Teaching Methods

A Survey of Horticulture and Plant Science Graduate Programs and Faculty Salaries at North American Universities

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ADDITIONAL INDEX WORDS. graduate student demographics, graduate student training, graduate stipends, graduate student compensation, horticulture graduate programs, tuition

SUMMARY. A group of 53 institutions of higher education in the United States and Canada offering degrees in horticulture, or closely related plant science degrees, was surveyed to determine various characteristics associated with the degree programs offered, demographics of students and faculty, and selected procedures and practices associated with administration of these graduate programs. Total response rate was 94%, yielding 85% usable completed surveys. Very few programs (0–3 per degree type) were offered via distance education and on average only 4.1% to 4.5% of resident instruction program students participated in distance education courses. Domestic students averaged 64% to 75% of enrollment. Students were 69% to 73% white. Asian students were the predominant minority group at 12% to 16% of enrollment, followed by African Americans (3% to 8%) and Hispanics (1% to 4%). Most institutions provided out-of-state tuition waivers (75%), and often in-state-tuition waivers (61%), to those students on assistantships or fellowships. Typical commitments to students were 3 years for a PhD and 2 years for a master's degree program. Research assistantships were the dominant form of assistance at all institutions (38% to 53% of students), while teaching assistantships contributed significant secondary funding (7% to 13%). With the exception of mean maximum fellowships, mean maximum assistantships (\$11,499–\$13,999) at non-1862 Morrill Act universities (NMAU) averaged near the mean minimums (\$13,042–\$14,566) for the corresponding assistantship types at 1862 Morrill Act universities (MAU). Requirements for teaching experience ranged from 41% of PhD programs to 18% of non-thesis master's degree programs. Typical departments contained 29 faculty members, of which 44% were full professors, 27% associate professors, 19% assistant professors, 6% junior or senior lecturers, and 3% were in other classifications. Traditional 12-month appointments (65.9% of faculty) were predominant at MAU. With the exception of junior lecturer positions, mean salaries at MAU averaged \$9125, \$6869, \$8325, and \$28,505 more for professor, associate professor, assistant professor, and senior lecturer, respectively, than at NMAU. This study provides useful information for departments undergoing external review or revision of graduate programs.

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Preparations for an external PhD program review at Texas A&M University (Arnold and Davis, 2005) necessitated the gathering of comparison data from our sister horticulture institutions. A search of the literature at that time yielded essentially no current published information on such critical issues as types of degree programs offered, student and faculty compensation, graduate student demographics, and programmatic policies for horticulture graduate programs. Hence the purpose of this survey was to obtain reliable comparison data among horticulture and related plant science graduate programs in the United States and Canada. In June 2005, Darnell and Cheek published the results of a 2003–04 survey of several plant science graduate programs, including 10 MAU offering horticulture programs. The present survey provides information not included in Darnell and Cheek's work relating to horticulture graduate programs, includes an increased number of institutions with horticulture-related programs, comparison data for MAU and NMAU, and information on faculty demographics and salaries. Training of traditional horticulture professionals for a range of positions from basic to applied fields of study is a high priority, according to the Cooperative State Research, Education, and Extension Service (2005). Data from the current study should assist with programmatic decisions relative to horticulture graduate education.

Materials and methods

A group of 53 institutions of higher education in the U.S. and Canada offering degrees in horticulture or closely related degrees, such as plant science with an emphasis in horticulture, was surveyed to determine various characteristics of the degree programs offered, demographics of students and faculty, and procedures and practices of the graduate programs. A three-page questionnaire (Arnold et al., 2005) was mailed on 15 Dec. 2004 to the 53 institutions along with a letter explaining that we were gathering comparative data for a PhD program review (Arnold and Davis, 2005) and offering to share a summary of the results with the respondents. Twenty-five institutions responded to the initial mailing. On 2 Feb. 2005, a second letter was sent to initial non-respondents, garnering 25 additional

responses. After eliminating those that disqualified themselves for one or more reasons, such as termination of degree programs or lack of sufficient information to complete the survey, this yielded 45 usable completed surveys. This represents a 47% response to the initial request, 94% total responses after the second request, and 85% usable completed survey response rate. These are very high response rates for typical mail surveys, suggesting a high degree of confidence in the survey being representative of the targeted population. Typical commercial consumer marketing surveys average only 10% to 15% responses (DSS Research, 2005). Responses to the current survey also exceeded higher response rate survey ventures where the targeted survey population has a vested interest, such as medical surveys of physicians (54%) (Asch et al., 1997).

