

cuttings in flats, not in pots. One problem is roots, so many roots you can't get them apart.

DR. BROWN: Was this redwood sawdust, Don?

MR. DON DILLON: Redwood sawdust, untreated, just off the pile, thrown in the flats.

DR. BROWN: So the problem was overrooting almost; this might be corrected by proper timing. I might mention too that some people have recorded an antibiotic quality in sawdust as a rooting medium. This of course would be very desirable from the standpoint of rooting cuttings here because it cuts down on the disease.

MR. ART MYHRE: We tried some easy-to-root rhododendrons in fir sawdust and they made wonderful roots, nice white roots, but you have to have the right nitrogen combination in the medium.

MR. STEVE FAZIO: Most of our sawdust from Arizona comes from the Ponderosa Pine, and in some of it having a high pitch content we did run into a toxicity problem. Some batches we would get excellent results. Those with a high pitch content, we did run into a toxic condition.

DR. BROWN: In regard to the redwood, some growers recommend leaching it very heavily before using it, yet Don Dillon reports no bad results from taking it just the way it comes from the saw mill.

DR. WILLIAM LIBBY: My comment comes from reading the Australian literature yesterday. They were commenting on pine sawdust. They mentioned toxicity in the first year and very favorable results after letting it rot for a year.

MR. EARNEST JENSEN: I think one thing that may be we are overlooking about John Roller's setup is the fact that he used fairly copious amounts of water and provided for excellent drainage through the sawdust which might be part of the answer to why he didn't get into trouble. In that particular area they'll have a mixture of soft wood and hard wood in their sawdust.

COMPARISONS: EUROPEAN AND AMERICAN PROCEDURES IN HORTICULTURE

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With the enthusiasm of "Youth" and the optimism of a "Freshman," I started on my sabbatical leave with the idea of comparing "Horticultural Procedures in Central Europe with those in the United States."

My colleagues had given me names and addresses, and by contacting the Ministeries of Agriculture and Education, I was able to make appointments and have interviews at 28 schools,

colleges, and universities where horticulture was taught. I also visited 51 nurseries, 22 arboretums or parks, 16 horticultural markets, 16 private gardens, and 8 flower shows or fairs. In all I drove 5,892 miles.

The trip in the United States included 34 schools, colleges, and universities in those states which lead in the production of horticultural crops. Needless to say, I visited many nurseries, parks and arboretums. In all I took 600 colored slides, 400 black and white pictures, and tape-recorded all of my interviews. From these tapes I have made four complete factual notebooks.

In the allotted time it would be impossible to give you a complete summary, so I have reviewed my notes and slides and will give you only the highlights.

In general the people of Europe are more law-abiding than Americans. They are extremely polite, thoughtful and careful in their personal relations with each other, and we found they responded quickly and warmly to friendly actions.

There is great interest on the part of the general public in agriculture and horticulture. Wherever space is available, people have gardens, both vegetables and flowers. City parks rent out 30' x 30' plots called "folk gardens" at a nominal fee (\$3.00 per year) so that the apartment dwellers may grow plants and get next to the soil. These gardens are open, and seldom bothered. The net result has been a wider knowledge of generic and species names, knowledge of what constitutes good nursery stock and recognition of individuals having training or having special abilities in the horticultural field. Horticulture is thought of as a profession, not as a gardening trade.

Institutions Teaching Horticulture

I found the institutions teaching horticulture were small and set apart from the large liberal arts colleges. This provided a setting with no crowding pressures and considerably reduced administrative problems. This is a far cry from what we are doing in the United States where we pile great masses of humanity on top of each other in small areas and snuff out a good horticultural program. This is happening in all of the colleges throughout America. Locally we are all familiar with the tragic closing of the horticultural program at the University of California, Los Angeles.

Instruction in horticulture is available at many levels and is arranged to suit practically any situation for both men and women. There are (a) evening classes, (b) day release classes, (c) apprenticeship programs, (d) institute programs of 1, 2, or 3 years, and (e) full university programs. As a result, you can see there are a great many more individuals trained at all levels.

