HortScience 17(6):882–884. 1982.

Comparison of Undergraduate Horticulture and Agriculture Students at Southern Land-grant Universities[1]

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Abstract. **Compared to majors in agriculture as a whole, horticulture students were *more likely* to be female, to have a feeling that women have a place in agriculture, to have a higher grade point average, to come from larger high schools, to have transferred from another 4-year college, and to have changed majors. Horticulture students were *less likely* to have a farm background, to have parents with a farm background, to have farm work experience, and to have been primarily influenced by their parents on choice of major. Both groups had the same positive perception of agriculture as a career and both were financed during college by their parents.**

From 1961–1976, undergraduate enrollments in agriculture at land-grant universities increased 199% nationally (9). The rate of increase had slowed by the end of the decade (7). All the plant sciences experienced expanding enrollments, but the largest percentage of growth was in ornamental horticulture (8). Horticulturists have expressed concern over the kinds of background experiences and occupational goals of students selecting horticulture as a major. Ballinger (3) reports that the great majority of horticulture students lack practical experience. What educational and training innovations may be needed to prepare these students for a wide variety of jobs in agribusiness and academe (2)? Greater standardization of horticulture curricula and even a professional degree have been recommended by some (6) and attacked by others (11). Emphasis on internship programs has been renewed (3). It is apparent that in order to develop appropriate curricular and teaching techniques for an increased number of horticulture students, it is important for administrators and teachers alike to better understand these students. The purpose of this study is to provide a detailed profile of horticulture students and to compare horticulture students to agriculture students in general.

This study was performed in the southern region which encompasses the 13 states of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. Both 1862 and 1890 land-grant institutions were surveyed. Traditionally, the number of black students in agricultural curricula has been relatively small; however, their numbers increased 37% between 1974 and 1975 at 1980 schools (10). Because of fundamental differences between 1862 and 1890 institutions, particularly regarding the racial composition and size of their student bodies, they were considered to represent 2 independent student populations. For sampling purposes, undergraduate enrollment lists for the spring term of 1977 were obtained for all agriculture students at each institution (5).

Because of the large enrollment at 1862 schools, a 15% random sample was selected for each of these schools. The 1890 institutions had a much smaller enrollment and all agriculture students were included in the study. Mailed questionnaires were completed and returned by 2,381 students attending 1862 schools for a response rate of 74%. At 1890 schools, 703 students replied for a 60% response rate. Statistical weights were compared to adjust the student numbers for both 1862 and 1890 schools proportionate to their share of students in the total population of agricultural students at southern land-grant institutions. This provided a weighted sample of 3,182 students of which 470 were horticulture students.

No statistical tests are reported. With sample sizes as large as these, relatively small percentage differences tend to be statistically significant. Differences of 5 percentage points or larger are considered meaningful and unlikely to be attributable to measurement or sampling error.

The results of this study show that horticulture has a much higher percentage of females than agriculture as a whole and that horticulture students and their parents are much less likely to come from a farm background (Table 1A, B, C). These facts may necessitate our teaching such things as the use of common farm equipment (e.g., tractors, backhoes, sprayers, and large trucks), and common farm operations (e.g., plowing and bushhogging) that we have assumed our traditional male students with a farm background already knew when they entered college. This also points up the probable need for internship programs: 1) to give nonfarm students some actual horticulture work experience; 2) to acquaint potential employees as to how well the nonfarm and female students can perform in actual work situations traditionally done only by males; and 3) to emphasize to employers the advantage of hiring college-trained horticulturists.

A higher percentage of horticulture students' parents have completed college (Table 1B). This may be a partial explanation of why horticulture students have a higher grade point average (Table 1D), along with the fact that horticulture students tend to come from larger high schools which probably provide more course offerings (Table 1E).