Tabular data are presented separately for MAU and NMAU. The NMAU category includes several state-supported non-land grant universities, three 1890 Morrill Act universities, and three Canadian universities (Table 1). All universities were promised confidentiality and were told that all data would be presented only as summary statistics. Thus, a list of respondents providing usable responses is provided (Table 1), but no data connected with an individual responding institution, except the authors' home institution, are revealed. All salary information was requested to be converted to a 12-month equivalent salary in U.S. dollars in an attempt not to bias salaries by appointment types. Where numbers were reported as less than 12-month appointments, they were converted to 12-month equivalents prior to analysis.

Results and discussion

GRADUATE PROGRAM DEMOGRAPHICS: CHARACTERIZATION OF GRADUATE PROGRAMS. Not including distance programs, slightly more of the responding institutions offered some type of combined plant science-related PhD degree program (58%) compared to a traditional horticulture PhD degree (44%) (Table 2). However, a nearly equal number of surveyed institutions offered horticulture MS thesis (62%) or MAgr/MS non-thesis (42%) degree programs compared to combined plant science MS thesis (62%) or MAgr/MS non-thesis (44%) programs. In many

cases these programs were not mutually exclusive, with some institutions offering all or some combination of the various programs. However, most of the NMAU offered degrees in which horticulture was an emphasis rather than an actual degree in horticulture (Table 2). A small proportion (9%) of the respondents indicated other types of programs; mainly non-degree or continuing education programs were offered.

GRADUATE PROGRAM DEMOGRAPHICS: DISTANCE PROGRAM PARTICIPATION. Few institutions offered degree programs via distance education (Table 2). No reporting institution offered a PhD in plant science at a distance and only one offered a PhD in horticulture at a distance. Likewise, only three institutions reported offering MS thesis programs at a distance, one in horticulture and the other two in plant science. A few more offered MAgr or MS non-thesis degrees at a distance in horticulture (3) or plant science or a related discipline (4). Although more graduate programs of all types were offered at MAU, mean student enrollment per institution was higher at NMAU. This was largely due to high enrollment in two Canadian institutions, which although not MAU, serve missions similar to those of MAU for Canada.

Use of distance education courses by students in traditional resident instruction degree programs was very low across institution types for PhD (minimum 0%, mean 4.5%, maximum 100% of students participating in distance courses), MS thesis (minimum 0%, mean 4.3%, maximum 80%), and MS/MAgr non-thesis (minimum 0%, mean 4.1%, maximum 100%). However, participation in distance education courses was moderately greater for students in "other," mostly non-degree continuing education types of programs (minimum 0%, mean 13.4%, maximum 100%).

Distance offerings of graduate horticulture degrees may offer a new niche market for expanding student enrollment. A consortium of on-line graduate degree programs listed only three graduate programs available at a distance in horticulture (Educational Directories Unlimited, 2005), one each from the U.S., England, and Australia. Based on our results (Table 2), others exist but the number appears to be small. Before universities embark

wholesale to pursue this opportunity, several challenges would need to be addressed, such as incentives for faculty to develop and continue to offer distance courses, provision of technical and equipment support to develop and maintain distance delivery technology, mechanisms for ensuring the quality of the academic experience, and overcoming the difference in perceived values of a traditional resident instruction degree and one earned via distance education. Advertisements offering horticulture master's degrees within 5 d over the Internet based on life experiences probably contribute to these perception problems (Affordable Degrees, 2003).

GRADUATE PROGRAMS: ADMISSIONS POLICIES. The vast majority (84.1%) of surveyed programs required that students identify an advisor (major professor) prior to acceptance into the program, while several programs permitted some form of laboratory rotation prior to identifying an advisor (15.9%). Some programs used alternative methods (13.6%) for matching students to appropriate programs, such as assignment by evaluation committees or department heads.

