My Career in Horticulture©

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By mid-August, 1945, inspecting parts for bombsights had become a job no longer needed so my dad quit his position in a factory and started working at the Toledo, Ohio, sales yard of a Michigan nursery. He had been raised on a farm and he and my mother were serious gardeners, but he had never worked in a nursery. After several months, he and two colleagues from the same firm decided they could do better on their own and opened a landscape design and contracting business on the western edge of Toledo in early 1946. Thus at age 12 I had my first taste of the nursery business, helping care for plants in the sales yard, helping make wreaths and roping for the Christmas holidays, and other general chores. I may even have gotten paid, though I don't remember. The business grew rapidly but was undercapitalized, so it was sold very profitably in 1948. My father then returned to his pre-war position with a furniture, carpet, and drapery retail firm.

By the next year, I was helping my dad root *Taxus* cuttings (his favorite plant) in a back yard cold frame. In 1950, he had purchased 3 acres of land west of Toledo and started a small part-time wholesale nursery. The idea was to make enough money from the nursery to pay for my college education, which it did, as well as being available for expanding into a full-size nursery when I came home after college graduation. My dad and I still did the propagating at home, but he also bought liners for growing on at the nursery. We did all the work after school/work but mainly on weekends.

In 1952, I decided on Michigan State University (MSU) and planned originally to take the 2-year nursery management program. Before enrolling, I changed to the 4-year program in ornamental horticulture, since I received a scholarship. A key influence in my years at MSU was Fred Widmoyer, my undergraduate advisor. He guided me into carrying out some research projects in the Horticulture Department my last 2 years there and also aided me in getting a summer job at a large wholesale nursery in southeastern Michigan. During my summer there, I gained invaluable experience working with William De Jong, a young Dutch propagator trained at Boskoop, who left a year or two later to start his own nursery. Both men were IPPS members.

In my senior year, Fred arranged for me to attend a nursery meeting in Detroit where he introduced me to John Creech, who was a speaker at the meeting. John was then head of plant exploration for USDA in Beltsville and later became director of the National Arboretum. We had a good discussion on possibilities in research on ornamental plants and his advice influenced my future plans. Soon after, I decided to follow Fred's urging and go on to graduate school.

In the summer of 1956, I started graduate study at Rutgers University under the guidance of Bill Snyder, then IPPS Secretary-Treasurer. That fall, he sponsored me for membership in IPPS and I was elated when I was accepted as a Junior Member credited with 2 years experience! Two years later, I was able to attend my first IPPS meeting, in Cleveland, and presented my first talk at any meeting. I faced

this challenge with trepidation, knowing that Case Hoogendoorn and Martin Van Hof would be in the front row with pointed questions if I misspoke, but all went well much to my relief. The following year, I presented my second paper at the meeting in Philadelphia. Perhaps the highlight of that meeting was giving Bill Flemer a ride back to Princeton since we both needed to be back in New Jersey early. He was a good sport although it was difficult for him to fold up enough to sit in my VW beetle.

During my time at Rutgers, Bill took his grad students around to various nurseries in New Jersey to meet and talk with many nurserymen (and IPPS members) such as Jim Wells, John and Peter Vermeulen, and Bill Flemer as well as to see early mist propagation systems and first efforts at container production. We also went to meetings of the New Jersey Association of Nurserymen (NJAN) each year, where we reported on our research. This was appropriate since NJAN and the North Jersey Nurserymen's Association co-sponsored my research assistantship. In addition, we participated in short courses on gardening organized by the Horticulture Department. Although I had a research assistantship, Bill had me assist in the lab section of his basic plant propagation class 2 years. The first time, the class included a brash young man by the name of Charles Heuser, who I still remind that he was my first student.

The Horticulture Department at Rutgers had many graduate students from other countries and some of the faculty were actively involved in international horticultural groups. Both certainly had an impact later in my career with USDA and influenced me not only in participating in international societies and meetings, where I again met some of these students, but also in having numerous visitors work in my lab.

When I was completing my research and writing my dissertation in late 1961, it was time to start looking for a job in the real world. That's when it became apparent that the old saying about "the best laid plans …" applied to me also. With three degrees in ornamental horticulture, the realistic job options then were either with the Texas Forest Service in College Station working on pines or with the predecessor of Agriculture Canada in either Nova Scotia or British Columbia working in pomology. After some indecision, I went to Texas in May, 1962.

