gasoline ran out after approximately two hours, but they provided the desired one inch of water on a half acre. Additionally, a tractor-powered pump, attached to the tractor power take-off, was purchased to increase the area that could be irrigated at one time.

The next irrigation improvement in the late 1960's was a main line of underground pipe installed in several fields connected to a stationary pump north of the present irrigation pond. An industrial gasoline engine powered the pump to give a much higher water output and was housed inside a small pump house. The gasoline engine was later replaced by an electric pump which is still in use. Another small building was constructed to house an electric pump for filling pesticide sprayers and a portable water tank trailer used to haul water for scattered plants.

A trickle irrigation system was constructed in 1979 to reduce water use by delivering directly to the root systems rather than watering the entire field. An electric pump was installed inside a new small building located by the other two pump houses on the north side of the lower pond. Main lines were

installed underground leading to the apple orchards, blueberry plantings and ornamental nursery. In following years, lines were added to irrigate orchard plantings to the south and southwest of the Blasberg building. The trickle system is still in use in 1996. Frequent maintenance and flushing the pipes with biocides is necessary to control the organisms that plug the emitters.

Environmental protection

Since pesticides were frequently used on orchards, a system was installed to avoid pollution from cleaning of application equipment. A wash pad and neutralization system was installed southeast of the fertilizer shed in 1986 under direction of manager Gregory Eurich. Pesticide wash water drained from the wash pad into a 500 gallon underground tank. When the tank was full, the content was checked and adjusted for pH and chemicals were added to precipitate out pesticides. Liquid was pumped from the first tank (#1) to the top of a charcoal filter on a second 500 gallon tank leaving solids in the bottom of tank #1. When tank #2 was full, the liquid was spread on a grass field with a sprayer.

This system was removed in 1994 because of concerns about future liability. Since then, pesticide application equipment is rinsed and the rinse water spread on the fields for biodegradation according to Vermont and the U. S. Environmental Protection Agency approved procedures.

Early plantings

Much of what is known about early

plantings at the Hort. Farm come from maps drawn up each year and plant records kept by the researchers and farm manager. The 1953 map shows plots for vegetables, orchards of dwarf and semi-dwarf apple stocks, raspberries, peaches, cherries, plums, blueberries, grapes, ornamentals and strawberries, all of which were planted in 1952 and 1953.

The 1954 map shows a row of crabapples on either side of the present main drive. Some of these still exist 44 years after planting. A semi-dwarf apple orchard was located to the southeast of the present entrance. The planting compared various combinations of grafted root stocks, interstems and scion cultivars. The root stocks of these trees were Robusta 5 (vigorous) and Ottawa 524 (dwarfing). The interstems were 'Robin' and East Malling #7, both expected to be dwarfing. The scion cultivars were, 'Cortland', 'Delicious', 'McIntosh', and 'Northern Spy'.

Other plantings, shown on the 1954 map, were made to determine the adaptation and yield under Vermont conditions:

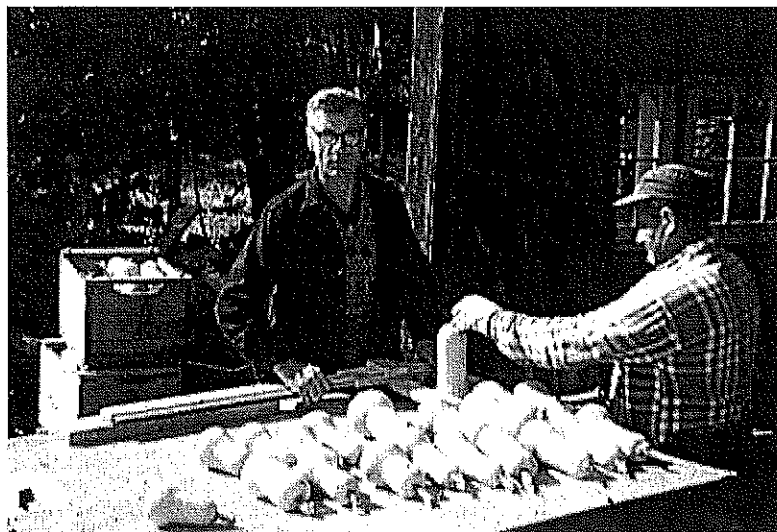
- Apple cultivar collection of standard (not dwarf) trees
- Raspberry cultivars
- Strawberry seedlings from Blasberg hybridization research, Vermont selections and cultivars of virus free 'Howard 17' and 'Catskill'
- Peach, cherry and plum cultivars
- Tomatoes, peppers, eggplants, sweet corn
- Perennial vegetables of asparagus, rhubarb and horseradish
- Grape cultivars

- Blueberry cultivars and selections
- Melons and squash
- Nut trees
- Floribunda roses donated by Jackson and Perkins Nursery, Newark, N.J.
- Lilac collection
- Nursery of ornamentals and fruits

The 1956 map shows variety trials with leek, tomatoes, eggplant, sweet corn, squash, 'Blue Lake' pole beans and other vine crops and the perennial vegetables, asparagus and rhubarb. Virus-free 'Catskill' strawberries were used to study the effect of foliar applications of nitrogen, 1% sugar and sodium carbonate. The effect on yield of varied plant spacing and number of runners were studied in irrigated and non-irrigated strawberry plots.

In 1957, seedling strawberries from 56

crosses made by Professor Blasberg were planted in plots where several soil fumigants had been applied during the previous fall. The fumigants were tested for their control of soil fungi, insects and weeds. Selected strawberry seedlings from Blasberg's breeding program were planted and treated with two different levels of manure and a control to compare the effect of nutrients on plant performance. 'Moreton hybrid' tomatoes, treated or not with the plant growth regulator, fertidyne, were planted in untreated plots or plots treated with the fumigant, chloropicrin. Six cultivars of winter squash were planted and the nutritive value of fruit was determined in cooperation with the nutrition research program of the Department of Home Economics. The nutritive studies with winter squash were continued for at least three years.



Professor Richard Hopp (left) and Arnold Breo measuring Butternut squash, ≈1959.

A 1957 irrigation experiment with virus-free 'Catskill' strawberries compared irrigation levels of one-inch every four days, one-inch every eight days, two-inches every eight days and no irrigation. A study on strawberries to control weeds, and pests compared several fumigants: PCNB at 50 and 100 lbs/acre, Dowfume W-85 at 9 and 18 gallons/acre, Durlone at 25 gallons/acre, Telone at 40 gallons/acre and no treatment. Most of these studies were continued for several years.

Dwarfing apple root stocks of 'East Malling VII' were established in 1958 for propagation by the stool form of layering. 'Catskill' strawberries were planted for comparing the hill system with the matted row system of culture on fruit yield. Also, 'Catskill' was compared with 'Sparkle' in the matted row system.

Changes were made in 1959 in the semi-dwarf apple orchard because some of the original graft combinations were incompatible and died. 'Cortland', 'Delicious', 'McIntosh' and 'Northern Spy' cultivars were grafted onto (a) dwarfing root stock of 'EMVII', (b) on dwarfing 'EMI' root stock, (c) combination of 'EMVII' interstem and vigorous 'Robusta 5' root stock, or (d) a combination of dwarfing 'Robin' interstem on 'Robusta 5' root stock. In addition to previous vegetable trials, strains of Vermont cranberry beans were compared. Black polyethylene film was compared as a mulch for weed control with other weed-control methods on tomatoes, peppers, melons and

cucumbers. Strawberry plantings showed severe winter-killing after the 1958-59 winter. Sweet corn and sunflowers were planted for windbreak between every five rows of strawberries. Fruit of Butternut squash, grown in plots of low and high nitrogen fertilizer and low and high moisture levels were analyzed for vitamin A, vitamin C and for storage changes in these vitamins.

The early strawberry plantings from Professor Blasberg's breeding program covered approximately two acres. The selections were evaluated by researchers and commercial strawberry growers. After selections were made, the fields were opened to pick-your-own customers. The fields would open to pickers at 6 a.m. and the picker's cars were often lined up to highway 7. The two acre field would be completely picked by noon.

Early pesticide and fertilizer records

Records show the kinds and amounts of fertilizer, lime and pesticide applications for many years. Annual soil tests show pH for each plot on the farm. The pH ranged between 4.4 and 7.1 depending on the year, location, fertilization and liming practices. The pH was commonly in the 5.3 to 5.7 range. Irrigation records show dates and amounts for different plots. Moisture blocks were placed in the soil in some plots in the 1950's and 1960's and used as a basis for timing of irrigation. A moisture block contains electrodes in a ceramic block and is used to measure the conductivity which is affected by the amount of moisture in the soil. When

the conductivity readings reached a critical level, irrigation was started.

The 1954 and 1955 pesticide records show that Craig herbicide and the fungicides of captan, fermate, phygon and insecticide/miticides of DDT, arsenate of lead, malathion, kelthane and 1% parathion dust were applied to tree fruit, strawberry and raspberry plantings at various times during the growing season to control weeds, fungi and insect problems. The fertilizers Nugreen (source of nitrogen) and epsom salts (source of magnesium and sulfur) were also applied several times during the early summer to the perennial crops.

Hort. Farm Sales

Apples and other crops from research plots were sold to raise money to help fund maintenance at the Farm. The public has, at times, been invited to pick their own strawberries, but not in recent years. Commercial growers objected to competition from the University which resulted in a decision to discontinue strawberry and vegetable sales in the 1960's. Apples have been sold annually during the harvest season either at the Farm or at the Hills building on the University campus. Sales were usually conducted by the Farm staff, however, for a period of years during the 1970's, the undergraduate Horticulture Club of Plant and Soil Science students sold apples on commission to raise funds for club activities. During the late 1980's and the 1990's, apple sales were held on Fridays at the Farm.

Managers

Management decisions at the Hort. Farm have, until 1993, been the responsibility of the chairperson of the Department of Horticulture and subsequently, Department of Plant and Soil Science when Horticulture and Agronomy Departments were merged. However, for most of the years, a foreman or manager has been responsible for maintenance of facilities and equipment, care of the grounds and supplying assistance to research scientists for specific projects. In the early years, Professor Blasberg provided the overall management, but a foreman carried out the day to day management.

In the early years, the Farm was closed during the winter months when the foreman managed the University horticulture greenhouse. Robert Cleveland was field and greenhouse foreman from 1954 to 1957. Bertie Boyce became foreman of the Farm in 1958 and was manager of the horticulture greenhouse during winter. Boyce was foreman until 1964 when he joined the faculty as assistant horticulturist. Arnold Breo was foreman from 1964 until he died in 1966. Fred Atwood was named farm manager October, 1966 and remained until his retirement in 1970. Atwood came to the Hort. Farm from his position as manager of a private orchard in Grand Isle County.

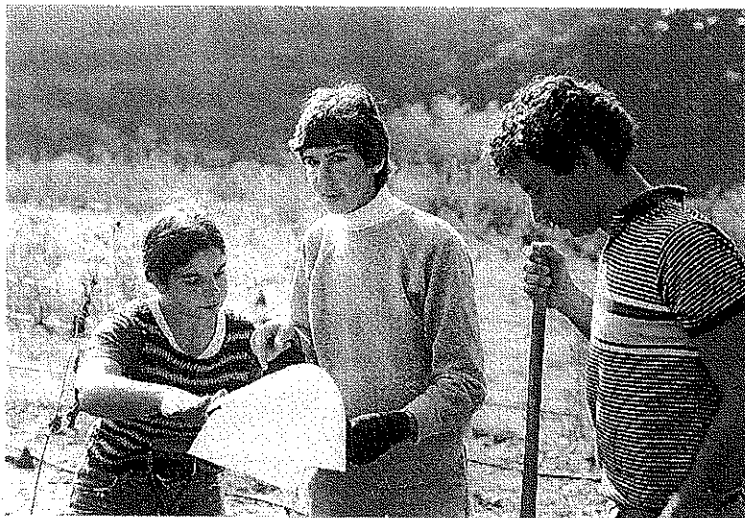
Dennis Bruckel was manager from 1972 until he resigned in 1977 to direct his expanding nursery business in Grand Isle County. Bruckel received his B.S. degree from Cornell University in 1966 and came to the University of

Vermont to work on his M.S. degree in horticulture with Professor Harrison Flint, and later with Professor Samuel Wiggans when Flint left Vermont. Bruckel also managed the Plant and Soil Science greenhouse at the University until 1970. At that time, the Departments of Botany and Plant and Soil Science had separate greenhouses under different managership.