GRADUATE STUDENT DEMOGRAPHICS: NATIONALITY AND ETHNICITY. In surveyed institutions, domestic students predominated over international students, particularly at NMAU, although the range was broad for both (Table 3). Our result for international enrollment at MAU is similar to the 63% international student enrollment reported by Darnell and Cheek (2005) based on their 2003–04 data.

Diversity of domestic students in many surveyed horticulture programs suffers from many of the same challenges that face most agriculture-oriented degree programs. Enrollment was typically majority white, with Asian students comprising the only substantial minority group enrolled in the responding programs (Table 3). Enrollment of African American graduate students averaged only 2.5% at the MAU, but was only slightly higher, 8.0%, at NMAU. This low African American enrollment was somewhat surprising, as three traditionally African American enrollment 1890s institutions were included with the NMAU. Enrollment of Hispanic students was very low at both groups of institutions, less than 4% (Table 3). Enrollment categorized by respondents under

Table 1. Institutions offering horticulture, plant science, or both degree programs which responded with usable mail surveys to inquiries about their degree programs, student and faculty demographics, and faculty salaries. Institutions were divided into groups composed of 1862 Morrill Act universities and non-1862 Morrill Act universities (including 1890 Morrill Act universities).

Type of institution	Responding institutions	Website of the academic unit housing the responding horticulture related program
1862 Morrill Act universities:	Auburn Univ.	http://www.ag.auburn.edu/hort/index.htm
	Clemson Univ.	http://www.clemson.edu/hort/
	Colorado State Univ.	http://hla.colostate.edu/
	Cornell Univ.	http://www.nysaes.cornell.edu/hort/
	Iowa State Univ.	http://www.hort.iastate.edu/
	Kansas State Univ.	http://www.oznet.k-state.edu/dp_hfrr/
	Louisiana State Univ.	http://www.lsu.edu/horticulture/
	Michigan State Univ.	http://www.hrt.msu.edu
	Mississippi State Univ.	http://www.msstate.edu/dept/PSS/public_html/
	North Carolina State Univ.	http://www.cals.ncsu.edu/hort_sci/
	North Dakota State Univ.	http://www.ndsu.edu/ndsu/academic/factsheets/ag/hortfore.shtml
	Ohio State Univ.	http://hcs.osu.edu/
	Oklahoma State Univ.	http://www.okstate.edu/ag/asnr/hortla/
	Oregon State Univ.	http://oregonstate.edu/dept/hort/
	Pennsylvania State Univ.	http://hortweb.cas.psu.edu/
	Texas A&M Univ.	http://aggie-horticulture.tamu.edu/
	Univ. of Arizona	http://cals.arizona.edu/pls/
	Univ. of Arkansas	http://www.uark.edu/ArkHort/
	Univ. of California at Davis	http://envhort.ucdavis.edu/eh/
	Univ. of Delaware	http://ag.udel.edu/plsc/
	Univ. of Florida	http://hort.ufl.edu/
	(Environmental Horticulture)	
	Univ. of Georgia	http://www.uga.edu/~hort/
	Univ. of Idaho	http://www.ag.uidaho.edu/psas/
	Univ. of Maryland	http://www.nrsl.umd.edu/
	Univ. of Minnesota	http://horticulture.coafes.umn.edu/
	Univ. of Missouri – Columbia	http://horticulture.missouri.edu/
	Univ. of Nebraska	http://hort.unl.edu/
	Univ. of Tennessee at Knoxville	http://plantsciences.utk.edu/
	Univ. of Vermont	http://www.uvm.edu/~pss/
	Utah State Univ.	http://www.psb.usu.edu/
	Virginia Polytechnic Institute and State Univ.	http://www.hort.vt.edu/
	West Virginia Univ.	http://www.caf.wvu.edu/plsc/horticulture/index.html
Non-1862 Morrill Act universities:	Alabama A&M Univ.	http://saes.aamu.edu/old_sps/centers/psc.html
	Arkansas State Univ.	http://agri.astate.edu/
	Laval Univ.	http://www.crh.ulaval.ca/
	North Carolina Agricultural and Technical State Univ.	http://www.ag.ncat.edu/
	Sam Houston State Univ.	http://www.shsu.edu/~agr_www/index.html
	Southern Illinois State Univ.	http://www.siuc.edu/~psas/
	Southeast Missouri State Univ.	http://www.semo.edu/
	Tarleton State Univ.	http://www.tarleton.edu/~aahrm/
	Texas Tech Univ.	http://www.pssc.ttu.edu/techhort/
	Texas State Univ. at San Marcos	http://ag.txstate.edu/
	Univ. of Guelph	http://www.uoguelph.ca/plant/
	Univ. of Saskatchewan	http://www.usask.ca/agriculture/plantsci/
	Western Kentucky Univ.	http://www.wku.edu/Dept/Academic/Ogden/Agriculture/home.htm