In Texas, I worked in the Forest Genetics Laboratory (FGL) on cutting propagation of loblolly and slash pine and collaborated with the other scientist and head of the FGL, J. P. Van Buijtenen, on developing screening methods to identify the most drought-tolerant loblolly seedlings produced in the tree breeding program. Studies on rooting cofactors in pines were reported at the 1963 IPPS meeting in St. Louis. However, College Station then was a culture shock for me that only intensified after November, 1963. In the summer of 1964 a position opened at Beltsville to work as a team member in a pear breeding program with the responsibility of studying juvenility in seedlings and developing methods of reducing it. I applied for and was offered this job. After a brief visit to Beltsville, I accepted the position.

At the beginning of January, 1965, I started work in the Pome Fruit Investigations of the Fruit and Nut Crops Research Branch under Howard Brooks, a Rutgers graduate who had overlapped about a year with me there. This position felt more permanent and I was happy to settle in Maryland.

My first responsibility in the pear breeding program was to evaluate the length of the juvenile period for the seedlings being field planted each year. This entailed taking flowering data on all seedlings each spring. In 1965, there were only about

2,500 seedlings to evaluate with just a few flowering, but that number grew by 1,200–2,500 each year until about 20,000 had to be evaluated every year. In addition, size of each seedling was tracked yearly by measuring trunk diameter so that a massive data set was developed. Summarizing and analyzing the data had to be done on a main frame computer (this was before PCs), which meant entering the data on coding sheets, having the data key punched, then proof reading the cards. Richard Bell, a grad student from Purdue University, was enlisted to analyze the data for his Ph.D. and he eventually became the scientist responsible for the breeding work. His analyses identified particular parent trees that conferred a short juvenile period on their progeny as well as the inheritance of many other useful characteristics. Two of the papers we published from this project received the Stark Award from the American Society for Horticultural Science in 1978 and 1982.

The second task was to determine if cultural practices could be used to shorten the time to first flowering on large populations of seedlings. To overcome the genetic variability of seedlings, I picked apomictic species to use and screened five species before settling on tea crabapple (*Malus hupehensis*) as a test organism. In this, Al Fordham (also IPPS member) was very helpful when I visited the Arnold Arboretum in 1965, showing me what fruit I could collect and giving me tips on extracting, cleaning, and treating the seed. He also collected later ripening fruit of *M. hupehensis* and sent me the cleaned seed. In the next few years, I grew thousands of seedlings and was able to develop methods to reduce the time to flowering from the normal 3–4 years to 12 months or even slightly less. In order to do this we grew the trees under long days in the greenhouse maintaining them finally in 8 in. plastic pots supported by a stake. The trees were 3 m tall in 7.5 months, growing at a peak rate of 2 cm per day. This work was reported at the 1971 IPPS meeting in Norfolk when we exhibited two potted trees about 3 m tall in flower. The main paper I published from this project received the J.H. Gourley award from ASHS in 1972.

Starting in 1972, I worked with other scientists in the U.S. and Europe to establish a working group on juvenility within the Fruit Section of the International Society for Horticultural Science. This effort led to twin international symposia on juvenility in plants in the fall of 1975, the first at the University of Maryland in College Park and the second 5 weeks later in Berlin, West Germany. At these symposia, botanists, foresters, and horticulturists discussed juvenility in woody plants in regard to its influence on propagation, flower initiation, tree form and growth, and other aspects. I edited the joint proceedings, published by ISHS as Acta Horticulturae no. 56.

By 1976, the Appalachian Fruit Research Station, a new U.S.D.A. facility, was nearly completed in Kearneysville, West Virginia. The pear breeding program and other tree fruit research were scheduled to be transferred there. I had reached a point in my program where it was time to take a new direction, whether in juvenility research or some other area. Permission was granted for me to begin research on tissue culture of fruit plants, which fit well with the 1972 reorganization of the Agricultural Research Service that placed all fruit research at Beltsville in the same laboratory. Accordingly, in 1976 we set up a tissue culture facility in my lab and started our first work late that year. While the main emphasis was to be on self-rooted apple trees, we worked also with thornless blackberries, strawberries, and blueberries.

From the beginning, we planned to grow substantial quantities of micropropagated plants in the field to compare their growth and productivity with conventionally

propagated plants of the same cultivars. The first experiments we did were with thornless blackberries of the series that had been developed and released by USDA, all of which were a bit difficult to root and for which rapid increase was desired to speed the introduction of new types. The same was true for strawberries, particularly the ever-bearing types then being prepared for introduction from the Fruit Lab. Results with the blackberries and strawberries were published starting in 1978. Our paper on field performance and phenotypic stability of micropropagated strawberries received the ASHS Darrow award in 1982.