Bruckel propagated and planted many new and uncommon woody ornamental plants for trial at the Hort. Farm while he was a graduate student, greenhouse manager and Hort. Farm manager. He planted many of the crabapple cultivars and other ornamental plants that are presently in the collection. He taught courses in Greenhouse Management, Weed Science and Woody Ornamentals. He taught courses in landscape design in cooperation with Paul Flinn, a local

landscape architect. During his tenure as Farm manager, he started his own nursery business in South Hero, Vermont. Although Bruckel left the Hort. Farm managership in 1977, he continued to teach courses until December, 1979.

Gregory Eurich became manager in September, 1977 and continues in 1996. Eurich received his B.S. degree in biochemistry from the University of Vermont in 1973. After graduation, he worked for a local contractor as a heavy equipment operator and supervisor in constructing interstate highways and tennis courts before becoming Hort. Farm manager. He received his M.S. degree in secondary education with specialty in chemistry, math and physics from the University of Vermont in 1984. He coordinated the farm improvements in water, irrigation and plumbing systems and supervised many



Teaching Assistant Marjorie Duarte (left) instructs students, Becky Phillips and Richard Loeb, on transplanting perennials, 1984.

other improvements. His managership has been made difficult with the decline of operating funds during his tenure.

Employees

Trudo Breo, father of Arnold who later became foreman, was employed as part-time field worker at the Hort. Farm in the late 1950's to early 1960's. Blease (Red) Matthews was employed full-time as mechanic and equipment operator from 1967 to his retirement in 1977. Lyman Howard was a field worker from 1967 to 1977. Jasper Rushford was mechanic and machine operator from 1977 to his retirement in 1993. Guy Potvin was a mechanic for three years leaving in December 1996. Andy Bessette has worked at the farm since 1994.

During the 1970's to mid-1980's, funds were available for hiring college student help under the federally funded work-study program. Ten to 20 students, eligible for work-study funds, worked summers at the Hort. Farm under the supervision of managers, Dennis Bruckel and, subsequently, Gregory Eurich. Fewer work-study positions were available when work-study funds dwindled during the mid-1980's. Many college students have worked on individual research projects under the direction of the research directors and their full time research assistants. The Hort. Farm experience has often been the first time students have experienced working with tractors, farm equipment and growing plants.

The University farms were reorganized in 1993 with the managers

of the Hort. Farm and the Paul Miller Research Center (dairy farm) reporting to Professor William Bramley who was appointed to chair the new supervisory farm committee. This committee is composed of faculty and staff who use the facilities for research. Under the restructuring, Gregory Eurich continued as Hort. Farm manager, reporting to the chair of the farm committee rather than the chair of Plant and Soil Science Department. He assumed responsibility of raising farm crops for dairy animals. Corn has been grown on the National Life section of the farm since 1995. After the reorganization, two staff members split their time between the Hort. Farm and the Paul Miller Research Center.

Research scientists

The research projects at the Farm have been carried out under the direction of faculty members who are scientists in the Department of Plant and Soil Science. The research is supported by Hatch and other funds granted to the research scientist. Some plantings have been made solely for teaching or demonstration purposes, however most are part of a scientist's research projects.

Charles H. Blasberg was chairman of the Horticulture Department when the Hort. Farm was established. Blasberg came to the University of Vermont to work as a research and extension horticulturist from Rutgers University in 1938 where he received his Ph.D. He advised apple growers in Vermont and conducted fruit research on the former horticulture research site where the present University Heights is located.

Blasberg was appointed chairman of the Horticulture Department in 1944. He carried out an ambitious research and educational program with fruits, vegetables and ornamentals at the new Hort. Farm. His primary research goal was to breed and select early bearing, cold-hardy strawberry cultivars for Vermont. At one time, 20,000 seedlings from Blasberg's breeding program were growing at the Farm.

Prior to the Hort. Farm purchase, Blasberg published many Vermont Agriculture Experiment Station pamphlets advising on vegetable and fruit culture. These include: *Selecting Tomato Varieties for Vermont*, Pamphlet 10, 1944; *Tree Fruits for Vermont Gardens*, Pamphlet 16, 1948; *Growing Grapes in Vermont*, Pamphlet 18, 1948; and *Growing Blueberries in Vermont*, Pamphlet 19, 1948, revised in 1961.

Blasberg passed away in April 1961 at the age of 54, his death caused by brain tumor. After his untimely death, the strawberries he selected were maintained for several years, but because early bearing cultivars were introduced from other states, the project was discontinued.

One of Blasberg's last public acts according to his wife, Helen, was to determine the location of the field laboratory building that would later bear his name. Two weeks before his death, Helen drove him to the Farm so he could decide where the long-needed facility should be built. The Blasberg building was built after Blasberg's death

and dedicated on May 18, 1962. A memorial plaque was presented at the dedication by the Vermont State Horticultural Society. It stated, "The Blasberg Horticultural Field Laboratory is dedicated as a tribute to a devoted colleague and an accomplished horticulturist, Charles H. Blasberg, who contributed to a fuller life for others through teaching, research and guidance, and the development of this farm for these purposes."

Blasberg was also honored by the American Society for Horticultural Science, a professional association of horticultural scientists. Their resolution in his honor stated, "Horticulturists of his caliber are becoming very rare . . . he impressed on his students, his readers, his listeners, the fact that we still live in a biological world, and all through our lives we are surrounded by plants and are dependent on their activity, but he also impressed on all of us who came into contact with him that we depend on plants not only as a source of food, but also as a source of recreation and enjoyment. His extensive knowledge of fruit tree nutrition and his influence in this important field will have a profound beneficial effect on commercial orcharding throughout the northeast for years to come."

Richard Hopp was a horticulturist at the University of Vermont from 1947 until his death in 1980. Born in Germany, he immigrated as a young man. He came to the University of Vermont Horticulture Department from the University of New Hampshire

where he received his M.S. degree. His early research at the Hort. Farm involved breeding of tomato and eggplant varieties and cultural studies of an assortment of vegetable crops. He published numerous articles and pamphlets before the purchase of the Hort. Farm advising gardeners and commercial growers on vegetable crop practices. Among these are: *Vegetable Varieties in Vermont*, Vt. Agr. Exp. Sta. Pamphlet 21, 1950), and with nutritionist, Susan S. Merrow, *Quality of Vegetables for Home Freezing*, Vt. Agr. Exp. Sta. Pamphlet 22, 1950.

Hopp conducted climatological and phenological studies using flowering time of lilacs and forsythia to estimate appropriate timing for spring agricultural activities such as appropriate dates for planting crops. These phenology studies were a cooperative venture with scientists at other northeastern land grant universities. He established lilac plantings with cooperators throughout Vermont and at the Farm. The cooperators reported spring temperatures and bloom dates.

Hopp's research publications touched on such divergent topics as variety differences and storage changes in ascorbic acid content of winter squash and the variation of extreme winter temperatures in Vermont. In association with a U. S. Weather Bureau climatologist, he published bulletins on the extreme winter temperatures and growing season length for the state of Vermont. He served as acting chairman of the Department of Horticulture from

May 1961 until February 1963 when the new chairman, Professor Samuel Wiggans arrived.

Hopp, together with Professor Wiggans, established a weather recording station with instruments in a 10-foot deep concrete pit at the farm in the early 1970's, a facility later removed because of budget restrictions. The deep pit and associated above ground measuring devices were located west of the Blasberg building and protected by a chain-link fence. The pit was filled in when the weather station was removed, but the fence still exists and is surrounded by displays of herbaceous perennials.

Hopp took vacations in the islands of St. Pierre and Miquelon (governed by France), off the coast of Newfoundland, to maintain his speaking of "Parisian French". During his tenure, He wrote many articles and bulletins on vegetable gardening. He taught courses in Vegetable Crops and Plant Propagation. Hopp retired from the Plant and Soil Science Department in 1970, but continued at the University as Assistant Director of the Vermont Agricultural Experiment Station until his death in 1980. Hopp took a sincere interest in graduate student's projects and informally advised other students in addition to his own advisees.



Professor C. Lyman Calahan pruning apple trees in the research orchard, ~1976.

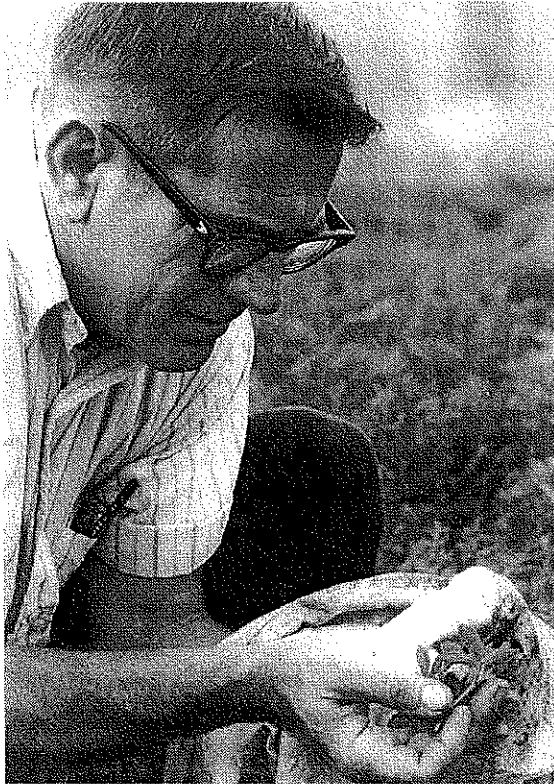
C. Lyman Calahan came to the University of Vermont Horticulture Department after receiving a M.S. degree from the University of New Hampshire in 1947. Cal, as he was popularly known, was appointed Extension Horticulturist to provide Extension educational leadership for fruit growers in Vermont. He, with Professor Blasberg, was instrumental in convincing the University of the need for a new horticulture research facility and was involved in the planning and establishment of the Hort. Farm. His research and outreach education encouraged the establishment of the

vigorous 'Robusta 5' apple root stock as the primary root stock for orchards in Vermont. He worked closely with commercial apple growers throughout the state to develop a vigorous industry. He often reported to the news media as spokesman for the apple industry.

Calahan took a special interest in the Hort. Farm and spent much time there. Margaret Calahan, wife of Calahan, remembers that their family often spent Saturdays at the farm while Cal worked on his research with apple trees. They brought a picnic lunch and Margaret remembers, "the family had the whole farm to themselves as if it were a park". In winter, she made spaghetti and the family and friends skated on the farm ponds. She says that Cal named an apple tree after her, but that it turned out to be inferior to others and was not suitable for fruit production. Calahan's daughter, Mary Calahan Cheney, remembers that, as a teenager, her father taught her how to drive a car at the Farm.

Calahan was a Burlington Parks Commissioner for 20 years. After his death the city of Burlington named the C. Lyman Calahan Park on Locust Street in honor of his contributions. Hundreds of flowering crabapple trees were planted along city streets as result of his interest and influence. Many of these were propagated and cultured by Calahan at the Farm before being planted on the city streets. Mature 'Robusta 5' crabapple trees can be seen on many Burlington streets today. He taught the courses Tree Fruits and Vegetable Crops. Calahan retired as

Extension Horticulturist in 1976, but taught courses for several more years. He died in March, 1986 at the age of 71.



Professor George MacCollom examining insects on alfalfa leaves, ≈1972.

George MacCollom received his Ph.D. in Entomology from Cornell University in 1954 and came to the University of Vermont as Extension and Research Entomologist. He did extensive research on insect pests of forage and field crops and tree fruits. His research focused on pest problems with apples, corn and alfalfa and included studies on the efficacy and drift of air-applied pesticide dusts and sprays.

In the early 1970's MacCollom planted an orchard of 'McIntosh', 'Red

'Delicious', 'Yellow Delicious' and 'Quinte' apple trees in the National Life section of the Farm. He used the orchard to evaluate how low volume, high concentrate sprays of fungicides and insecticides effected phytotoxicity and pest control in orchards.

MacCollom's orchard was later used for apple maggot research. The first observation was made in this orchard of the attraction of adult flies to washed cells of a bacterium isolated from the adult female fly and from flesh of apples infested by the maggot. Over the years a high population of the insect pest, apple maggot, developed at this site which permitted field studies as well as a supply of pupae for laboratory studies. This research, supported by a U. S. Environmental Protection Agency grant in 1994, showed that certain bacteria attract female apple maggot flies to the fruit for egg laying resulting in subsequent larval damage to the fruit. The research is continued at a USDA lab in Gainesville Florida to determine whether volatiles given off by specific bacteria are attractive to other fruit flies.