“other” varied substantially, particularly for MAU. The most frequently cited groups by participants in this category were Indian, Pakistani, and “unreported” cultural groups.

Interestingly, these estimates of minority enrollment may still overestimate the proportion of domestic minority students. Much of the minority enrollment may consist of

international students. For instance, 44% of all students enrolled in the Texas A&M University Department of Horticultural Sciences graduate program in Fall 2004 were minorities,

Table 2. Programmatic offerings by North American universities which offer graduate degrees in horticulture or plant sciences areas via traditional resident instruction or distance education. Usable surveys were received from thirty-two 1862 Morrill Act and 13 non-1862 Morrill Act universities.

Degrees offered	1862 Morrill Act universities			Non-1862 Morrill Act universities		
	Programs (no.)	Students (mean no. $\pm$ SE)	Distance degree programs ^z (no.)	Programs (no.)	Students (mean no. $\pm$ SE)	Distance degree programs ^z (no.)
PhD in Horticulture	18	10.6 $\pm$ 2.8	1	2	30.0 $\pm$ 8.1	0
PhD in Plant Science ^y	20	14.0 $\pm$ 4.4	0	6	34.8 $\pm$ 8.1	0
MS in Horticulture (thesis)	24	11.9 $\pm$ 2.4	1	4	16.0 $\pm$ 5.2	0
MS in Plant Science ^y (thesis)	18	14.4 $\pm$ 4.8	1	10	24.9 $\pm$ 6.3	1
MS/MAgr in Horticulture (non-thesis)	18	6.4 $\pm$ 3.1	2	1	7.0 $\pm$ 13.7	1
MS/MAgr in Plant Science (non-thesis)	13	0.9 $\pm$ 1.6	3	7	6.6 $\pm$ 2.0	1
Other (mostly non-degree seeking)	3	3.8 $\pm$ 4.5	1	1	30.0 $\pm$ 7.1	0

^zDegree-granting programs that are offered via distance education.

^yAlso includes interdisciplinary programs.

Table 3. Nationality and ethnicity of student populations in graduate degree programs in horticulture or plant science disciplines at North American universities. Usable surveys were received from thirty-two 1862 Morrill Act and 13 non-1862 Morrill Act universities.

Nationality/ethnicity	1862 Morrill Act universities			Non-1862 Morrill Act universities		
	Minimum percentage of students (%)	Mean percentage of students (mean % $\pm$ SE)	Maximum percentage of students (%)	Minimum percentage of students (%)	Mean percentage of students (mean % $\pm$ SE)	Maximum percentage of students (%)
Domestic students	13 ^z	64.4 $\pm$ 3.7	100 ^z	20 ^z	74.8 $\pm$ 5.8	100 ^z
International students	0	35.6 $\pm$ 3.7	87	0	25.2 $\pm$ 5.8	80
White	19	69.1 $\pm$ 4.3	94	0	72.9 $\pm$ 6.4	100
Hispanic	0	3.8 $\pm$ 0.7	15	0	1.4 $\pm$ 1.1	10
African American	0	2.5 $\pm$ 1.6	20	0	8.0 $\pm$ 2.4	50
Asian	0	16.2 $\pm$ 2.7	50	0	11.6 $\pm$ 3.9	50
Native American	0	0.4 $\pm$ 0.3	10	0	0.0 $\pm$ 0.4	0
Other ^y	0	6.1 $\pm$ 1.7	42	0	1.9 $\pm$ 2.4	15

^zValue represents the absolute minimum or maximum number reported among responding institutions.