In 1979, I went to Poland to review projects on which I and other U.S.D.A. scientists were collaborating. Since I needed to go via Italy, an Italian friend invited me to present a talk at a one-day tissue culture conference there and to visit some tissue culture labs. These labs impressed me so much that I presented a talk at IPPS about one of them later that year. I also started to work with my colleagues Freddi Hammerschlag and John McGrew to organize a conference at Beltsville to showcase the possibilities of micropropagation for American nurseries, which seemed to be lagging behind those in Europe, particularly in the areas of fruit and woody ornamental crops. The meeting was in early 1980 and we hoped to attract perhaps 100 attendees from the U.S.A. In the end, we had more than 200 including some from Europe and Canada. The proceedings were published by USDA and were quite popular with more than 2100 copies distributed eventually.

In 1979, Bill Snyder mentioned to me that the IPPS Board wanted to have an index of the first 30 volumes of the Proceedings. After the completion of the tissue culture conference, I thought I might have the time to take on this project and so submitted a proposal to the Board in 1980, which was accepted. I started work in February 1981, thinking that I could do it in a year or perhaps a bit more. It was a bigger task than I anticipated and wasn't completed until early 1984, with publication in mid 1984. Both the Board and I heaved a collective sigh of relief when it was finished!

Starting in 1981, I began to have visitors come to do research in my laboratory and this continued until 1995. There were a total of 18 from 12 countries, with most staying from 3–12 months. These years were exciting, interesting, and very productive, although all had to compromise a bit at times when the facilities were inadequate for the number of people trying to use them. One of the most pleasant aspects of these visits were the enduring friendships that developed including those between visitors who happened to be at Beltsville during the same time.

The decades of the 1980s and 1990s were particularly busy with the visitors, an expanded research program in the laboratory and the field, increased activities in scientific societies (ASHS, IPPS, ISHS, Plant Growth Regulator Society of America, and the International Association for Plant Tissue Culture), and service as an editor or on editorial boards (*Hortscience*, *Journal of the American Society of Horticultural Science*, *Plant Cell, Tissue and Organ Culture*, *Journal of Environmental Horticulture*, and *Scientia Horticulturae*, plus several books). Among my activities in ASHS were service on the Board 1983–85 representing the Northeast Region of ASHS and serving as President of this group in 1985–86. During these years, I was privileged to receive a number of awards and honors including Fellow of ASHS (1979), Norman Jay Colman Award from the American Association of Nurserymen (1984), Award of Merit from the Eastern Region of IPPS (1984), Superior Service Award from U.S.D.A. (1986), Fellow of the Eastern Region of IPPS (1993) and International Award of Honor from IPPS (1995).

As our research on micropropagation continued to expand, Robert Griesbach, Freddi Hammerschlag, Roger Lawson, and I decided it was time for another conference at Beltsville, which we organized in 1985. Tissue Culture as a Plant Production System for Horticultural Crops had broader subject matter than the one in 1980 and attracted about 300 participants including some IPPS members. The proceedings were published by Kluwer Academic Publishers.

Starting in 1979, we began planting micropropagated apple trees in orchards at Beltsville and other locations. Several large experiments were established involving hundreds of trees, many in a study conducted with my colleague George Steffens. These involved collecting data on tree size and form, flowering, and fruiting over a period of years. One of the major studies examined the use of spacing and plant growth regulators to control tree growth and stimulate flowering.

This combination proved to be moderately successful, especially with 'Gala', but our timing was off since publicity and regulatory decisions ended the possibility of using growth regulators as planned. The experiments were terminated in 1993.

In ISHS, I attended the Horticultural Congresses in 1966 and then every 4 years 1982–2002 as well as a number of international symposia organized within ISHS. At the end of a symposium in Italy in 1989, I was elected to organize a Tissue Culture Working Group. My ISHS activities were a factor in my being appointed in 1986 as one of the U.S. representatives on the ISHS Council. During these years, rapid growth of ISHS created increasingly difficult problems. Starting in 1992 I helped lead an effort to restructure the governance and management of the Society that culminated in major changes in 1994. When I went off the Council in 1992, I was appointed to the Executive Committee to organize the Commission Biotechnology and chaired this Commission until 1998. Then in 1994 I was elected to the newly constituted Board and served on that as Treasurer until 2002. When I retired from the Board, I was elected an Honorary Member as were my fellow Board Members.