More horticulture students have transferred from another 4-year college than have other agriculture students (Table 1D). This probably indicates a dissatisfaction with their initial major. Parents are designated as the major influence in the selection of a college major, yet the high rate of transfers and curriculum change by horticulture students would tend to underscore the influence of college teachers and college friends on the student's ultimate decision to pursue a degree in horticulture (Table 1F). This may also explain why horticulture students listed parents less frequently as their major influence on curriculum decision compared to agriculture students as a whole. It is significant to note the lack of influence of high school counsellors and college deans of agriculture on students' choices of curricula. If recruiting becomes necessary in the future, then it is clear that reaching a student's parents is probably the best single approach, while a second approach would be to create a positive perception of horticulture at the university to capitalize on the influence which college faculty and college friends have on curriculum choice. At the high school level, teachers and friends have the most influence on choice of major.

The primary source of funds for agriculture (including horticulture) student's education is their parents, but three-fourths of the students also work at summer jobs to help defray

[1]Received for publication May 20, 1982. Journal series number 1-820222 of the Alabama Agricultural Experiment Station. This report is a contribution to the Southern Regional Project, S-114 and Alabama Hatch Program 440.

The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

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Table 1. Characteristics of horticulture and agriculture students attending southern land-grant universities.

Characteristic	Students (%)[z] Horticulture	Students (%)[z] Agriculture
1A Personal attributes		
Females	45	27
Blacks	1	5
Other nonwhites	3	5
Foreign citizens	1	3
Residence most of life:		
farm	9	20
rural nonfarm and town (<10,000)	19	23
metro cities	48	36
1B Family characteristics		
Fathers:		
raised on farm	21	33
raised rural nonfarm or town	33	31
completed college	52	43
farm occupation	5	15
professional occupation	28	26
Mothers:		
raised on farm	18	27
raised rural nonfarm or town	36	34
completed college	33	28
employed	56	49
Parents:		
presently live on farm	12	25
own, lease or rent farm	24	39
primary income from farm	22	31
annual income below $15,000	24	30
1C Work experiences		
Either home farm or hired farm work	41	59
Worked on home farm	32	48
Hired farm worker	27	47
1D College characteristics		
Transferred from another school:		
2-year junior or community college	21	18
4-year college	27	17
Changed college major since enrolling	68	52
Junior-senior standing	66	60
3.0 college GPA or above	42	37
1E High school experiences		
High school attended:		
small (fewer than 150 in graduating class)	29	37
large (400 or more in graduating class)	39	30
offered agriculture course	40	47
Completed agricultural course(s)	13	24
4-H and/or FFA participation	16	30
1F Influence of others on choice of college major		
Family:		
father	57	65
mother	56	61
brother	17	23
sister	16	18
other relatives	26	30
High school contacts:		
friend	21	26
teacher or principal	19	23
counselor	10	18
agriculture teacher	8	16
Community contacts:		
veterinarian	3	22
county extension agents	7	11
College contacts:		
teacher or advisor	36	37
friend	35	36
alumni	20	23
dean	9	13
1G Sources of college funds		
Parents	85	84
Summer jobs	73	78
Personal savings	73	75
Part-time job while attending college	58	54
Scholarships	23	28
Student loans or grants	25	28
Employed spouse	14	10
1H Attitudes toward agriculture		
There are good career opportunities in agriculture (percent agree)	90	87
Most agricultural occupations are unsuited to women (percent disagree)	70	58
1I Adult goals		
Expects a graduate or professional education	30	42
Desires:		
to live on farm	26	38
to be a farmer or manager	10	17
to be in ornamental horticulture	42	7
Expects to be in ornamental horticulture	47	8
Sample size	470	3,182

[z]These proportions are based on the combined totals for 1890 and 1862 land-grant universities adjusted for unequal sample sizes and variable response rates.

the cost of college (Table 1G). This large percentage of working students might show that an intern program could fit well into most horticulture curricula.

Nearly 90% of the agriculture students surveyed (including horticulture) felt that there were good career opportunities in agriculture (Table 1H). This points to a positive perception of agriculture by our students. Also, more of the students in horticulture felt that agricultural jobs are suited for women. This perception may help explain the attractiveness of horticulture to female students.

A large proportion of horticulture students both desire and expect to enter occupations that relate to ornamental horticulture (Table 1I). The desire to enter farming is not prevalent among agriculture students generally, and is even less so among horticulture students. About a quarter of both student groups desired to live on a farm some day.