^yIndian, Pakistani, and "unreported" cultural groups were most frequently cited by participants under the category "other."

but domestic minorities were only 2% of the total enrollment. Finding ways to increase enrollment of domestic minority students is a continuing challenge.

GRADUATE PROGRAM DEMOGRAPHICS: GRADUATE STUDENT FUNDING. All participating institutions in the survey offered some form of stipend with their fellowships and assistantships. Most institutions waived out-of-state tuition (75.0%) and in-state tuition (61.4%), but only a minority of institutions waived fees (20.5%). Some institutions provided medical coverage for those on assistantships or fellowships (43.2%), and a few (6.8%) provided other miscellaneous benefits.

The lengths of commitments to students at responding institutions varied from one semester at a time to as much as 5 years for a PhD or 3 years for a MS. The most frequent commitment for PhD assistantships was 3 years

(71.4%) and for a master's degree, 2 years (72.7%). Not including those institutions that made only semester-to-semester funding commitments, the mean length of funding commitments for students at MAU was 3.2 $\pm$ 0.1 years for PhD and 2.1 $\pm$ 0.1 years for master's degree students compared to 2.7 $\pm$ 0.2 years for PhD and 1.5 $\pm$ 0.2 years for master's degree students at NMAU.

Across institutions, research assistantships were the predominant mechanism for providing graduate student funding (Table 4). Of those students receiving funding at responding institutions, 80.1% at MAU and 64.2% at NMAU were on research assistantships or some form of combination assistantship that included research responsibilities. If fellowships were presumed to include a research component, this proportion jumps to 87.5% and 66.6%, respectively, of

funded students. Only teaching or combination assistantships containing teaching responsibilities contributed a significant secondary source of funding (Table 4). Consistent with these results, Darnell and Cheek (2005) reported that in the plant science departments they surveyed, 60% of the funds for assistantships came from grant funding, whereas only 21% was derived from state funds.

Although the number of hours of departmental service for assistantships varied among assistantship types and institutions (Table 4), by far the most frequent requirements were for 20 h/week on teaching (22 institutions), research (26 institutions), extension (2 institutions), or combination (9 institutions) assistantships. Although several institutions offering teaching, extension, or combination assistantships required fewer than 20 h/week, none required more than 20 h. Likewise,

Table 4. Funding sources, service requirements, and stipends of students in graduate degree programs in horticulture or plant science disciplines at North American universities. Usable surveys were received from thirty-two 1862 Morrill Act and 13 non-1862 Morrill Act universities.

Type of Funding	Means for 1862 Morrill Act universities				Means for non-1862 Morrill Act universities			
	Students receiving this type of funding [% (mean $\pm$ SE)]	Required service time [h/week (mean $\pm$ SE)]	Minimum stipend in 12-month equivalent [\$ /year (mean $\pm$ SE)]	Maximum stipend in 12-month equivalent [\$ /year (mean $\pm$ SE)]	Students receiving this type of funding [% (mean $\pm$ SE)]	Required service time [h/week (mean $\pm$ SE)]	Minimum stipend in 12-month equivalent [\$ /year (mean $\pm$ SE)]	Maximum stipend in 12-month equivalent [\$ /year (mean $\pm$ SE)]
Fellowship	5.7 $\pm$ 1.7 ^z	8.2 $\pm$ 3.1	14756 $\pm$ 1692 ^y	20042 $\pm$ 1696 ^x	2.1 $\pm$ 2.4 ^z	0.0 $\pm$ 8.6	2000 $\pm$ 6768 ^y	30000 $\pm$ 6570 ^x
Teaching assistantship	6.8 $\pm$ 2.8	17.2 $\pm$ 1.1	14566 $\pm$ 730	16825 $\pm$ 934	13.4 $\pm$ 4.1	16.4 $\pm$ 2.1	9218 $\pm$ 1346	11499 $\pm$ 1571
Research assistantship	53.2 $\pm$ 6.6	18.2 $\pm$ 1.4	13525 $\pm$ 679	19064 $\pm$ 704	38.1 $\pm$ 9.6	13.6 $\pm$ 2.9	9827 $\pm$ 1357	13999 $\pm$ 1408
Extension assistantship	2.1 $\pm$ 1.7	16.7 $\pm$ 3.3	13042 $\pm$ 647	15375 $\pm$ 747	0.0 $\pm$ 2.4	na ^w	na	na
Combination assistantship	8.4 $\pm$ 4.3	14.7 $\pm$ 2.3	13869 $\pm$ 1354	17262 $\pm$ 2537	16.5 $\pm$ 6.2	18.2 $\pm$ 4.2	9800 $\pm$ 2473	12800 $\pm$ 4632
Funded by home country	4.0 $\pm$ 1.2	8.4 $\pm$ 3.7	na	na	2.9 $\pm$ 1.7	1.0 $\pm$ 7.8	na	na
No funding provided	23.1 $\pm$ 5.7	na	na	na	14.9 $\pm$ 3.9	na	na	na