MacCollom prepared numerous pest control recommendations for vegetable, fruit, dairy farm crops and domestic insect pests. He taught undergraduate courses in Insect Pest Management, Economic Entomology and a graduate course in Biological Control of Insects. He brought students to the Farm on insect collecting trips and for exercises in calibrating pesticide application equipment. He collected mosquito larvae from the Farm for student projects in bioassay of unknown

toxicants. MacCollom retired in 1994 after 40 years at the University of Vermont, but continued work on bacterial volatile attractants to fruit flies.

Kenneth Varney, after receiving his M.S. degree in agronomy at the University of Vermont, joined the Agronomy Department faculty in 1943. His primary research was with field crops at the Agronomy Farm which was then located at the current site of the Sheraton Hotel in South Burlington. During the latter part of the 1950's he participated in irrigation studies at the Hort. Farm. He was involved in a study to determine the best date of seeding for silage corn. Results were used by Extension personnel in advising dairy farmers. Varney retired in 1973.

Glen Wood came to the Agronomy Department at University of Vermont in 1950 from Rutgers University where he received his Ph.D. His early research at the University of Vermont focused on forage crops for livestock, but in the mid-1960's, after the Agronomy Department merged with the Horticulture Department to become Plant and Soil Science, he started research on turf grasses at the Farm.

He tested cultivars of common lawn and golf course grasses and developed cultural practices for Vermont conditions from 1968 to 1977. He developed methods for evaluating turf grass performance with infrared photography. Chemical weed-control studies on turf grasses were conducted between 1968 and 1970. He studied the effect of cutting height on turf quality,

density and weed invasion of turf from 1970 to 1977. Comparisons were made of rotary versus reel mowers on the turf quality when cut at different heights. He studied the survival and performance of turf grass seedlings subjected to drought stress.

During Hort. Farm open houses for the public and numerous Farm tours for professionals, Wood labeled his research plots and discussed techniques and research results with visitors. He taught courses in Turf Grasses, Field Crops, Forage Crops and Scientific Photography. Professor Wood retired in 1985.

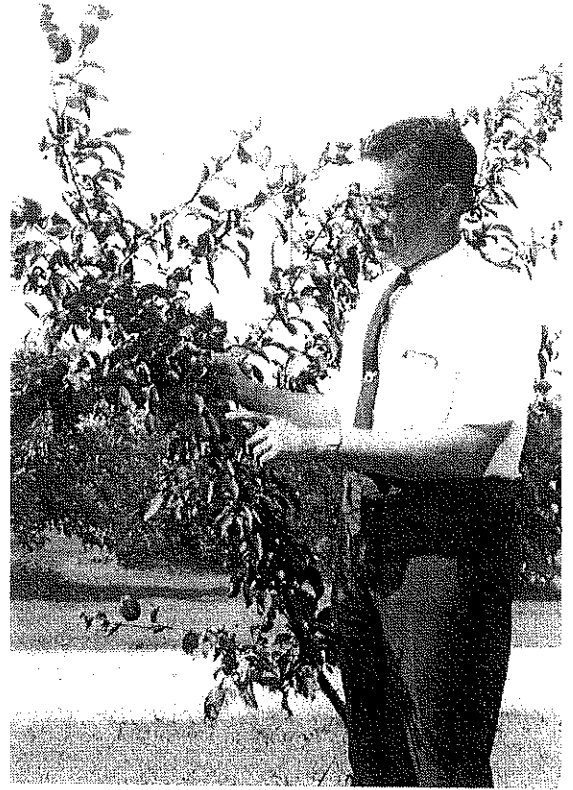
Harrison Flint came to the University of Vermont from the University of Rhode Island faculty in 1962 to serve as Extension Ornamental Horticulturist. He earlier received his Ph.D. from Cornell University. He taught a course in Ornamental Horticulture and provided Extension education to the nursery and greenhouse industry as well as the general public. His research focused on the cold hardiness and the landscape potential of new and uncommon woody landscape plants.

Flint started an extensive program of testing trees, and shrubs for their adaptation, cold hardiness and landscape value. He planted hundreds of species and cultivars at the Farm and at test sites throughout Vermont. He collected a variety of native junipers from eastern coastal regions of Maine for trial as landscape plants.

Flint published a popular Extension Service bulletin entitled *Landscape Plants for Vermont* in 1967. This publication was revised in 1980 by Professor Norman Pellett and is currently available. Flint left the University of Vermont in 1966 to become Horticulturist at the Arnold Arboretum in Jamaica Plain, Mass. Two years later he took a position at Purdue University in Indiana where he continues in 1996.

Samuel Wiggans became chairman of the Horticulture Department in 1963. He received his M.S. (1947) and Ph.D. (1951) degrees at the University of Wisconsin in plant breeding and in plant physiology, respectively. He was on the Iowa State University faculty for seven years and Oklahoma State University faculty for five years before coming to the University of Vermont. When the Horticulture Department was merged with the Agronomy Department in 1964, he was appointed chairman of the new Plant and Soil Science Department. Wiggans developed a keen interest in the Hort. Farm as evidenced by his daily presence and his many projects there. His family built a home just outside the northwest corner of the Farm in 1967 which they still own.

Wiggans maintained trials of hundreds of garden chrysanthemum cultivars for many years. Each year he planted new cultivars and took data on flowering time and wintering survival. He established collections of daylilies, peonies and irises. He established an All-American Selections annual garden



Professor Samuel Wiggans examining fruit set on young apple trees, ≈1970.

to display new flower cultivars for the public. Twice yearly he organized an open house at the Farm for the public on Sunday afternoons in May when the crabapples and lilacs were in flower and in September when the chrysanthemums were in flower. Hundreds of people attended these events. After taking winter injury data on chrysanthemums, Wiggans opened the Farm in May each year for the public to dig plants which had survived the winter. Each year he started with new chrysanthemum plantings adding new kinds to test their adaptation.

Many organizations used the Hort. Farm for professional meetings, picnics, and tours at the invitation of Wiggans. He obtained funding for putting in the chain-link fences that provide security from deer and unauthorized persons.

In addition to his achievements at the Hort. Farm, Wiggans established a highly popular undergraduate course at the University called Home and Garden Horticulture. He coordinated lectures by Plant and Soil Science faculty with some guest lecturers from outside the University. In the mid-1970's, more than 300 students enrolled in the course. He also taught a graduate course in Plant Research Techniques. Wiggans along with P. S. Ingram published *Climate of Burlington Vermont* in 1968 (Vt. Agr. Exp. Sta. MP 53). Wiggans left the University in 1980 to take a position with the U. S. Department of Agriculture in Washington D.C. In 1996, he was named a Fellow by the American Society for Horticultural Science for his contributions.

Bertie Boyce received a B.S. and M.S. degree in Horticulture from the University of Vermont. In 1958, he became manager of the Hort. Farm during the growing season and greenhouse manager at the University during the winter season. Boyce conducted his Ph.D. research project on strawberry cold hardiness at the Hort. Farm and in the Horticulture Department laboratory while he was Hort. Farm manager. He finished his Ph.D. at Rutgers University in 1964 and was appointed assistant professor in the Department of Plant and Soil Science.



Professor Bertie Boyce demonstrating strawberry plant anatomy to students, 1988.

Boyce's research focused on cold hardiness and cultural practices that improve winter survival and subsequent yield of strawberries. He developed techniques for studying strawberry cold hardiness, identified the hardiest cultivars, and determined the effect of light and presence of foliage on cold hardiness development. He studied the effect of raised beds on soil temperatures and winter injury. He determined that strawberries should be mulched after mid-November in Vermont rather than earlier. He compared many types of winter-protective mulches, among them straw,

black or clear polyethylene, sawdust and snow cover including a comparison of natural snow with machine-made snow at various depths on cold hardiness and survival of strawberry plants.

Boyce published his research results on the best yielding blueberry varieties and their culture. He conducted an 8-year study on the root stock, interstem interaction of four different root stocks and four different interstems on growth and yield of 'Cortland', 'Delicious', 'McIntosh' and 'Northern Spy' cultivars of apple. He compared the yield of 'Mutsu' apples on several different root stocks. In 1985, he planted a student orchard south of the Blasberg building to train students in pruning and other cultural methods for fruit trees.

He taught the course, Introductory Plant Science to several thousand students since 1961. He also taught Small Fruits, Tree Fruits, Plant Propagation, Vegetable Crops and Home and Garden Horticulture.

Norman Pellett started his duties as Extension Ornamental Horticulturist in 1967 coming from the State University of New York at Cobleskill. He received his Ph.D. from the University of Minnesota in 1965. Pellett's primary responsibility at the University of Vermont until 1980 was providing horticultural education for the state's nurserymen, landscape contractors and greenhouse operators and for the general public as well as conducting research on woody landscape plants. In 1980, he exchanged his Extension position for undergraduate teaching, but

continued his research.

Pellett's research emphasis was laboratory and field studies of woody plant cold hardiness. Thousands of new and uncommon trees, shrubs and ground cover plants were propagated and tested at the Hort. Farm and other sites in Vermont for their hardiness and landscape potential. This project continued the plant trials started by Professor Flint in 1962.

Research by Pellett, his research technicians and graduate students included: methods for overwintering container-grown nursery stock, winter protection procedures for garden roses, comparing growth of field-grown with container-grown nursery stock, propagation of woody plant cuttings in a fog environment using hydroponic techniques, fertilizing procedures for container-grown shrubs, use of season extending rowcovers to enhance the growth rate of young trees and shrubs and comparing chopped newspaper with other mulches for weed control. Pellett studied the cold hardiness of crabapple cultivars, forsythias, hawthorn and mountain ash. He determined the relationship of cold hardiness development to leaf drop for crabapple cultivars. He determined the number of degree-days to flowering for crabapple and lilac cultivars and reported the flowering date for many shrub species.

In 1978, Pellett received a USDA Plant Introduction Station grant to collect seed of native azalea and rhododendron species from the highest elevation or northernmost limit. Seed



Professor Norman Pellett examining tallhedge buckthorn, ≈1976.

from 60 locations was distributed to experiment stations and arboreta worldwide. Seedlings were planted at the Hort. Farm for evaluation of cold hardiness, growth rate, flowering time, fall color and adaptation. Research results were published on cold hardiness, floral characteristics and fall color of plants from different locations.

During his 29 years at the University, Pellett taught courses in Ornamental Horticulture, Woody Landscape Plants, Greenhouse Management, Plant Propagation, Herbaceous and Indoor Plants, Turf Grasses, Landscape Practices, Orientation for Urban Forestry and

Landscape Horticulture and Home and Garden Horticulture. He was called "Stormin Norman" by his students for his fast walking pace during outdoor classes. He retired in 1996.

Dean Evert came to the University of Vermont in 1970 from the University of Minnesota where he received his Ph.D. in plant physiology. He had earlier obtained his M. S. degree in electrical engineering from the University of Illinois and worked for an electronics firm before starting his Ph.D. studies. He used his engineering background to determine that electrical measurements of stem tissues could be used to predict plant cold hardiness and freeze injury. For these laboratory studies, he and his graduate students measured the cold hardiness of apple, forsythia and redosier dogwood stem pieces from the Hort. Farm.

Evert studied the adaptation of cold-hardy apple root stocks from North Dakota. He planted tree peonies and Japanese heartnut at the Hort. Farm to determine their adaptation to Vermont. He built solar-heated structures to evaluate their potential for successful wintering of container-grown nursery stock. He taught courses in Plant Propagation and Plant Winter Hardiness. Evert left the University in 1979 for a research position on peaches at the University of Georgia.

