URBAN HORTICULTURE—BASIC HORTICULTURE FOR THE NEXT DECADE

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Simultaneous establishment of many formal urban horticulture programs has occurred within the last decade. One of the first to be established was the Center for Urban Horticulture at the University of Washington (7). Now in its tenth year, the Center has established the following program priorities: to build a national center for scientific research; to train leaders in research and professional practice; to build an interdisciplinary program; to build a system for distributing information; and to develop advocacy for trees in cities.

The following summary emphasizes several areas of research and public outreach currently in the Center's programs.

ENVIRONMENTAL STRESS

Researchers have shown that when one part of a plant is stressed, often another part of the plant responds in some way in order to increase the plant's chances of survival. In the laboratory directed by Dr. Barbara A. Smit (2), they are studying the means by which long distance signaling occurs within plants.

In one system being used, specific leaves on plants of a hybrid poplar *Populus* × *generosa* (*Populus trichocarpa* × *P. deltoides*), were wounded (as often occurs with insect feeding). This wounding elicits the production of substances in other leaves which are thought to be defense proteins. This can tentatively be thought of as a "plant immune response."

Specifically, a leaf (labeled as number 9 position) was wounded. After a specific period of time, all of the leaves from positions number 9 upwards to number 3 were assayed for chemical responses. In this instance, both the number 9 and number 4 leaves showed the same response. We already know that these two leaves have direct connections by which the leaf at position number 9 feeds sugars to the growing leaf at position number 4. Now researchers are trying to determine the nature of the other materials.

Understanding this type of defense mechanism may enable us to genetically manipulate plants to enhance their resistance to insect and disease problems. It certainly could have implications for plant production in the future.

PLANT INTRODUCTION THROUGH CLIMATE ANALYSIS

The ease of travel has opened new international vistas for the exchange of plant materials. However, this further emphasizes the need for better determination of genetic background, which ultimately determines how well a plant will grow in a new area. Plant introduction studies of Dr. Clement Hamilton are using a type of diagram developed during the years 1960 to 67 by Heinrich Walter and Helmut Lieth (5). This uses a series of diagrams of temperature and rainfall which takes into account the duration of cold seasons, rainfall total, and seasonal patterns of temperature and precipitation.

As an example, Figure 1 depicts the climatic information for Seattle, Washington. The horizontal axis (Figure 1a) represents January to December in the Northern Hemisphere (July to June in the Southern Hemisphere). The vertical axis has divisions for each 10°C (temperature) and 20 mm (precipitation). In Seattle, the temperature curve (Figure 1a) illustrates that the average daily temperature is highest in the summer and lowest in the winter. The precipitation curve (added in Figure 1b) shows higher winter rainfall. If you superimpose the two curves, the relatively humid season (shown as vertical shading Figure 1c) and relative drought (dotted pattern) appear. When the precipitation exceed 100 mm per month, the area under the curve is colored black.