^zMean percentage of students, may not sum to 100% due to rounding.

^yMeans of the minimums provided by each responding institution.

^xMeans of the maximum provided by each responding institution.

^wna = not applicable or not available.

Table 5. Faculty demographics and salaries of faculty at North American universities offering graduate degree programs in horticulture or plant science disciplines. Usable surveys were received from thirty-two 1862 Morrill Act and 13 non-1862 Morrill Act universities.

Classification	Means of 1862 Morrill Act universities				Means of non-1862 Morrill Act universities			
	Faculty holding these positions (no.)	Minimum salary in 12-month equivalent [\$ /year (mean $\pm$ SE)]	Mean salary in 12-month equivalent [\$ /year (mean $\pm$ SE)]	Maximum salary in 12-month equivalent [\$ /year (mean $\pm$ SE)]	Faculty holding these positions (number)	Minimum salary in 12-month equivalent [\$ /year (mean $\pm$ SE)]	Mean salary in 12-month equivalent [\$ /year (mean $\pm$ SE)]	Maximum salary in 12-month equivalent [\$ /year (mean $\pm$ SE)]
Professor	14.1 $\pm$ 2.0	73587 $\pm$ 1784	89738 $\pm$ 2631	118197 $\pm$ 5381	12.4 $\pm$ 3.2	65080 $\pm$ 3641	80613 $\pm$ 4460	96337 $\pm$ 10984
Associate professor	7.9 $\pm$ 1.2	61571 $\pm$ 2609	73248 $\pm$ 1885	83500 $\pm$ 2484	9.4 $\pm$ 2.0	55199 $\pm$ 5326	66379 $\pm$ 3264	71490 $\pm$ 4788
Assistant professor	5.5 $\pm$ 0.7	58975 $\pm$ 1886	63211 $\pm$ 1814	68820 $\pm$ 2422	6.5 $\pm$ 1.1	44529 $\pm$ 3492	54886 $\pm$ 2691	58632 $\pm$ 4742
Senior lecturer	0.6 $\pm$ 0.3	61444 $\pm$ 9062	63655 $\pm$ 7875	65871 $\pm$ 8364	0.2 $\pm$ 0.4	31150 $\pm$ 18124	35150 $\pm$ 17608	na ^z
Lecturer	0.7 $\pm$ 0.5	38244 $\pm$ 4907	39488 $\pm$ 6291	41130 $\pm$ 6525	3.1 $\pm$ 0.8	27946 $\pm$ 6940	39746 $\pm$ 8122	40146 $\pm$ 8424

^zInadequate number of responses to make an estimate, maximum senior lecturer salaries were reported at only three responding non-1862 Morrill Act institutions.

only one institution offering research assistantships required more than 20 h. Many fellowships and home country funding sources required little or no service to the departments, which is reflected in the low mean number of hours of departmental service required with these funding sources (Table 4).