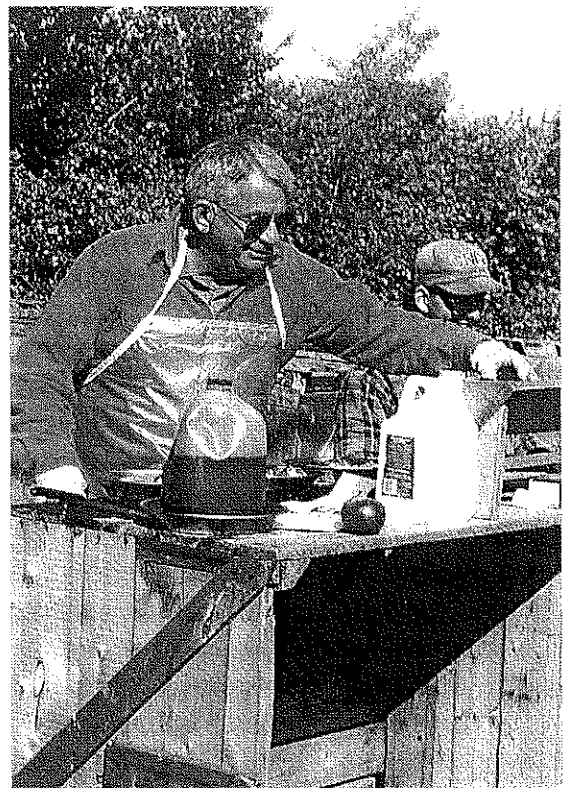
Alan Gotlieb came to the Department of Botany at the University of Vermont as Extension and Research Plant Pathologist in 1974 from the University of Wisconsin where he

received his Ph.D. He joined the Department of Plant and Soil Science in 1980 when he was appointed chair. Most of his research was carried out on dairy farms and commercial orchards and at the Paul Miller Research Center. His research at the Hort. Farm included a study on the biocontrol of the weed, velvetleaf which is a serious pest in corn and soybean crops. A fungus, *Colletotrichum coccodes*, was studied as a mycoherbicide to control velvetleaf, *Abutilon theophrasti*. Six U.S. and Canadian patents were received for this mycoherbicide. Monique Brosseau and Audrey Liese were research technicians working on this project at the Hort. Farm.

Gotlieb was part of a team of Department of Plant and Soil Science scientists who tested pesticides for the USDA to supply phytotoxicity information for registration with the Environmental Protection Agency for use on minor crops. This project, funded by the USDA for six years in the 1980's, was managed by Gregory Eurich. Gotlieb cooperated with Professor Lorraine Berkett in studying methods for developing apple scab spore development in orchards for use by orchardists to reduce fungicide applications.

Joseph Costante came to the University of Vermont in 1976 as Extension Fruit Specialist from Massachusetts where he was a regional fruit specialist in the Extension Service. He had received his M.S. degree from the University of Vermont in 1967 and completed his Ph.D. in 1986.

Costante worked closely with the tree fruit growers in Vermont to promote a healthy, viable and expanding industry. His research at the Hort. Farm included development of new systems for training and pruning apple trees. He led evaluative studies on the relationship between apple cultivar and root stock performance at the farm and in other states. With Professor Berkett, he established disease resistant apple cultivar trials at the farm as part of a northeast region cooperative study.



Professor Joseph Costante measuring starch content in apples, 1992.

Costante studied the use of chemical growth regulators for controlling preharvest fruit drop, fruit thinning and

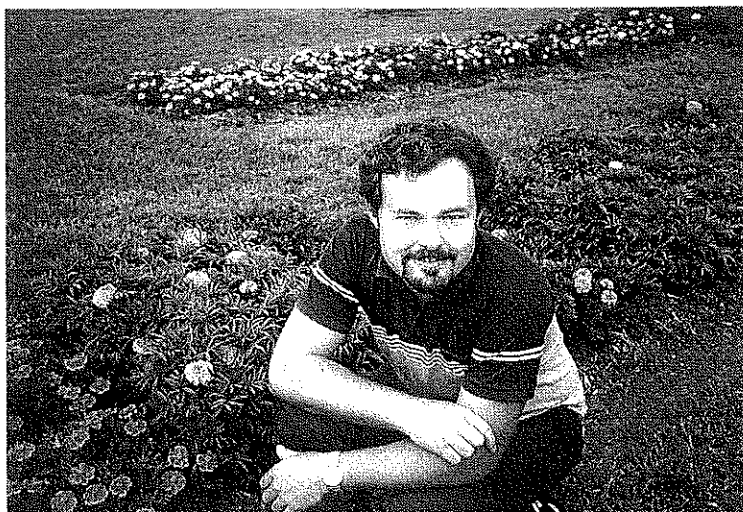
branching of young trees. He established cultural methods and programs for dealing with orchard development and harvest when the chemical fruit-drop retardant, Alar, was removed from the market. He defined the best cultural practices for several apple scab resistant cultivars. He studied the effect of apple replant disease caused by nematodes and other factors on new plantings and developed replant programs for new commercial orchards. He started a diagnostic service for determining parasitic nematode numbers in orchard soils.

Costante was contributing author to the *New England Apple Pest Management and Production Guide* published annually for commercial apple growers. He established the *Apple Press Newsletter* for commercial orchardists, consultants, Extension agents and researchers in the U.S. and Canada. Under his direction, annual apple production workshops and orchard tours, often held at the Hort. Farm were usually attended by 80 percent of the state's commercial apple producers. Costante retired in 1996 and moved to Arizona.

Leonard Perry received his Ph.D. from Cornell University and came to the University of Vermont in 1981 as Extension Ornamental Horticulturist. He provides Extension education to commercial greenhouse, nursery and landscape operations and to gardeners. His research has focused on the adaptation, culture and winter hardiness of herbaceous plants.

Perry re-established the All American Selections annual display in 1984, gardens originally started by Professor Wiggans. He established a demonstration perennial border surrounding the chain link fence which formerly housed the weather recording station (see perennial display garden, map 3). He studied the winter survival, performance, flower color and bloom time of many herbaceous perennials at the Hort. Farm and at other sites in Vermont. Perry established hops variety trials at the Farm in 1988 (hops cultivation trials, map 3) and at several sites in Vermont.

Perry and his graduate students have conducted many research projects on the culture and performance of herbaceous perennial plants since 1981 (perennial research, map 3). They include: yarrow cut flower spacing, cut flower yield study with 40 annuals and perennials, effect of mulch and fertilizer on cut flowers, post-harvest treatment on vase-life of cut flowers, aster and goldenrod performance studies, effect of black plastic mulch on cut flower yields, effect of row covers on early yield of cut flowers, daylily - cause and prevention of spring sickness, comparison of mildew resistance and performance of phlox and bee balm cultivars, and media and fertilizer effects on growth of container-grown perennials. Perry studied the coldhardiness of garden mum cultivars and overwintering container-grown perennials.



Professor Leonard Perry in his herbaceous plant All American Selection display, 1986.

Lorraine Berkett came to the University in 1983 as Extension Integrated Pest Management Specialist from Pennsylvania State University where she received her Ph.D. in plant pathology. Her M.S. degree was in entomology. She developed Extension and research programs to address commercial apple growers' needs for information on environmentally and economically sound methods for managing the numerous insects, mites and diseases of apples. She was the principal investigator in a five-state USDA sustainable agriculture research and education program on apples in the northeast.

Berkett's research emphasis has focused on controlling apple scab fungus, *Venturia inaequalis*, a serious disease in commercial apple orchards. Berkett, in cooperation with Professor Gottlieb and research technician Jerilyn

Bergdahl, developed an ELISA diagnostic kit (enzyme-linked immunosorbent assay) for orchardists to determine the amount of apple scab spore development. She studied methods to trap ascospores of the apple scab fungus and then to detect these spores using the ELISA procedure.

Orchardists can use the ELISA kit to determine the necessity for fungicide application potentially reducing the number of fungicide applications required. Along with Gottlieb and Professor William McHardy, University of New Hampshire plant pathologist, she studied the potential ascospore dose on leaves in the fall that would lead to significant infection in the spring. This study measured whether the number of fungus lesions on leaves in the fall could give a reasonable estimate of the spring spore development in an orchard.



Professor Lorraine Berkett examining apple leaves for apple scab fungus, 1995.

Berkett, in cooperation with research colleagues in Vermont and other northeastern states: has tested new apple cultivars resistant to apple scab, for susceptibility to other common apple diseases and their suitability for commercial fruit production; test-marketed the scab-resistant cultivar 'Liberty' and determined that it is a marketable fruit; compared an organic insecticide with a common synthetic insecticide for efficacy in minimizing insect injury to fruit and foliage; studied whether autumn rather than spring application of dormant oil sprays for European red mite control is efficacious since, timely spring application is often hindered by poor weather conditions; experimented with insect traps for suppressing the spotted tentiform leaf miner, a serious pest of Vermont apple trees; and experimented with a predator mite as a potential control agent for the European red mite.

Berkett was appointed chair of the Plant and Soil Science Department in July, 1993. She represents the department on the board of directors of the Friends of the Hort. Farm.

Edward Bouton started with the Vermont Extension Service in 1967 as Washington County Agricultural Extension Agent. He received his M. S. degree in Plant and Soil Science from University of Vermont in 1975. He joined the Plant and Soil Science Department in 1984 as Extension Specialist for small fruits and vegetables.

Bouton provided commercial strawberry, blueberry and vegetable farmers with information and service as well as helping educate home gardeners on these topics. He used the Hort. Farm for a number of demonstration and research projects, including cultivar trials of sweet corn, tomato, pepper and

melons to determine differences in performance under Vermont climatic conditions. Results were provided for growers at meetings, in leaflets and newsletters.

Bouton, working with Professor Berkett, studied European corn borer control comparing a biological control agent, the bacterium *Bacillus thuringiensis*, with several recommended chemical controls. The biological control was slightly less effective than the chemical methods. He used several kinds of plastic film mulches around cold sensitive vegetable plants. The films resulted in one- to two-week earlier maturity for some crops.

Cooperating with Professor William Jokela, Extension Soil Scientist, Bouton studied quack grass control in field corn using reduced rates of herbicides. Farmers were informed of results through meetings and extension publications. He taught the Vegetable Crops course in the Plant and Soil Science Department. Bouton retired in 1989.

Tree fruits

Professor Costante established an orchard block numbering system after his arrival in 1976 (map 3). Block numbers are used here to show the location of Costante's research as well as earlier studies by Professor Boyce.

Several apple plantings to study the effect of root stocks on growth and yield have been made since the Hort. Farm



Professors C. Lyman Calahan (left) and Samuel Wiggans in orchard, ≈1964.

was started. Seeking combinations to result in dwarf trees, most of these studies compared the use of either dwarfing root stocks or combinations with various interstems thought to cause dwarfing. The objectives were to reduce tree size, increase yields, reduce time to fruiting and increase winter hardiness. These orchards were located south of the present farm entrance road (location of current blocks 6 and 9). After adequate yield data was collected, the trees were pulled out and other root stock/scion combinations were planted. This process was repeated in 12 to 15 year cycles. The last of these apple root stock studies were terminated in 1992.

An orchard was established where the current blocks 8 and 14 are located to compare performance of approximately 75 apple cultivars. This collection was established soon after the Abbott section was purchased and included many older as well as newer cultivars. Bloom and yield data were collected for 15 years and then the orchard was removed.

Several plantings of other tree fruits have been made for cultivar evaluations. A planting of stone fruits, made in the 1950's and 1960's, was located where the current block 4 is and included peaches, plums, sweet and sour cherries and apricots. Bloom data and cold injury data was collected and the trees were used for public demonstrations. Most of these were removed by the late 1960's and early 1970's because of winter injury, disease and other causes of decline.

A block of apples was planted in 1981 by Boyce to study the effect of different grafted interstems on growth and production of 'McIntosh' on various root stocks and 'Empire' grafted onto the semi-dwarfing 'East Malling #7' root stock (block 6). Interstems reduced growth of some scion-rootstock combinations, but not others. After 1990, this block was used several years for the trapping study of spotted tentiform leafminer, an increasing pest for orchards. Traps were placed in this orchard to evaluate use for trapping leafminers, a serious apple pest.

European red mite is another serious pest of apple. Oil sprays applied in the spring are usually effective and have a

low impact on beneficial organisms, however, due to rainy weather, orchardists often can't apply timely sprays to control the pests. A limited research project on block 6 determined that fall application of oil was not an effective control option. Trees in block 6 provide fruit for Hort. Farm sales.

A student orchard containing plum trees and a variety of apple cultivars on several different understocks was planted between 1983 and 1986 (block 8). This orchard has been used in Boyce's Tree Fruits course for demonstration of pruning and training methods. During the mid-1980's manager Gregory Eurich planted a small orchard of popular apple cultivars to supplement fruit sales (block 4). The cultivars in this orchard were 'Cortland', 'Macoun', 'Mutsu', 'Northern Spy', 'Paula Red', 'Spartan' and 'Sunrise'. Fruit from these trees have been used for classroom demonstration.