As an example, Aalsmeer in the Netherlands has a population of 15,000 of which 266, ages 14 years and older, are in the Elementary Horticultural Education, 92 in Secondary Horticultural Education, 104 in Vocational Horticultural Programs,

75 in Special Horticultural Programs, and 53 in Horticultural Training Courses for a grand total of 590 students over 14 years of age in horticultural training dealing with floriculture and ornamental horticulture.¹

In the publication, "Enrollment and Degrees in Agricultural Institutions of Higher Education," issued by the United States Department of Health, Education and Welfare, there were, during the same period, for the entire United States only 143 Floricultural undergraduates and 325 Ornamental Horticultural students and even if we add in the 937 General Horticultural students, which include pomology, fruit production, vegetables and crops, this gives us a total of only 1,405 students out of our total population of 185,000,000. The report covers all universities, colleges, and junior colleges. No report is available on high schools, but few have horticultural programs.

There is no doubt that Europeans slant the technical school programs toward the commercial phase of horticulture, or that they use a great deal more time in laboratory classes to attain this. These schools work closely with the universities and their research experimental stations. The newly found information is continually being put to immediate practical use.

Regardless of the level of instruction in which the student was enrolled, I felt that he looked upon his education as a real opportunity and definitely a necessary preparation for his life's work. In general the students appeared to have quite clear cut objectives in mind and were working toward them. Opportunities are available only to those who are academically trained or professionally accredited. Here in the United States, the students seem less eager, have no clear-cut objectives, and often fail to take advantage of their opportunities in college.

On the Continent I found that each of the universities, technical colleges and apprentice schools had their own very rigid entrance requirements. Most required from one to three years of practical work experience in a commercial field, before admittance. All institutions required evidence of proper academic competence for their level of instruction. Interviews of prospective students was common, and many were not admitted because of poor attitude or lack of interest. On an average, it can be said that more than half of the students who applied were refused admittance, even in the apprentice program.

In the United States we not only lack the number of institutions, but we have few or no programs for non-college students. Regrettable is the fact that the horticultural enrollment of the colleges I visited in 1961 was low: it averaged less than 17 students per department.

It appeared to me that much of the research being carried on in Europe had more practical application than that which I saw in the United States. As an example, the following are

¹Extension Service Publication for Floriculture. Aslmeier. 1960.

three of the recent projects that have been successfully completed: (1) the investigation and development of tomatoes with more chlorophyll to grow under poor light conditions; (2) the development of a commercial red delphinium to increase sales of this plant (incidentally, they used a native wild plant from California for one parent); (3) the development of a good garden pea in which the pod as well as the pea could be eaten.

On the other hand, our basic research is excellent, with money and laboratory equipment often coming out of our ears. Because of the emphasis placed on advanced degrees and publications in our institutions, the undergraduate is frequently the forgotten man, and enters graduate work with little or no concept of commercial work or practices. One Ph.D. Thesis I heard discussed was "The Classification of Crab Apple Trees by a Microscopic Analysis of the Stem Tissues."

I have promised Dr. Brown I would not steal his thunder by covering our method of teaching Horticulture at Cal Poly, Kellogg Campus, Pomona. Suffice to say we have a current enrollment of 75 degree students in Ornamental Horticultural and 230 degree students in the Landscape Architecture program.

The European Horticultural Industry

In all of the parts of Europe that we visited, the normal concept of a nursery is an establishment where plants are propagated, grown, and sold. For the most part nurseries are small, two acres or less, usually family owned and operated. The range of material handled is broad, from annuals and perennials sold by the dozen, to large specimen trees field grown to be dug in season on order. The rest of the general nursery stock is sold either bare-root in season or balled and burlapped. The only container-grown material are pot plants for summer plunging and house plants. The one exception to this was in the Riviera area where specimen boxed trees were available as was a small amount of container stock.

From the standpoint of quality, efficiency of growing and ingenuity, one would have to rank the nurseries of the Netherlands as the most outstanding. The average nursery stock was better than the United States average, and the best European nurseries excelled our best in all phases. The only possible exception would be in the use of mechanization, but with the availability of well-trained inexpensive labor, the net result would still favor the European nursery.