Mean minimum stipend ranges were fairly uniform at MAU, from a low of \$13,042/year for extension assistantships to a high of \$14,756/year

for fellowships (Table 4). However, the disparity among mean assistantship/fellowship stipends ranges increased substantially at the maximum end, from a low of \$15,375/year for extension assistantships to a high of \$20,042/year for fellowships at MAU. With the exception of fellowship stipends, the mean minimum stipends at NMAU averaged about \$3000 to \$5000 less than at MAU (Table 4). The data for fellowship stipends at

NMAU may not be representative, as they included only two NMAU that reported offering fellowships. Salary ranges and averages reported herein are similar to those reported for MAU horticulture programs by Darnell and Check (2005).

Across all surveyed institutions, in-state tuition ranged from \$1450 to \$20,824/year, with an average of \$6870/year. Out-of-state tuition ranged from \$4500 to \$30,995/year,

with an average of \$13,272/year. Tuition rates at NMAU averaged 38.8% less for in-state ($\$5052 \pm \$1900/\text{year}$ vs. $\$8249 \pm \$1078/\text{year}$) and 53.1% less for out-of-state ($\$7033 \pm \$2502/\text{year}$ vs. $\$14,981 \pm \$1298/\text{year}$) compared to rates at MAU. Competitiveness for top students may be a challenge for many horticulture faculty working in areas where grants large enough to support multiple years of funding for graduate students are scarce. Darnell and Cheek (2005) reported that this was one of the main obstacles to recruiting top-quality students to plant science disciplines. In recent years, a dramatic rise in in-state tuition levels and health insurance costs has exacerbated this problem. Darnell and Cheek (2005) concluded that the transfer of assistantship costs from institutional support to individual faculty-supported funds has resulted in a reallocation of funds toward hiring post-doctoral students and/or technicians and away from graduate assistantships. Maintaining and funding a critical mass of traditionally trained horticulturists, particularly in ornamentals research, education, and extension, is a major challenge, according to the Cooperative State Research, Education, and Extension Service (2005).

GRADUATE PROGRAM DEMOGRAPHICS: NON-COURSE EXPERIENCES. In addition to the general course or research requirements, only teaching experiences were required with any frequency by responding institutions. Teaching experiences were required by 40.9% of PhD, 34.1% of MS thesis, and 18.2% of MAgr/MS non-thesis programs. Only 8.9% of the responding programs required any extension experiences. No PhD programs and only one MS thesis program required internships, whereas 11.1% required internships for students in MAgr/MS non-thesis programs. In an informal survey of 12 horticulture departments, Davies (2005) reported that little training was given to develop teaching or extension skills, and he suggested that the reason was because faculty members would be unwilling to trade graduate student research progress for teaching experience in our predominantly research-driven systems. Davies (2005) suggested that students gained teaching experience at institutions with large undergraduate enrollments and the motivation was to satisfy the need for teaching assistants, rather than to develop teaching skills of the graduate students.

FACULTY DEMOGRAPHICS AND SALARIES. Across surveyed institutions, a typical department contained 29.2 faculty members and the number of professors (44.2%) was approximately equal to the total number of associate (27.4%) and assistant (19.2%) professors. Senior lecturers and lecturers constituted only a small component (6.1%) of typical faculties. Lecturer positions were more prevalent at NMAU, but senior lecturer positions were slightly more frequent at MAU (Table 5). Total faculty numbers were similar at MAU and NMAU, but the NMAU numbers may have been skewed by a couple of sizeable Canadian universities included in the NMAU. Generally, MAU faculty tended to be more senior, with 49.0% professors compared to 39.2% at NMAU.

Traditional 12-month appointments still constituted a strong majority of appointments in responding MAU ($79.3 \pm 6.1\%$), whereas less than half of the appointments in NMAU were 12-month ($42.3 \pm 9.7\%$). Two programs reported no 12-month appointments compared to 11 programs that reported only 12-month appointments. Strictly 9-month appointments ($12.6 \pm 5.6\%$ MAU, $41 \pm 8.9\%$ NMAU) and 9-month appointments with options for additional summer funding ($4.8 \pm 4.1\%$ MAU, $16.3 \pm 6.5\%$ NMAU) were more common at NMAU than at MAU.