In 1990 I was invited to spend a month as a visiting professor at the University of Bologna, Italy, where I worked with a team of young scientists to design and implement a data collection program for an extensive planting of micropropagated pear trees derived from plants that had been irradiated. Their goal was to identify any favorable mutations. While there, I also attended the International Horticultural Congress in Florence and finished proofreading on a book, Micropropagation, that my Belgian friend and colleague, Pierre Debergh, and I edited.

Other important activities during this period included co-organizing with Freddi Hammerschlag an ISHS symposium on in vitro culture and horticultural breeding in 1992 in Baltimore. This well attended meeting was the second in an ongoing series on this topic. In 1996, I did a telephone survey of U.S. commercial micropropagation laboratories and reported the results at IPPS-Eastern Region, North America in Cincinnati as well as at an international symposium in Ireland. When Rob Griesbach updated this survey in 2001, I aided him and presented our results at IPPS-ER in Lexington, Kentucky.

By 1995, research priorities were shifting once again and the project on which I was the sole scientist was underfunded by the budgeting standards then used. For 2 years in a row, the funding was eliminated in the proposed USDA budget only to be restored by Congress. Finally in 1997 when it happened again, I was urged to become the Research Leader for the Fruit Laboratory, which I did reluctantly, but

this guaranteed my job security. At this time the Fruit Lab was expanded by adding the blueberry and cranberry research in New Jersey plus taking over administrative control of the Plant Germplasm Quarantine Office at Beltsville, which resulted in a larger than usual Lab. This left little time for research but enough still for three interesting projects. I completed nearly 3 years in this position and retired from USDA at the end of 1999 after 35 years at Beltsville.

Of these last three projects, the first evaluated growing blueberries in containers filled with an acidified mix of coal ash plus composted sludge and/or leaves and comparing their growth and fruiting with plants grown in a typical blueberry soil from New Jersey. Plants grown in some ash/compost mixes grew larger and had more fruit than plants in the sandy New Jersey soil. The study was expanded by Brent Black, my successor, who published the results.

The second project resulted from the discovery by my assistant, Ingrid Fordham, working with other scientists, that the red color of the edible fruit of autumn olive, *Elaeagnus umbellata*, was not due to anthocyanins but from a high concentration of lycopene, valued as a food additive. This concentration is much higher than in tomato or any other foods that are considered valuable sources for the human diet. Potential exists for selecting plants for fruit size, lycopene content, and flavor. Brent and Ingrid showed that the fruit can be machine harvested. This research created great interest among growers and others and one grower produced jam from the fruit. Its future is bleak since the species is now classified as invasive.

The last project dealt with the true identity of *M. hupehensis*. After I published my results on juvenility, I saw trees reputed to be this species in England, Germany, Netherlands, Poland and France that always had red fruit and a different growth habit than the trees grown in the U.S.A. Descriptions in books varied but I relied on Rehder's Manual. A scientist who had used this species in breeding apple rootstocks assured me that I had worked with a mislabeled species. For years, there seemed no way to resolve this issue. Then in 1999, I met Laura Benson, a young woman working for USDA at Geneva, New York, who was about to leave for China to collect crabapples, including *M. hupehensis*. To identify species, she was using a new technique based on DNA fragments. We obtained leaves from trees reputed to be *M. hupehensis* from several sources in Europe and the U.S.A., which she compared with material she collected in China. The plants from China were identical to the trees from Beltsville and the Arnold Arboretum, but to none of the other trees sampled. Others will now have to work out the proper species identity of the trees at botanic gardens and other collections in Europe.

The International Plant Propagators' Society was the second professional society that I joined, a few months after I joined ASHS, but my membership in IPPS has always had a special meaning for me. The mix of professional propagators and nurserymen, specialists from botanic gardens and arboreta, and scientists working on a wide range of topics related to the nursery industry has always made the meetings particularly interesting. Although I was unable to attend many meetings early in my career, by 1970 I was able to resume regular attendance and have missed only seven since then. Thus this meeting is my 38th (36 Eastern Region, 2 Western Region) since 1958. I hope to continue participating as long as I am able.

What I value most about the IPPS are the friendships that I have made over the years, too many to enumerate individually. However, I want to note particularly Bruce Briggs whom I first met before 1975. When I organized the juvenility

symposium in 1975, Bruce was the first to contribute support and he attended the College Park portion. With his friendship came many opportunities for discussions about tissue culture, the nursery business, and a wide range of topics as well as visits to his nursery. He truly epitomized the motto of IPPS. Two other friends not previously mentioned above that I particularly value are Elwin Orton, whom I met outside IPPS but with whom I have attended IPPS meetings for many years, and Darrel Apps, who introduced me to modern daylilies and rekindled my interest in gardening with perennials.