In the matter of quality control, the Dutch use the bud wood from one tree to bud one row. If disease or virus appears in the parent stock, the budded row is destroyed.

The I.T.T. or Horticultural Engineering Department at Wageningen tests and reports on all equipment sold in the Netherlands and carries on a terrific research program on all engineering phases of horticulture. I saw no "Mickey Mouse" piece of equipment in Europe.

The grower associations in the Netherlands are socialistic

in nature and the industry is so closely regulated by these associations as to stifle the younger people. New facilities cannot be constructed or acreage of crops changed without approval of the association responsible for its control. For instance, all the cyclamen growers send three of their best plants of variety and color to Aalsmeer for show and testing, and only seed from the best plants are allowed to be harvested and sold. Ninety percent of the horticultural products are exported from the Netherlands, and this is carefully controlled so that only their top quality merchandise leaves the country. In England, Germany, France and Switzerland horticulture is an open industry with no controls except for quality, disease and pests. However, most require an individual to pass an examination or to appear before a board to show competence before he can open a new business.

It is interesting to note Americans spend less than five-tenths of one percent of their income on horticultural products as compared to one percent spent by Europeans. The Europeans pay more for their horticultural products on the basis of wages than do Americans, but at the same time they are receiving a better quality plant backed up by sound practical horticultural advice. The shows and fairs plus the recommendation of the horticultural societies play an important part in the buyers selection. Varieties placing well at the Royal Horticultural Society "fort-nightly" shows, automatically becomes a best seller, so highly is the society regarded. The "Modern Garden Center" is fast becoming a normal method of selling all things for the garden and their best equal our best in California. The "Farmers Market" is a historic tradition and seems to take care of surpluses and home produce and are found in most all towns in all countries.

At the wholesale level the "Veilings" or markets of the Netherlands and Belgium are outstanding but only operate when there is a total involvement of all growers in the one marketing organization. Under these circumstances, it becomes a highly efficient bargaining center.

In closing I would say Europeans are more horticulturally minded than Americans, better informed, and more conscious of quality and value. The nurserymen are better trained in all departments. Each man knows his job and is an authority within his realm. Bosses are bosses and having worked up through the ranks, they are able to direct and supervise all jobs under their control. In Europe the way to the top in horticulture is slow but thorough.

MR. WESLEY KEYES: Where is the source of the red delphinium?

MR. JOLLY BATCHELLER: That was at the Horticultural school in the Netherlands, Wageningen.

MR. DARA EMERY: Gardening Illustrated, a British pub-

lication, carried a good article on the origin and development of this red delphinium within the last year.

MR. JOLLY BATCHELLER: When Dr. Doorembos got his Ph.D. at U.C.L.A., he took the seed back from a native plant. I don't know whether he was actually in on the development of it or not.

MR. DARA EMERY: The man who did the work on the hybrid delphinium was Legro.

DR. DENNISON MOREY: In connection with the *cardinelli* hybrids, if you're anticipating development work, get in touch with Dr. Gustav Melquist at Storrs, Connecticut. He initiated work at U.C.L.A. with *cardinelli* twenty years ago and has been carrying it on with some of the Pacific hybrids. I think he is now concerned with rhododendrons. I know him well enough to know that he would have material that the *cardinelli*'s left and it might be of interest to you.

THE ROLE OF RESEARCH IN PLANT PROPAGATION¹

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THE EFFECT OF SEVERAL ANTI-TRANSPIRANT MATERIALS ON APPARENT TRANSPIRATION OF SELECTED ORNAMENTAL PLANTS¹

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Although anti-transpirants have been known and used for more than fifteen years, there is little information based on experimentation concerning the effects of these materials on transpiration. Before considering some of our recent work with these anti-transpirants, let us briefly review what is meant by transpiration and how it occurs.

Transpiration is the evaporation of water from plant tissue. Basically it follows the physical laws which govern the evaporation of water; however, there are modifications based on plant structure. Woody twigs may lose water through the lenticels; however, the major path of water loss from the plant is through the leaves.

An examination of the structure of a leaf will help to understand transpiration more completely (Figure 1). Both the upper and lower surfaces of a leaf are covered with a layer of

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