Salaries are important factors in retaining high-quality faculty, and thus in maintaining high-quality graduate training. Mean faculty salary ranges were most variable at the professor level and least variable at the lecturer level (Table 5). Across all institutions, reported professor salaries ranged from a low of \$51,000/year to a high of \$183,061/year. This wide variation in full professor salaries is likely a result of several factors. Presuming a new PhD takes his or her first assistant professor position in their late 20s to early 30s, this would allow a typical faculty member a 35- to 40-year career in the professoriate. Assuming typical ranges of 5 to 7 years in rank before promotion from assistant to associate and associate to full professor, this would leave most faculty with 20 years or more in rank at full professor, and hence a greater opportunity for salary ranges

to increase at that grade. Another contributing factor to wider salary variation at the full professor rank may be inclusion of high administrative salaries retained when former administrators return to regular faculty positions. This was noted by several participating units on the returned surveys. Also, the full professor level is likely to include faculty with current administrative supplements for such positions as department heads, associate department heads, and center or institute directors.

On average across all institutions, a spread of \$18,465/year was present in associate professor salaries and an average spread of \$10,194/year was present at the assistant professor level. The spread from absolute lowest to highest reported salaries for associate professors was \$43,000/year to \$114,144/year, respectively, and from \$24,000/year to \$89,000/year, respectively, for assistant professors.

On average across all institutions, senior lecturer and lecturer positions appeared to have fairly narrow ranges, \$55,385/year to \$61,918/year and \$35,869/year to \$39,387/year, respectively. While this appears to also be consistent with absolute salary ranges for lecturer positions, with a minimum reported salary of \$22,000/year and maximum of \$60,000/year, it did not represent the absolute range in senior lecturer salaries. The minimum reported senior lecturer salary was only \$30,000/year, whereas the maximum senior lecturer salary was \$116,847/year. This discrepancy is likely a result of the much wider range of experience, and probably years of service, present in the senior lecturer position, which may be a career position; whereas junior lecturer positions are often temporary or "stepping stone" positions. With the exception of lecturer positions where NMAU paid an average of \$258/year more than at MAU, for all other categories MAU paid more than NMAU. For mean salaries the differentials between MAU and NMAU were \$9125, \$6869, \$8325, and \$28,505/year for professor, associate professor, assistant professor, and senior lecturer, respectively. Similar trends, but with more variation, were apparent for mean minimum and maximum salaries between MAU and NMAU. This is in agreement with Cooperative Extension Service data, which indicate a difference in average salaries for state extension specialists with doctorates

of \$79,303/year for MAU compared to \$59,296/year at 1890 Morrill Act universities (Cooperative State Research, Education, and Extension Service, 2004). Mean horticulture faculty salaries (Table 5) were low, particularly at NMAU, compared to means of professors (\$104,006/year), associate professors (\$80,471/year), assistant professors (\$68,009/year), or instructors (\$47,302/year) across all agriculture disciplines (Current Research Information System, 2005), suggesting that horticulture faculty may be underpaid in comparison to other agricultural disciplines. A survey conducted by the College and University Professional Association for Human Resources indicated an average agriculture faculty salary across all ranks at 4-year institutions of \$67,693/year (Smallwood, 2005).

Darnell and Cheek (2005) provided good comparison data among student demographics for horticulture and allied fields. Data in this paper augment that of Darnell and Cheek (2005) by providing additional information on horticulture-specific graduate programs, the inclusion of an increased number of institutions with horticulture-related programs, comparison data for MAU vs. NMAU programs, and information on faculty demographics and salaries. Additional survey work on such topics as admissions criteria, correlations of admissions criteria with graduate performance, common course requirements, examination procedures and requirements for graduate degrees, graduation rates,

student satisfaction with degree programs, job placement, faculty degree background, faculty nationality and ethnicity, funding shifts among graduate students, postdoctoral positions, and technical support, etc., are needed to complement these studies. The current survey provides baseline data for individual horticulture program comparisons to their peer group institutions in the U.S. and Canada.

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