Since 1984, funded by a number of USDA sustainable agriculture and other grants, Costante and Professor Berkett have established a number of orchard blocks to study methods for pesticide reduction in controlling common apple pests. The planting, maintenance and data collection was carried out by research technicians, David Schmitt and Jon Clements with the help of undergraduate student employees.

One of Vermont's first plantings of scab-resistant apple cultivars was established in block 2 by Costante in 1982. Research by Costante and Berkett focused on culture, fruit quality and pest

management to determine suitability for commercial fruit production in Vermont. The apple scab-resistant cultivar 'Liberty' was identified as having commercial potential.

Berkett and Kirsten Bower, a graduate student, documented that production practices, such as planting scab-resistant cultivars, have potential for enhancing biological control of pest mites (block 2). During a two year study, 1988-1989, they showed that scab-controlling fungicides did not affect the population of two pests, European red and two-spotted mites, but did reduce predacious mite populations that feed on the pest species. The use of scab resistant apple cultivars may reduce the need for fungicides which kill the predacious mites.

A research orchard of 740 trees in block 9 was established in 1988 by Costante. Covering 2.7 acres to the south of the main drive, this orchard was planted to 'Redmax McIntosh' and 'Liberty' apple cultivars grafted onto semi-dwarfing Malling #26 root stocks. The purpose was to determine the effect of green manure crops, fertilization, fumigation, herbicides and irrigation on growth and performance of young apple trees planted on a site diagnosed to have a severe apple replant disease problem. This disease occurs on sites where former orchards inhibit growth of new trees and is caused by nematodes and other unidentified factors. This site had been planted to apple orchards since 1952, the first year of the Farm.

A green manure crop of marigolds,

reputed to reduce nematode activity, provided equal results with chemical fumigation. This project was a cooperative project between Vermont, Cornell University and the University of Massachusetts. The project was finished in 1995 and seven rows were removed leaving three rows which supply fruit for sale.

A 1.4 acre orchard in block 10, established by Berkett in 1988, was used for evaluation of conventional versus alternative pest management practices on common and newer scab-resistant apple cultivars. The orchard design allowed for statistical comparison of insect populations and diseases under various biological, chemical and/or integrated pest management schemes. A two-year study was initiated in 1994 to determine whether there is a difference between 'Liberty' and 'McIntosh' for percent of fruits injured and severity of injury caused by plum curculio, a major insect pest of apples. During both years 'Liberty' had a higher percentage of fruit damaged, but there were no differences in the severity of damage. In 1994, damage was observed earlier on 'Liberty' than 'McIntosh', but in 1995 damage was first observed on both cultivars at the same time. With incorporation of new cultivars into commercial production it is important to determine susceptibility or attractiveness of trees to major pests.

A research orchard in block 11 was established in 1990 as part of a five state USDA funded sustainable agriculture project to provide information on tree growth and development, yield potential, and fruit quality of disease-

resistant cultivars judged to have high potential for commercial use. This project ended in 1996. In 1995, a project was started on this block to study the impact of reduced fungicide application on 'Liberty' performance and yield.

A planting was established in block 7 in 1992 to evaluate the growth and production efficiency of the 'Liberty' cultivar on new root stock selections from the Cornell/Geneva root stock breeding program. This is part of the North Central-140 Regional Root Stock Project with similar plantings made in several states and Canada. Other cultivars were subsequently planted. Data on tree growth, survival, and fruit yield comparing the root stocks was collected. Since 1993, this orchard is also used for pruning, training and support demonstrations in tree development. This block currently provides a variety of apples for Farm sales including 'Empire', 'Golden Supreme', and 'Gala'.

A 1990-planted orchard in block 12 contains five selections considered to be the best scab-resistant apples from the plant breeding program at the New York State Agricultural Experiment Station in Geneva. Also, included are two recently named disease-resistant selections from the Purdue, Rutgers and Illinois plant breeding program, 'Dayton' and 'Williams Pride'.

An orchard, planted 1990 in block 13, was used to investigate the effect of different planting hole soil amendments on young apple tree growth, vigor and early yield. A novel young tree training and pruning system,

dubbed "Vermont lattice" focused on rapid development of many weak lateral scaffold branches requiring routine renewal and replacement. The goal was to promote early fruit bearing on easily managed trees. Some trees in this block died or were severely injured during the 1992-93 winter and the block was removed in 1995 because data could not be reliable with missing trees.

In 1995, as part of an international project NE-183, approximately 20 new apple cultivars were planted at the Hort. Farm and 34 other locations mostly located in the United States and Canada. More cultivars will be added and data will be collected on mortality, tree growth and precocity. The intent is to find new cultivars suitable for commercial production.

The scab-resistant cultivar, 'Liberty', through test marketing, was accepted by the public in supermarket studies. This cultivar is not immune to other apple diseases and pests. A three year Hatch-funded project was started in block 11 in 1996 to determine whether reduced fungicide programs will adversely effect tree vigor, productivity and fruit quality.

During the last few years, new chemical growth regulators have been evaluated on the efficacy and effect on fruit quality of 'McIntosh' and 'Empire' cultivars. These growth regulators have the potential to thin apple numbers to improve fruit size and are considered to be environmentally benign.

A cooperative project with Cornell University established populations of

the predator mite, *Typhlodromus pyri*, as a potential control agent for the serious apple pest, European red mite. This predator mite was introduced into 33 orchards in seven states including the Hort. Farm and two other Vermont orchards.

Information generated through research and observations at the Farm was published in *The Apple Press* and *The Vermont Apple Integrated Pest Management Newsletter*. The Virtual Orchard, a world wide web site for the dissemination of apple information over the internet, was established in November of 1995 by Jon Clements and Win Cowgill, a Rutgers University Cooperative Extension Agent.

Strawberries

Strawberry field research has been a continuous activity at the Hort. Farm since Professor Blasberg's breeding project in 1952. Professor Boyce has directed the research since 1961. Research technicians and graduate students participating in these studies include: Susan Gates, Ann Hazelrigg, David Heleba, John Hoon, Karen Inman, William Jenney, Hugues LeBlanc, Ann Linde, Richard Marini, Helen Myers, Robert Raiser, Richard Reed, C. R. Smith, Jessica Strater and Julius Szabo.

During the late 1960's and 1970's, Boyce compared the winter hardiness and yield of dozens of commercially available strawberry cultivars. Since then, his research has focused on the effect of various cultural practices on cold hardiness, winter damage and fruit

yield. Every spring, new plantings have been made with subsequent measurements on winter injury, laboratory determinations of cold hardiness and yield. Boyce used laboratory freezers to stress the strawberry plant crowns and determine the cold hardiness levels during the winter.

During 1963 and 1964 studies, the amount of crown injury increased with increasing rates of temperature drop, with the length of time the crowns remained frozen, and with repeated freezing and thawing. Dormant plants lost their cold hardiness soon after being placed in warm temperatures.

Dormant 'Catskill' strawberry plants were frozen at several temperatures to determine the effect on the plant development and yield. Approximately one half of the plants were injured at minus 12.5 °C (9.5 °F). Freezing, but non-lethal temperatures resulted in abnormal growth of leaves, early runner production and decreased blossom numbers.

Strawberry crown and soil temperatures were measured under an ice layer that developed during the winter of 1980-81. Crown temperatures under the layer of ice were several degrees colder than temperatures of plants without ice cover. More injury of crown tissues and reduced subsequent growth occurred for ice covered plants.

Crown temperatures were recorded throughout two winters in strawberry plants growing on raised and flat beds,

with and without straw mulch. Plants in raised beds were colder than those in flat beds, and those without mulch were colder during winter than those with mulch. The combination of raised beds and no mulch resulted in considerable winter injury, even when covered with over four inches of snow. This resulted in a significant reduction in yield.

Spring frosts sometimes kill the earliest opened strawberry blossoms. In mimicking a frost, the removal of the earliest (primary) blossoms from field-grown plants of four cultivars did not increase berry size from secondary and tertiary (later) blossoms. Although primary fruit accounted for 14% of the number of fruit, they contributed 30% of total weight.

Snow made by snow-making equipment was evaluated for winter protection of strawberry plants from 1983 to 1985. Crown temperatures, plant mortality and fruit yield were comparable from plants covered with six inches of manmade snow or with six inches of natural snow. Both types of snow provided better insulation against cold temperatures than straw (5 tons/acre).

Straw mulch (5 tons/acre) was removed from 'Midway' strawberry plants periodically over six week periods in the springs of 1984 to 1986. Highest yields were always obtained when the mulch was removed as early in the spring as possible. Delaying the removal of mulch beyond the accumulation of approximately 120

degree day units (base 40) resulted in significant yield reductions.

Straw mulch (5 tons/acre) was applied to 'Midway' strawberry plants at four different times over six to eight weeks in the autumns of 1984 to 1986. The latest application was near the end of November. Early mulching resulted in increased winter injury and lower yields. Highest yields were obtained by delaying mulching to late November or early December so long as injurious low temperatures did not occur prior to mulch application.

'Midway' strawberries were mulched in late November during three winters in the late 1980's with straw (5 tons/acre), clear polyethylene or black polyethylene film or combinations of straw and polyethylene. Winter minimum crown temperatures of plants mulched with either clear or black polyethylene ranged from 2.8 to 5.0 °C colder than those mulched with straw (5 tons/acre). Yields from these plants were lower than from straw-mulched plants and were comparable to, or only slightly better than yields from plants that were not mulched. When mulched with less straw (2.2 tons/acre) and covered with either black or clear polyethylene, yields were higher than with polyethylene alone, but not as high as when the conventional straw mulch was used.

Blueberries

A map of blueberry cultivars shows plantings in October of 1952. Eight plants each of the following cultivars were planted at the Hort. Farm by

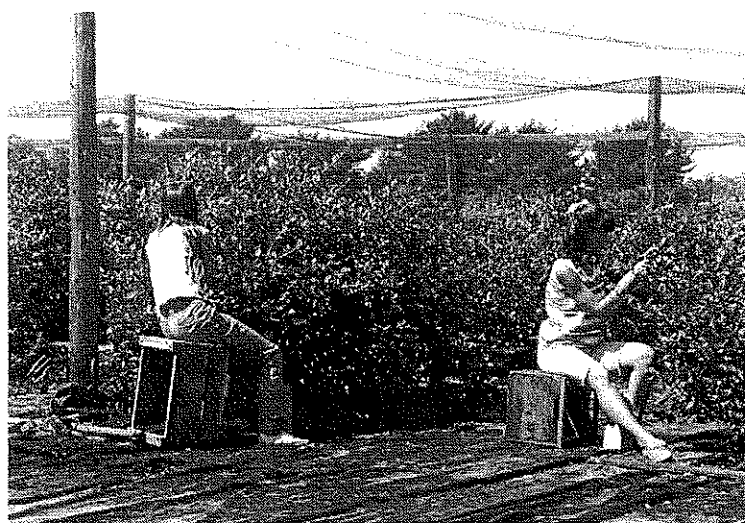
Professor Blasberg: 'Atlantic', 'Burlington', 'Concord', 'Dixi', 'Pioneer', 'Stanley', 'Blue Crop', 'Herbert', 'Berkeley', 'Cabot', 'Jersey', 'Coville', 'Pemberton', 'Rancocas', 'Scammell', 'Wareham', and 'Earliblue'. Others added in the spring of 1960 were: 'Blueray', 'Collins' and 'Ivanhoe'.

The blueberries were located approximately where the current orchard block 12 is sited (map 3). Yield and fruit size records were taken for many years. Wiggans and Boyce published Vt. Agr. Exp. Sta. Misc. Pub. 26, *Cultural Studies on Blueberries in Vermont* in 1965. Other plantings of more recent introductions were made during the 1970's and yield records were taken yearly. Most of the blueberry plantings were removed during the 1980's when the research terminated. A small collection remains for use in teaching.

Nut trees

Seedlings and selections of commercially important nut trees were planted in 1954 by Professor Blasberg. They included: *Juglans nigra*, black walnut, selections entitled 'Ohio', 'Cornell', and 'Thomas'; *Juglans cordiformis*, Japanese heartnut, selections entitled 'Marvel', 'Fodermaier', 'Faust', 'Stranger', and 'Wright'; *Juglans regia*, English or Persian walnut, selections entitled 'Ashworth' and 'Colby'; and *Juglans sieboldiana*, Japanese butternut.