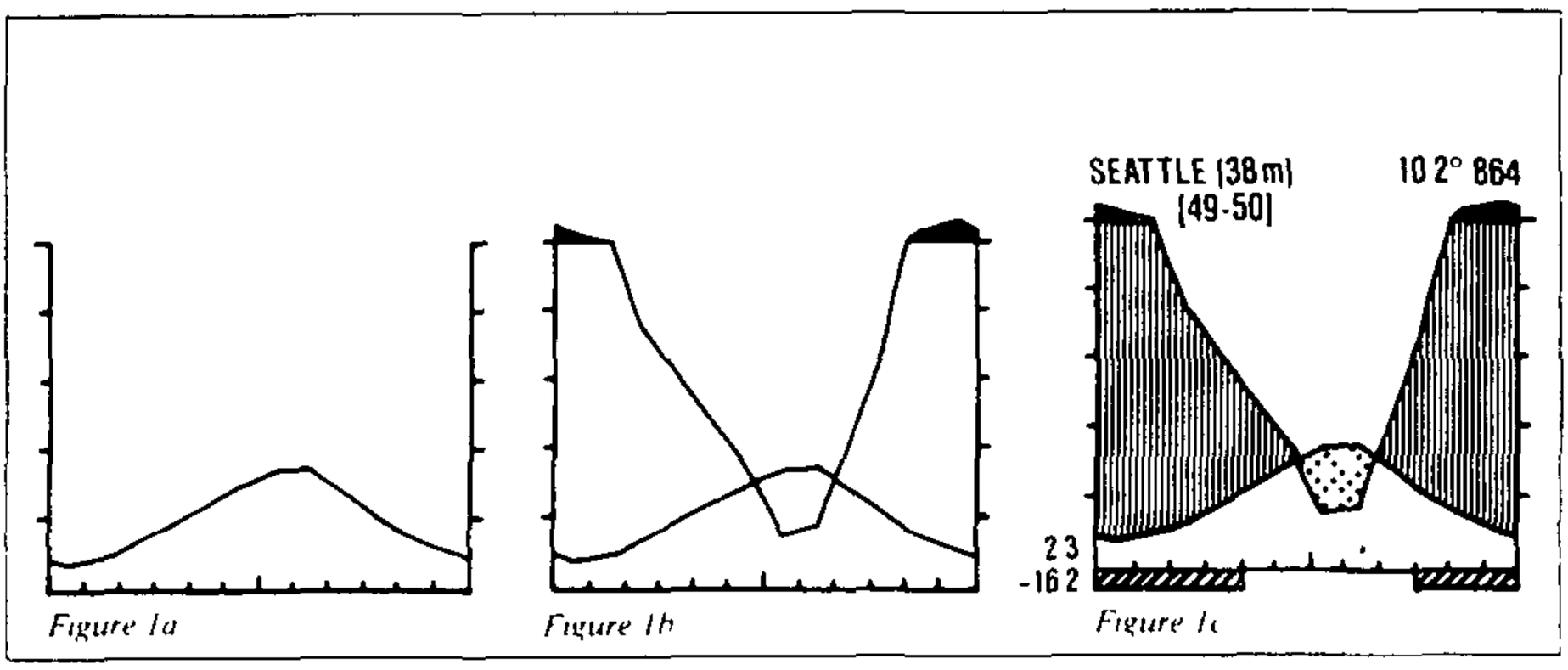

Figure 1. Development of the Seattle, Washington, U S A diagram, number 360 on the North America map of the Klimadiagramm-Weltatlas, redrawn by Karen Krager. (Reprinted by permission of the The Public Garden)

The horizontal bars across the bottom of the diagram (Figure 1c) indicate what months the temperature usually drops below 0° C at least once (diagonal shading). The top number, 2.3 is the mean daily minimum of the coldest month. The lower number (-16.2° C) is the coldest temperature on record.

The number in parenthesis to the right of the station's name indicates that Seattle's elevation is 38 m above sea level. The numbers below show that the graph is based on 49 years of data for temperature and 50 years for precipitation. The numbers in the upper right corner represent annual means, i.e. the average temperature in Seattle is 10.2°C and the average annual precipitation is 864 mm.

Dr. Hamilton and Ms. Reichard have used the above information to select an area for a collection trip to Southern Chile in 1988, an area with a similar climate to Seattle. From this trip, several plants, including *Orites* and *Embothrium* are now being tested (6). In addition, the natural forests of *Araucaria* were evaluated. Similar studies are needed in order to evaluate the potential of future plant introductions.

SELECTION AND EVALUATION OF URBAN TREES

The massive nursery production industry has grown highly sophisticated through the agricultural-type of research conducted by multitudes of Land-Grant institutions. In an effort to produce a large number of similar plants in as short of period of time and at the most efficient cost, ease of propagation and transplantation are among the criteria for efficient nursery production (Table 1).

Table 1. Criteria for nursery production of trees (from J R Clark)

Market potential of the crop
Ease of propagation
Ease of transplantation
Responsive to intensive culture

The qualities of an "ideal" street tree are listed in Table 2. Urban forestry professionals such as Dr. James R. Clark (1) are now actively involved in trying to develop vigorous testing and evaluative techniques for plants in the urban environment. This includes studies on selection, growth habits, durability, longevity, and stress resistance.

Table 2. Qualities of an "ideal" street tree (from J R Clark)

Moderate size	Hardy
Regular upright form	Minimal litter
Deep-rooted but not invasive	Durable and fast-growing
Stress tolerant	Solar-friendly
Pest resistant	Easy to transplant
Excellent ornamental features	Strong wood compartmentalization
Not responsive to artificial lighting	

It is apparent that the nursery production environment with its intensive cultural techniques is totally dissimilar to the urban environment in which the nursery plants are then planted (Table 3). Nurseries most often occur in rural areas, with moderate climates, usually have agricultural soils, and use intense fertilization, irrigation, pruning, and pest management. In urban planting areas, temperature extremes are common, soils are highly disturbed, and management intensity is moderate or minimal. Moreover, urban areas possess an abundance of people.