In conclusion, these data demonstrate the extent to which nonfarm men and women have been attracted to horticulture as a college major. Imaginative curricula need to be developed to provide adequate experiential compensation through summer camps, co-op programs, and internships (4) for their lack of farm and agricultural backgrounds. The entry of women into the field has given rise to professional concerns about discrimination in the labor market after graduation (1). This situation must be confronted by the discipline over the coming years.

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HortScience 17(6):884–885. 1982.

Evaluation of Sprinkler Application Rate Models Used in Frost Protection[1]

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Additional index words. cold protection, irrigation

Abstract. **Two related sprinkler application rate models used in frost protection, published in the mid-1960s, are shown to include an assumption leading to the erroneous conclusion that humidity does not affect the determination of the application rate. A third, 1981 model documents the effect humidity has on the application rate calculation. A distribution factor accounting for nonuniform application is described.**

The current awareness of fossil fuel shortages and subsequent inflated cost have triggered a renewed interest in sprinkling crops with water for frost protection. Two models, one by J. A. Businger (3) and a related one by J. F. Gerber and D. S. Harrison (4), published in the mid-1960s, calculate the required application rate for adequate protection from given atmospheric conditions. Both these models used a heat budget approach relating the sprinkling rate to the rate of heat loss from the plant part, i.e., supplying the heat of fusion at the necessary rate to maintain a constant temperature above the damaging level. These 2 models are evaluated in relation to a recent intermittent application study (7). A 3rd model by B. J. Barfield et al. (2) is also reviewed. A significant difference between the 2 earlier models (3, 4) and the more recent one (2) is noted. The difference is that the earlier models (3, 4) assumed no humidity effect in the determination of the application rate. The later model (2) documents the humidity effect. Ignoring humidity can cause a rather large error to be made by underestimating the required rate. This information is of great horticultural significance, because most sprinkling systems have been designed based on the extension publication (5) which resulted from the Gerber and Harrison work (4). The more recent work must be considered in future designs. This significant difference between the Businger (3) and Gerber and Harrison (4) models and the Barfield et al. (2) model is described herein.

Humidity effect. The approaches used by Businger (3) and Gerber and Harrison (4) are very similar. Input parameters required by these models are critical temperature, point below which damage will occur, dry leaf temperature, air temperature, characteristic dimension, and wind speed. Both models determine the energy balance for a dry unprotected leaf and the energy balance for a sprinkled leaf maintained at the critical temperature. Two equations document this approach.

$$CdT_l/dt = LE_l + K_l + R_l = O \qquad \text{[Equation 1]}$$

and

$$CdT_c/dt = LE_c + K_c + R_c + I = O \qquad \text{[Equation 2]}$$

where C = Heat capacity of a cross sectional area of the leaf
T = Dry leaf temperature
LE = Latent heat exchange
K = Convective heat exchange
R = Radiative heat exchange
I = Application rate
Subscript l = Dry leaf
Subscript c = Sprinkled leaf at critical
T_c = Critical temperature

If equations [1] and [2] are solved for I and it is assumed that

$$dT_c/dt = dT_l/dt,$$

the following expression results for the application rate,

$$I = (LE_l - LE_c) + (K_l + K_c) + (R_l - R_c) \qquad \text{[Equation 3]}$$

Both models (3, 4) assume for both the sprinkled leaf and the dry leaf that the vapor pressure at the leaf surface is at saturation. Such an assumption is not necessarily correct for the case of the dry leaf. The vapor pressure at the surface of such a leaf should be a function of the relative humidity of the ambient air. By assuming the vapor pressure at the dry leaf surface to be at saturation conditions, the application rate is not affected by humidity. This assumption is implicit in the Businger (3) and Gerber and Harrison (4) models.

The Barfield et al. (2) model uses only equation [2] to determine I. The same input parameters used in the Businger (3) and Gerber and Harrison (4) models are required with the addition of relative humidity. The existing atmospheric conditions are used to determine the 3 heat transfer parameters required

[1]Received for publication Dec. 3, 1981. Pennsylvania Agriculture Experiment Station Journal Series No. 6357.
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