No records exist on nut tree performance, but fruiting on most was sporadic because of short growing seasons for fruit maturity and late spring frost damage to new stem growth in some years. The collection was eliminated in 1970 because no research was being conducted on the trees and space was needed for other plantings.

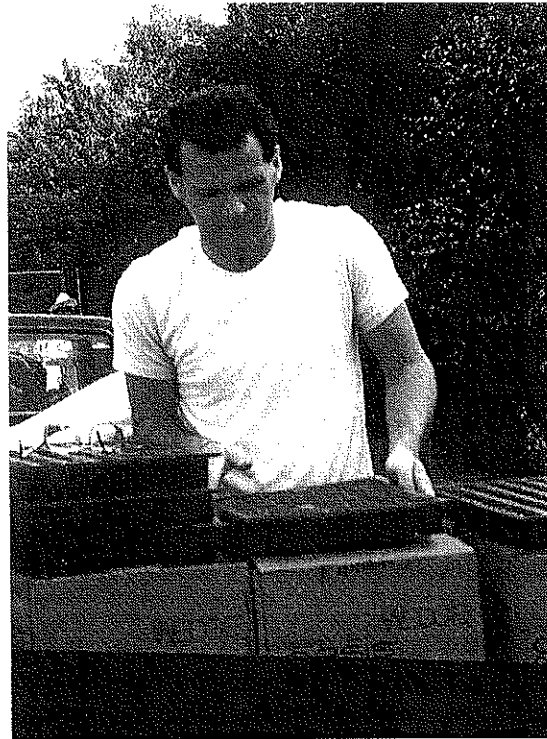


Student employees picking blueberries for yield comparisons of cultivars, ≈1978.

Crabapples

The first crabapples were planted in 1952 by Professors Blasberg and Calahan along the road which is now the entrance to the Hort. Farm. The 1952-planted cultivars which still exist are 'Almata', 'Beauty', 'Dolgo', 'Erie', 'Mercer', 'Namew', 'Hyslop', and *Malus pumila* 'Pendula'. During the 1960's many cultivars were planted along the Farm roads in the northwest area of the Abbott section (crabapple collection, map 3). Professors Wiggans, Flint, and graduate student, Dennis Bruckel were responsible for the 1960's crabapple plantings. Two trees of each cultivar were purchased or donated by commercial nurseries. The root stocks on most trees were apple seedlings resulting in standard sized trees.

No crabapples were planted in the 1980's because of a change in research emphasis. The condition of the collection deteriorated because of little or no pruning nor pest control. With renewed interest stimulated by the Friends of the Hort. Farm, Saturday workdays since 1994 were held for pruning the crabapples. Instruction on was given and the volunteers did the pruning. Most of the supervision and organization for the restoration of the collection is due to research technician David Heleba. During the years 1994 to 1996, 25 newer cultivars, reported to be disease resistant, were added to the collection. Some of the older cultivars were propagated for replacement of dead or dying trees. In 1996, there were 137 cultivars with a total of 235 trees in the collection.



Research Technician David Heleba placing foam blocks in trays for propagation study at Hort. Farm, 1988.

Lilacs

The first lilacs were planted in 1952. Two rows were established in the same location where they are in 1996 on the west side of the collection (lilac collection, map 3). Some reportedly came from a dismantled lilac collection at an estate. Correct nomenclature for many of these early plants is missing. Professor Flint and Dennis Bruckel planted many new cultivars in the 1960's. Many came from Professor Owen Rogers, horticulturist at the University of New Hampshire, and from Phil Hodgdon, a nurseryman and instructor at Vermont Technical College in Randolph Center, Vermont.

Late flowering species and hybrids were added in the 1970's by Bruckel and Professor Pellett. The Friends of the Hort. Farm started a pruning effort to rejuvenate the lilacs in the mid-1990's. Pruning, fertilization and scale insect control have gradually improved the health of the collection since 1994.

Shrubs and trees

The first ornamental trees and shrubs were planted in 1952 by Professor Blasberg. While there are lists of plants he established in the early 1950's, records don't show whether existing plants of the same kind are the ones that he planted. His primary interest was in fruit crops and there wasn't a scientist or staff member responsible for ornamental plant research with until Professor Flint was hired in 1962. Flint's trials of woody ornamental plants were continued by Professor Pellett who came to the University in 1967. Hundreds of new plants were planted each year during the 1960's and 1970's. Most plants were eliminated when their landscape potential was deemed poor for lack of cold hardiness or other problems. However, over 700 kinds from Flint's and Pellett's studies makeup the ornamental woody plant collection at the Hort. Farm in 1996.

Plantings around the Blasberg building represent mostly low or slow growing plants with a variety of growth habits. This planting has changed over the years to showcase plants of current interest. The first plantings were made in 1962 by Flint and specimens from his plantings still growing there include:

dwarf sawara false-cypress, *Chamaecyparis pisifera* 'Plumosa Nana'; dwarf Norway spruce, *Picea abies* 'Procumbens', dwarf blue spruce, *Picea glauca* 'Nana' and winterberry holly, *Ilex verticillata*.

A number of dwarf conifers, especially cultivars of Norway spruce, were purchased from nurseryman Donald Allen of Barre in the mid-1960's. Other slow growing conifers were contributed by nurseryman Greg Williams of East Hardwick in the early 1970's. Some of the dwarf conifers were moved to the University campus in the early 1980's for planting north of the University Store, however, many still can be seen in front of the south wing of the Blasberg building.

The deciduous shrub collection (map 3) was started by Flint and expanded in 1969 by Pellett and Dennis Bruckel in its present location. The nut tree collection was removed to make room for the shrubs. Plants placed in this collection were considered to have more landscape potential and interest for Vermont than the many hundreds propagated and planted in the test nursery. Nevertheless, plants were removed when they were no longer deemed useful or had become common in the nursery trade. Records on winter injury, plant size and plant problems were taken annually. Four Vermont Experiment Station or Extension Service publications reported the results of these studies.

Plants acquired by Flint from 1962 to 1964 which have withstood the test of

time and can be seen in the collection include: large fothergilla, *Fothergilla major*; white forsythia, *Abeliophyllum distichum*; Siberian peatree, *Caragana arborescens* 'Nana'; bloodtwig dogwood, *Cornus sanguinea*; redvein enkianthus, *Enkianthus campanulatus*; drooping leucothoe, *Leucothoe fontanesiana*; star magnolia, *Magnolia stellata*; kobus magnolia, *Magnolia kobus*; and dwarf garland spirea, *Spiraea arguta* 'Compacta'.

The viburnum collection was started by Flint in the mid-1960's in a small clearing in the woods. He propagated or purchased many species and cultivars. Many came from the Arnold Arboretum in Jamaica Plain, Massachusetts. Pellett and Bruckel re-spaced the plantings in the early 1970's and added new selections. During the 1980's, when research priorities were different, the collection was not adequately maintained. With new interest in the collection generated by the organization of the Friends of the Hort. Farm, research technician David Heleba and student employees gradually revived the collection in the 1990's by removing tree seedlings and renewal pruning. New cultivars and hybrids have been added since 1994.

A deciduous tree collection was started by Flint on the south end of the Abbott section (map 3). Three rows of trees planted approximately 20 feet apart include hybrid elms, ornamental pears, new cultivars of honeylocust and maples, buckeye, European birches, Asian species of mountain ash and others. Some trees from this collection

have been moved to the University campus over the years. A few deciduous trees were planted at other locations at the farm. Unique older deciduous trees at the Farm and their planting date include: Tuliptree, *Liriodendron tulipifera*, 1963 and Amur corktree, *Phellodendron amurense*, 1968, located east of the irrigation pond. A yellowwood tree, *Cladrastis kentukea*, on the north side of the Abbott section was probably planted in the 1950's although there is no record of planting date. A few oaks were planted by Flint along the ravine between the upper and lower ponds.

In 1996, the small tree collection (trees under 25 to 30 feet) was planted in east meadow (map 3) northeast of the upper pond. The new collection acquired by Pellett includes hybrids of ornamental pears and mountain ash from the University of Minnesota Landscape Arboretum as well as hawthorn and Asian species of maples and mountain ash. The small tree planting plan was designed by Kathleen Ryan and laid out by Terrence Boyle as a volunteer of the Friends of the Hort. Farm assisting David Heleba.

A conifer collection is located on the north side of the Abbott section (map 3) and consists of three rows representing uncommon cultivars and selections of spruce, pine, fir, arborvitae and juniper. Oldest among this collection are 10 feet tall globe arborvitae, *Thuja occidentalis* 'Globosa' and 25 feet tall mugo pine, *Pinus mugo*. These were probably planted in the 1950's by Professor Blasberg. Other unique mature trees in

the collection include fraser fir, *Abies fraseri*, and western arborvitae, *Thuja plicata* 'Elegantissima'.

The juniper collection is located adjacent to the original building on the northwest corner of the farm (map 3). First planted in 1964 by Flint, this collection was greatly expanded by Pellett and Bruckel in the late 1960's and early 1970's. Three beds of spreading junipers were established by Flint, mostly from selections of creeping juniper, *Juniperus horizontalis*, he collected and propagated from the coast of Maine. Common cultivars of creeping juniper, Chinese juniper, *J. chinensis*; Eastern red cedar, *J. virginiana*; and Rocky Mountain juniper, *J. scopulorum*; were planted in the early 1970s. Other species planted in the 1970's were Japanese juniper, *J. procumbens*; savin juniper, *J. sabina*; common juniper, *J. communis*; shore juniper, *J. conferta*; and singleseed juniper, *J. squamata*. Not all of these have survived, but a collection of mature specimens provides an attractive juniper garden.

The rhododendron and azalea collection (map 3) was started in the 1960's by Flint. He propagated seed purchased from a woody plant seed company and planted seedlings of Japanese azalea, *Rhododendron japonicum*; catawba rhododendron, *R. catawbiense*; rosebay rhododendron, *R. maximum*; and Smirnow rhododendron, *R. smirnowii*. In 1970, the collection of approximately 30 Japanese azaleas were moved to the Shelburne Museum and displayed there

for a number of years. Because of poor soils and reduced maintenance, they gradually declined and were removed.

The seed propagated plants of the broadleaved evergreen species were planted under the pine trees on the south side of the current woody plant nursery. Great variation in leaf, flower and plant shape suggest that the seed resulted from hybrids of several species. This collection ranges from six to ten feet tall. Other species in this collection are *Rhododendron ferrugineum*, *R. x laetevirens*, and mountain andromeda, *Pieris floribunda*. Blue holly cultivars *Ilex x meservae* 'Blue Boy' and 'Blue Girl' were planted in 1976.

The native azalea and rhododendron collection was started by Pellett in 1979 when seedlings of 11 different species of azaleas and rhododendrons were planted at the Hort. Farm. These plants were from 60 different collection sites (provenances). Seed was collected from high elevations or the northernmost region for each species in the eastern U. S. In 1990, the collection was reduced in number, but most of the provenances are retained except for those that died due to infection by *Phomopsis* fungus. Species include: sweet azalea, *Rhododendron arborescens*; flame azalea, *R. calendulaceum*; rhodora, *R. canadense*; Carolina rhododendron, *R. carolineanum*; catawba rhododendron, *R. catawbiense*; rosebay rhododendron, *R. maximum*; pinxterbloom azalea, *R. periclymenoides*; roshell azalea, *R. prinophyllum*; pinkshell azalea, *R. vaseyi*; and swamp azalea, *R. viscosum*.

Natural hybrids of three species propagated from seed collected in 1979 from Gregory Bald, a 5000 ft. elevation mountaintop in the Smoky Mountain National Park in North Carolina, are in the azalea collection. These, reportedly, are hybrids of *R. arborescens*, *R. cumberlandense* (*bakeri*) and *R. viscosum*. They have survived more than 15 winters at the Hort. Farm.

Many students and research technicians have been involved in establishment, labeling, maintenance and record-keeping of the woody ornamental plant trials. They include: Karen Alpert, Diana Aubin de Paradis, David Beattie, Kim Brainerd, Dennis Bruckel, Daphne Dippre, Ann Hazelrigg, David Heleba, Mary Holt, Marlowe Iverson, Deirdre Kelley, Emily Moore, Carla Pastore, Amy Rose, Nancy Rowan, Stephanie Solt and Busbee Williams, Jr..