Table 3. Comparison of nursery production to street tree program (from J R Clark)

	Shade tree nursery	Street tree program
Primary goal	Production	Management
Product	Tree	?
Rotation length (yr)	2 to 4	50 to 100
Intensity of culture		
—irrigation	High	Low
—nutrition	High	Low
—pruning	Annual	3 to 10 year cycle
—pest management	High	Minimal

The Center has also been instrumental in bringing together professionals in many diverse areas of urban forestry, all of whom have some type of management responsibility in urban street trees. In January 1990, municipal foresters, community planners, community activists, politicians, landscape architects, public utility officials, arborists, urban forestry professionals, and educators attended an informational forum entitled "Your Community Trees—Asset, Not Liability". During the program, the new *Urban Forestry Notebook* (4) designed for use by public agency employees who have responsibility for urban trees, was unveiled. This 90-page 3-ring hardbound notebook was a cooperative project between the Washington State Department of Natural Resources, Puget Power Company, and the Center for Urban Horticulture.

NATURAL WETLANDS

Natural wetlands are coming under increasing pressure from urbanization. Because of expected or observed degradation, regulatory agencies are requiring management, restoration, and creation of wetland systems. These activities often require the incorporation of new planting material (3).

The major causes of failure of new plantings in wetlands include: a) choosing the wrong species, b) incorrect timing of planting, c) failure to match environmental conditions with plant requirements (which may include nutrient levels, organic material, periods of

both soil saturation and lack of aeration). The research of Dr. Kern Ewing will look at the specific requirements of three indicator species (*Carex spp.*) and three trees with potential utility for restoration (*Alnus oregona* [syn. *A. rubra*], *Populus trichocarpa, Fraxinus latifolia*). He is also conducting studies on plant responses to increases in heavy metal concentrations and to hydrologic perturbations.

PUBLIC OUTREACH

Continuing education and public outreach continue to be a top priority in the Center's programs. Programs are currently conducted for kindergarten through college-age students, general and enlightened public, professionals in horticulture, urban foresters, landscape architects, and multitudes of plant enthusiasts. In addition, professional graduate programs are now producing graduates for employment in urban horticulture/forestry fields.

The program directed by Dr. John A. Wott currently has the highest number of annual contacts of any continuing education unit on the University of Washington campus (Table 4). Classes, lectures, demonstrations, and guided tours are held on both the Union Bay headquarters site and in the 200-acre Washington Park Arboretum. In 1989, over 8000 participants attended 94 seminars as part of the second annual Northwest Flower and Garden Show in the Washington State Convention Center.

Table 4. Total Number of Contacts in Continuing Education and Public Outreach, Center for Urban Horticulture, 1989

Type of activity	Number of programs	Attendance
Public lectures	54	1,085
ProHort seminars	21	704
Special activities	31	1,236
N W Flower Show seminars	90	8,000
Arboretum tours	142	1,995
Miller Hort Library tours	31	545
Community lectures	55	3,255
Other arboretum activities	84	2,000
Miller Hort Library contacts		3,019
Graham Visitors Center contacts		38,688
Master Gardener contacts		1,975
Horticulture organizational meetings	95	2,457
Hort Shows/plant sales	8	4,650
Total	611	69,609

Continuing education and public outreach are the last step in bringing the latest scientific research in urban horticulture to audiences ranging from school children to professionals. It is

important that proper public understanding is developed and also that professionals implement new procedures.

LITERATURE CITED

1. Clark, James R and Roger K. Kjelgren. 1989. Conceptual and management considerations for the development of urban tree plantings *Jour of Arbor.* 15·229-236.

2. Davis, J , M Gordon, and B.A. Smit. 1991 Assimulate movement dictates remote sites of wound-induced gene expression in poplar leaves. *Proc. Nat'l. Acad. Sci.* (in press)

3. Ewing, Kern. 1983 Environmental controls in Pacific Northwest intertidal marsh plant communities *Can. Jour. of Botany* 61 1105-1116

4 Funk, Sue Ann. 1990. *The Urban Forestry Notebook.* University of Washington. 90p

5. Hamilton, Clement. 1987. For climate descriptions . try the Walter system. *The Public Garden* 2·20-22

6. Hamilton, Clement and Sarah Hayden Reichard. 1988. Plants of winter-rain IV. Plant exploring in southern Chile. *Arb. Bull.* 51.18-22.

7. Wott, John A. 1988. The science of urban horticulture the coming of age in using plants in an urban environment *Proc Inter Plant Prop Soc* 38:399-403.