Herbaceous plants

Professor Wiggans tested cultivars of garden chrysanthemums, irises, day lilies and peonies for adaptation in the 1960's and 1970's (page 23). The present herbaceous perennial plant collection located around the the old weather station fence in the Abbott section (map 3) was first established in the early 1980's by Professor Perry. The purpose was to test the winter hardiness, adaptation and to display a wide variety of perennials for public observation. Numerous species have been added over the years and the plants are labeled for public information. The collection is popular with visitors to the Hort. Farm. Friends of the Hort. Farm organize a work day each spring for volunteers to



Professors Wiggans (left) and Pellett in the All-America Annual selections display garden, ≈1970.

clean up and mulch the beds. A collection of hops cultivars is trellised nearby for determining the best ones adapted to Vermont conditions. Annual data is taken on survival and yield.

Perry re-established the All-America Selections annual display garden in 1984 that was started by Wiggans in the 1960's. Over a 100 new and popular varieties were planted and evaluated each year. The plants were labeled for public viewing. The planting was moved to the Burlington waterfront in

the 1990's where it is viewed by thousands of people annually.

Starting in 1990, perennial aster and goldenrod from around the world were evaluated at the Hort. Farm for four years. A collection of garden phlox was established in 1990 to evaluate resistance to powdery mildew, a disease that disfigures the foliage. Many other research studies have been conducted at the Farm by Perry and his graduate students (p. 28). Graduate students involved in herbaceous ornamental plant research by Wiggans and Perry were: Sinclair Adam, Chris Darrow, Marjorie Duarte and Wallace Grube.

New plant introductions

Two spreading junipers, 'Livingston' and 'Hermit' were named by Professor Pellett and registered with the Arnold Arboretum in 1972. 'Livingston' juniper was named after Professor Robert B. Livingston, University of Massachusetts botanist. Livingston collected native junipers from Hermit Islands off the coast of Maine in the early-1960s. 'Hermit' juniper was named after Hermit Island, the site of its origin. These plants were propagated from Livingston's collection by Professor Flint. The two named junipers were distributed to ten nurseries and arboreta around the country in 1973, but have disappeared from the commercial scene. They are still in the juniper collection at the Farm.

Forsythia mandschurica 'Vermont Sun' was introduced in 1978 by Pellett and registered with the Arnold

Arboretum. This plant introduced into the Hort. Farm collection in 1968, was received by Montreal Botanic Garden from Harbin, Manchuria in 1940. Graduate student, Kim Brainard and her advisor, Professor Evert, demonstrated that the flower buds of this forsythia were more cold-hardy than other forsythias in the market. This forsythia is sold by nurseries in the northeastern U. S.

A new boxwood cultivar named 'Verdant Hills' was registered by Pellett with the American Boxwood Society in 1997. Reportedly a hybrid between *Buxus sinica* var. *insularis* and *Buxus sempervirens* 'Suffruticosa', this plant was distributed by Sheridan Nurseries of Ontario Canada through the USDA plant introduction program for testing at numerous sites throughout the northeast in the early 1970's. Located adjacent to the north entrance to the Blasberg building for over 20 years, this plant is four feet tall and six feet wide. It has suffered little winter injury during the coldest winters and it displays attractive green foliage through the year.

Friends of the Hort. Farm

The Friends of the Hort. Farm organized during the spring of 1994 to support the research, collections and the development of the Hort. Farm. Motivated by their interest in the ornamental plant collection at the Farm, this group organized and registered incorporation papers with the State of Vermont and the Internal Revenue Service as a non-profit corporation. This occurred at a time when the University administration was

considering the possibility of selling certain agricultural lands to support the development of a new agricultural research site away from the urban setting to consolidate all agricultural research. The University applied to the city of South Burlington to change the city zoning of certain lands including the Farm from agricultural district to residential/commercial district. The Friends of the Hort. Farm helped convince the city to designate the Farm as an institutional and agricultural district thereby preventing its development for housing or commerce.

The Friends of the Hort. Farm sponsor many educational programs each year and, in cooperation with the Department of Plant and Soil Science, have held open house for the public on two weekends each year. Volunteers publicize the events, schedule tours of the farm, and give information about the farm and its activities.

The Friends of the Hort. Farm publish a newsletter for members and friends. They developed a woodland trail and published a self-guiding interpretive brochure. They purchased permanent signs for many of the plants in the collections. During 1997, they designed and built an information kiosk north of the Blasberg building (map 3). Cooperating with the Shelburne Museum, Shelburne Farms, the University Department of Plant and Soil Science, the Vermont Association of Professional Horticulturists and other organizations, they sponsor and/or participate in public programs on horticulture, community planning and

sound ecological landscape use. Many members have been active in the organization. Kristina Bielenberg and David Heleba, in particular, have provided continuous effort and creative leadership from the beginning.

Student Farm⁷

The Common Ground Organic Student Farm was developed by the Common Ground Agricultural Club in May 1994. Students in the Agroecology class at the University formed a club that focused on agricultural issues. The discussions took place at the Common Ground Restaurant in Brattleboro Vermont and from this namesake, the Common Ground Agricultural Club was born. Professor Wendy Sue Harper, soil scientist in the Department of Plant and Soil Science, became faculty advisor.

The Common Ground club decided in September 1994 to focus on four areas, one of which was the development of a student run farm. Founders of the club were: Michael Ghia, Amanda Ellis, Ross Thurber, Jennifer Cirillo, Ryan Rich, Nat Bacon, Thea Preuss and Stacey Spencer. Ryan Rich and Manuel Garay, wrote a proposal during the spring semester, 1995, outlining how to organize and operate a student run farm. They developed plans for growing at the Hort. Farm.

The Department of Plant and Soil Science provided the start-up money for the 1995 growing season. During the first growing season, Jennifer Cirillo, Jeff Nissman and Lori Porciello grew vegetables at the Hort. Farm and

received credit for writing a farm manual. The vegetables were donated to the Burlington Food Shelf or consumed by the growers. The students demonstrated the farm practices to high school students and teachers from the Agroecology Institute during the summer.

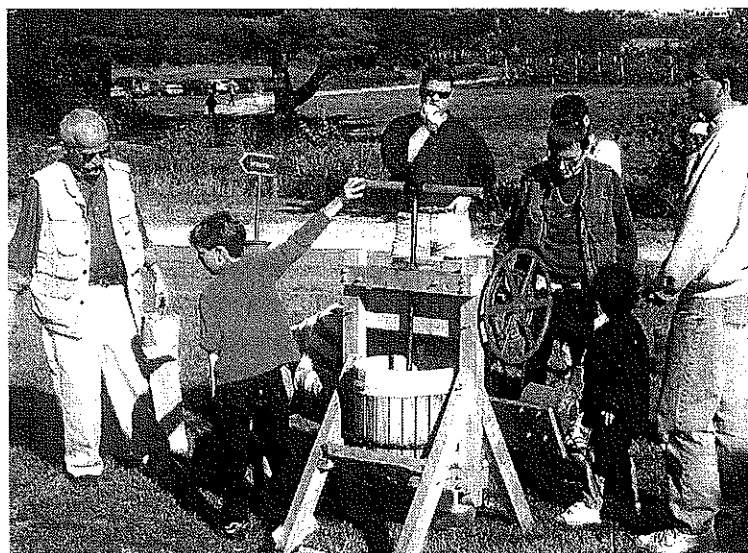
The Friends of the Hort. Farm provided seed money for the 1996 season. Bryan Connolly was manager for 1996 with help from Josh Toney and Lori Porciello. Realizing that they needed consistent funding they adopted the model where customers pay a set amount before the growing season and receive vegetables during the summer. The club decided that the Chittenden Burlington Food Shelf and the University Food Salvage would receive half of the produce and they would market to College administrators. Their marketing brochure featured hands-on education. Eighty dollars was charged to the seven customer shareholders in 1996.

Jon Hartland became manager at the end of the 1996 season in preparation for 1997. His helpers were Stacey Schuster, Caitlin Brady and Christina Fabrey. The clientele was expanded to nine shareholders and the share price of \$120 included delivery to the campus. Thirteen Vermont Youth Corp high school students spent an afternoon at the farm to learn about vegetable production. They helped weed the corn and identify beneficial and pest insects.

Hartland developed a record keeping system to determine how much produce should be grown and when transplants need to be started in the greenhouse to get a successful crop. He recorded the amount of produce grown and provided for each shareholder. He experimented with growing cover crops to control weeds, growing grain crops and used cold frames and row covers to encourage early yield of vegetables.



Hort. Farm visitors touring the orchards during the autumn open house, 1995.



Visitors pressing apples for cider at autumn open house, 1997.

Publications

The following list of publications report the results of research at the Hort. Farm, from plant material grown at the farm, or recommendations based on the research. The work, in some cases, was in collaboration with scientists at other sites.

1954. Blasberg, C. H. and R. J. Hopp. Vegetable gardening in Vermont. Vt. Ext. Circ. 109.

1954. Hopp, R. J. Growing asparagus in Vermont. Vt. Agr. Exp. Sta. Pamph. 30, Revised in 1963. Revised in 1970 as Vt. Ext. Circ. 142.

1954. Hopp, R. J. Insects and diseases in the vegetable garden. Vt. Ext. Circ. 123. Revised in 1956, 1958 with G. B. MacCollom as co-author.

1955. Hopp, R. and M. P. Lamden. Ascorbic acid content of some Vermont-grown fruits and vegetables. Agr. Exp. Sta. Bull. 579.

1955. Hopp, R. J. and S. B. Merrow. Quality of vegetables for home freezing. Vt. Agr. Exp. Sta. Pamph. 22, Revised from 1950.

1956. Flanagan, T. R. and R. J. Hopp. Weed control recommendations for horticultural crops. Vt. Ext. Serv. M 4856, Revised in 1957.

1956. Hopp, R. J. Vermont grown vitamin C. Vt. Farm and Home Sci. 1(4):10.

1957. Hopp, R. J. Tomatoes for Vermont. Vt. Farm and Home Sci. 2(3):4, 11.

1958. Gingrich, J. R. and R. J. Hopp. Bigger strawberries. Vt. Farm and Home Sci. 4(1):11,15.

1958. Hopp, R. J. Vegetable varieties for Vermont. Vt. Ext. Br. 1011, Revised 1960, 1963, 1965.

1959. MacCollom, G. B., T. J. Sproston, T. R. Flanagan and R. J. Hopp. Potato and vegetable recommendations: Diseases, insects, weeds, varieties - for commercial growers. Vt. Ext. Serv. M 4747, Revised in 1960, 1961, 1962, 1963. Revised in 1964, 1965 with K. D. Fisher as co-author.

1960. Hopp, R. J., S. B. Merrow, and E. M. Elbert. Varietal differences and storage changes in β -carotene content of six varieties of winter squashes. Proc. Amer. Soc. Hort. Sci. 76:568.

1961. Blasberg, C. H. Growing blueberries in Vermont. Vt. Agr. Exp. Sta. Pamph. 19. Revised from 1948.

1961. Merrow, S. B., and R. J. Hopp. Associations between the sugar and starch content of, and the degree of preference for winter squashes. J. Agric. and Food Chem. 9(4):321.

1962. Hopp, R. J., B. R. Boyce and G. B. MacCollom. Strawberries in Vermont. Vt. Agr. Exp. Sta. Pamph. 33, Revised in 1969.

1962. Hopp, R. J. Studies of the sex ratio in butternut squash, *Cucurbita moschata* Poir. Proc. Amer. Soc. Hort. Sci. 80:473
1963. Boyce, B. R. and R. J. Hopp. Semi-dwarf apple trees: performance of several rootstock-interstock combinations. Vt. Agr. Exp. Sta. Bull. 633.
1963. Hopp, R. J. and S. B. Merrow. Varietal differences and storage changes in the ascorbic acid content of six varieties of winter squashes. J. Agr. and Food Chem. 11:143.
1963. Nasrallah, M. E. and R. J. Hopp. Effect of a selective gametocide on eggplant, *Solanum melongena* L. Proc. Amer. Soc. Hort. Sci. 83:575.
1964. Hopp, R. J. Mechanisierung im Gemüsebau, insbesondere der Ernte, in den Vereinigten Staaten von Amerika. In: Obst und Gemüse im modernen Markt. Vorträge Deutscher Gartenbautage Heft 1: 55.
1965. Boyce, B. R. and S. C. Wiggans. Cultural studies on grapes, 1953-1964. Vt. Agr. Exp. Sta. MP 45.
1965. Hopp, R. Entwicklungstendenzen im Gemüsebau der USA. Deutsche Gartenbauwirtschaft 13(1):14.
1965. Hopp, R. Rückstandsprobleme und Gesetzgebung in den USA. Deutsche Gartenbauwirtschaft 13(1):16.
1965. Hopp, R. J. and S. B. Merrow. Yield and composition of *Cucurbita moschata* Poir., cultivar Butternut, as affected by nitrogen and carbohydrate status of the plants. Qual. Plant. et Mat. Veget. 12:59.
1965. Wiggans, S. C. Peony variety collection, 1955-1964. Vt. Agr. Exp. Sta. MP 47.
1965. Wiggans, S. C. and B. R. Boyce. Cultural studies on blueberries in Vermont 1952-1964. Vt. Agr. Exp. Sta. MP 46.
1966. Flint, H. L. Landscape plants for Vermont. Vt. Ext. Serv. S.P. 8. Revised in 1980 by N. E. Pellett as Vt. Ext. Serv. Br. 1290.
1966. Hopp, R. J. and B. R. Boyce. What's new in the garden? Vt. Farm and Home Sci. 9(2):4.
1967. Boyce, B. R. and C. R. Smith. Low temperature crown injury of dormant 'Catskill' strawberries. Proc. Amer. Soc. Hort. Sci. 91:261.
1967. Hopp, R. J. Home garden vegetables. Vt. Ext. Serv. Br. 1149.
1967. Hopp, R. J. and Haydon Rochester, Jr. Responses of Butternut squash to N-dimethyl amino succinamic acid. HortScience 2:160.
1967. Jesinger, R. and R. J. Hopp. Einfluss der Jahreszeit auf die Stecklingsvermehrung von Koniferen. Gartenwelt 67:309.

1967. Jesinger, R. and R. J. Hopp. Rooting of conifer cuttings. *Arnoldia* 27(12):85.
1968. Boyce, B. R. Factors contributing to low temperature injury in strawberries. *Fruit Notes*, Nov.-Dec. Univ. of Mass.
1968. Costante, J. F. and B. R. Boyce. Low temperature injury of highbush blueberry shoots at various times of the year. *Proc. Amer. Soc. Hort. Sci.* 93:167.
1968. Hopp, R. J. Varietal and cultural studies on peppers. *Vt. Agr. Exp. Sta. MP* 54.
1968. Hopp, R. J. Muskmelons in Vermont. *Vt. Agr. Exp. Sta. Bull.* 653.
1968. Hopp, R. J. Qualitätssteigerungen durch Gemüsezüchtung. *Gemuese* 4:244.
1969. Bruckel, D. W. and S. C. Wiggans. Effects of certain growth regulators on the temperature injury of cultivars of *Chrysanthemum morifolium*. *HortScience* 4:220.
1969. Hopp, R. J. Auswirkung der Vollmechanisierung der Gurken und Tomatenernte auf Anbautechnik und Sortiment. *Gemuese* 5:5,.
1969. Hopp, R. J. Vegetable varieties for Vermont Gardens. *Vt. Ext. Serv. Br.* 1188.
1969. Hopp, R. J. W. A. Way and S. C. Wiggans. The home vegetable garden. *Vt. Ext. Circ.* 138. Revised in 1970.
1969. Pellett, N. E., D. W. Bruckel and B. J. Williams, Jr. Survival and performance of woody ornamental plants in Vermont. *Vt. Agr. Exp. Sta. MP* 61.
1970. Boyce, B. R. Severity of fireblight on young 'Mutsu' apple trees. *Plant Disease Rptr.* 50:638.
1970. Boyce, B. R. and S. C. Wiggans. Highbush blueberries in Vermont. *Vt. Agr. Exp. Sta. Pamph.* 37, Rev. 1976.
1970. Peters, R. A., J. A. Jagschitz, J. A. Sheehan, L. J. Higgans, V. H. Holyoke, J. F. Ahrens, G. M. Wood and T. R. Flanagan. New England chemical weed control for turf grass. *Ext. Serv.* publication revised yearly to 1977.
1970. Hopp, R. J. Charting the progress of spring. *Weekly Weather and Crop Bull.* 58(16):12.
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1971. Wood, G. M. Photographing the invisible world of infrared. *Vt. Farm and Home Sci.* 14(1):8.
1972. Williams, B. J., Jr., N. E. Pellett, and R. M. Klein. Phytochrome control of growth cessation and initiation of cold acclimation in selected woody plants. *Plant Physiol.* 50:262.
1973. Evert, D. R. Factors affecting electrical impedance of internodal stem sections. *Plant Physiol.* 51:478.

1973. Hopp, R. J. and B. O. Blair. Plant phenology in Eastern and Central North America. I. Development of networks and preliminary results. Vt. Agr. Exp. Sta. Bull. 677.
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1973. Pellett, N. E. Influence of nitrogen and phosphorus fertility on cold acclimation of roots and stems of two container-grown woody plant species. J. Amer. Soc. Hort.Sci. 98:82.
1974. Blazich, F. A., D. R. Evert, and D. E. Bee. Comparison of three methods of measuring winter hardiness of internodal stem sections of *Forsythia intermedia* 'Lynwood'. J. Amer. Soc. Hort. Sci. 99:211.
1974. Boyce, B. R. and G. B. MacCollom. Strawberries in Vermont. Vt. Agr. Exp. Sta. Cir. 141.
1974. Boyce, B. R. and S. C. Wiggans. Early performance of apple tree size-controlling planting at the University of Vermont. Proc. Ann. Mtg. Mass. Fruit Growers Assn. 80:69.
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1975. Pellett, N. E. Plants in cold climates. Danish Dendrological Soc. Yrbk. 4(2):47.
- Pellett, N. E., M. K. Iverson and D. R. Evert. Winter survival and performance of woody ornamental plants in Vermont, five year report. 1969-1974. Vt. Agr. Expt. Sta. Res. Rep. 85.
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1976. Murphy, H. J., M. J. Goven, C. L. Thomson, O. S. Wells, M. R. Henninger, J. D. Harrington, D. R. McKenzie, W. R. Kelly, R. Jensen and S. C. Wiggans. Maine, Massachusetts, New Hampshire, New Jersey, Pennsylvania and Vermont potato variety trials for 1975. Univ. Maine Agr. Exp. Sta. Bull. 719. Published annually for several years.
1977. Marini, R. P. and B. R. Boyce. Susceptibility of crown tissue of 'Catskill' strawberry plants to low temperature injury. J. Amer. Soc. Hort. Sci. 102:515.
1977. Warren, C. G., J. A. Jagschitz, W. H. Holyoke, J. Troll, G. M. Wood and R. A. Peters. New England chemical weed control for home lawns. Published annually for many years by the Coop. Ext. Serv.
1978. Boyce, B. R. and R. P. Marini. Cold acclimation of everbearing strawberry blossoms. HortScience 13:543.

1978. Hopp, R. J. (ed.) Phenology: an aid to agriculture technology. Vt. Agr. Exp. Sta. Bull. 51.
1978. Parker, B. L., B. R. Boyce and R. P. Marini. Strawberry deformities. Vt. Agr. Exp. Sta. Bull. 683.
1979. Marini, R. P. and B. R. Boyce. Influence of low temperatures during dormancy on growth and development of 'Catskill' strawberry plants. J. Amer. Soc. Hort. Sci. 104:159.
1979. Brainerd, K. D., D. R. Evert and N. E. Pellett. *Forsythia* flower bud cold hardiness. HortScience 14:623.
1979. Costante, J. F. 5 + 4: The shape of things to come - a promising alternative for training and pruning apple trees. Vt. Ext. Serv. Br. 1284.
1979. Pellett, N. E. and B. R. Boyce. Flower bud cold hardiness. Amer. Hortic. 58(5):11.
1980. MacCollom, G. B., A. R. Gotlieb, C. L. Calahan, G. Baumann and D. Eddy. Air spraying for orchard pest control in Vermont. Vt. Agr. Exp. Sta. Bull. 685.
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1981. Pellett, N. E. Uncommon landscape trees and shrubs: winter survival and performance in Vermont. Vt. Agr. Exp. Sta. Res. Rep. 14.
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1982. Rose, A. E., N. E. Pellett and J. Aleong. Effects of protective covers on cold acclimation and survival of hybrid tea roses. J. Amer. Soc. Hort. Sci. 107:1173.
1983. Boyce, B. R. and R. A. Reed. Effects of bed height and mulch on strawberry crown temperatures and winter injury. Adv. Strawberry Prod. 2:12.
1983. Pellett, N. E. Early covering may cause winter injury. Amer. Rose Mag. 28(9):4.
1983. Pellett, N. E., D. Dippre and A. Hazelrigg. Outdoor rooting under a white polyethylene tent. Proc. Int. Plant Prop. Soc. 33:366.

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1985. Boyce, B. R., A. L. Hazelrigg and A. W. Linde. Field evaluation of loss of primary and secondary blossoms on strawberry fruit weight and yield. *Adv. Strawberry Prod.* 4:32.
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1990. Costante, J., L. Berkett and J. Clements. 'Liberty' apple evaluated in a major Vermont supermarket. *N.E. LISA Apple Production Nwsl.* 1:16.
1990. Magdoff, F. R., W. E. Jokela, R. H. Fox and G. F. Griffin. A soil test for nitrogen availability in the northeastern U. S. *Comm. Soil Sci. Plant Analysis* 21:1103.
1990. Perry, L. P. Overwintering container-grown herbaceous perennials in northern regions. *J. Environ. Hort.* 8:135.

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1992. Costante, J. F. L. P. Berkett and J. M. Clements. Liberty tops in taste. N.E. LISA Apple Production Nwsl. 3(1):10.
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1993. Berkett, L. P., A. R. Gotlieb and J. A. Bergdahl. Development of an on-farm diagnostic kit to detect mature *Venturia inaequalis* ascospores. VI Intl. Congr. of Plant Pathol. Montreal, Canada. p.39. Abstract.
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1994. Clements, J. M., W. P. Cowgill, Jr. and J. F. Costante. UVM apple fruit quality testing: an efficient procedure for measuring. *HortScience* 29:520. Abstr.
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1994. MacCollom, G. B., C. R. Lauzon, E. B. Payne and W. W. Currier. Apple maggot (*Diptera: Tephritidae*) trap enhancement with washed bacterial cells. *Environ. Entomol.* 23:354.
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1994. Perry, L. P. and S. A. Adam. 'David' phlox. *HortScience* 29:713.
1994. Perry, L. P. Powdery mildew control on 'White Admiral' phlox. Biological and Cultural tests. *Amer. Phytopathol. Soc.* 9:163.
1994. Schettini, T. M. and L. P. Berkett. Scab-resistant apple cultivars: an update on horticulture, pests and markets. *Fruit Varieties J.* 48:33.
1995. Bower, K. N., L. P. Berkett and J. F. Costante. Non-target effect of a fungicide spray program on phytophagous and predacious mite populations in a scab-resistant apple orchard. *Environ. Entomol.* 24:423.
1995. Pellett, N. E. and D. A. Heleba. Chopped newspaper for weed control in nursery crops. *J. Environ. Hort.* 13:77.
1995. Perry, L. P. 'Corbett' columbine. *HortScience* 30:165.
1995. Schmidt, D. and L. P. Berkett. Evaluation of a new trap for monitoring plum curculio *Conotrachelus nenuphar* (Herbst) in New England apple orchards. *Proc. Annu. Mtg. Mass. Fruit Growers Assn.* 101:109.
1996. Pellett, N. E. and D. A. Heleba. Yesterday's news, today's mulch. *Amer. Nurseryman*: 183(1):42.

Graduate student theses

The following are titles of Masters Degree theses for research conducted at the Hort. Farm or on plant material grown at the Hort. Farm.

1958. Boyce, B. R. A study of responses of strawberry plants to various foliar nutrient spray applications. Advisor: Charles Blasberg
1960. Teunissen, Caroline G. The influence of light, variety and growth status upon the rooting of the blueberry, *Vaccinium corymbosum* L. Advisor: Charles Blasberg
1962. Nasrallah, Mikhail E. Hybridization and inheritance studies in *Solanum melongena* L., and selected *Solanum* species. Beauv. Advisor: Richard Hopp

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7. Adapted from information written by Professor Wendy Sue Harper, Dept. of Plant and Soil Science, University of Vermont, December 1997.

Endnotes:

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