Greenhouse management competencies for beginning agricultural educators in Montana, North Dakota, and Wyoming
by Roger M Hybner

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Agricultural Education
Montana State University
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Abstract:
This thesis was a descriptive study to assess the greenhouse management competencies needed by beginning agricultural educators. The survey used was both an open and closed form instrument based on the survey research design by Borg and Gall (1996). The populations consisted of agricultural educators at high schools and junior colleges in Montana, North Dakota and Wyoming. (Tri-State Area) who operated a greenhouse as part of their horticulture curriculum.

Survey responses were entered into a Microsoft© Excel spreadsheet program and statistically analyzed using the SPSS statistical program. Total group responses for each competency were analyzed using descriptive statistics. A Likert-type scale (1-5) allowed each respondent to rate each competency. Competencies were analyzed to determine valid (most important) or invalid (least important) status. To reach a valid status and to retain for a future greenhouse management curriculum, the competency would have to be rated a r (Important) or 5 (Most Important) by more than 50% of the respondents. Data analysis revealed thirty-nine competencies were considered valid for beginning agricultural educators teaching greenhouse management.

Responses to the survey indicated over 50% of the greenhouses in the Tri-State Area were used year-round for activities involving plant production education, greenhouse management instruction and student plant sales in the spring. A large majority of agricultural educators responding indicated they acquired their horticulture knowledge by being self-taught.

The study's thirty-nine valid competencies serve as an excellent source for a needed horticulture education guide for agriculture education majors in the Tri-State Area. They may also be used as a training guide for current agricultural educator horticulture inservice training as well as the foundation for the development of a greenhouse management curriculum for high schools and junior colleges in the Tri-State Area.

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Roger M. Hybner

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Committee Chair — Date

Approved for the College of Agriculture

Dr. Donald Kress — D D Kress — 7/23/99
Date

Approved for the College of Graduate Studies

Dr. Bruce McLeod — Bruce R. McLeod — 7-27-99
Date

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July 19, 1999

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ABSTRACT

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CHAPTER 1

THE PROBLEM

Introduction

Historically, cultivation of plant material in the greenhouse industry in the states of Montana, North Dakota and Wyoming (Tri-State Area) has been late in development compared to areas of the Midwest and Northeast. Even though the Zone 3 – 4 climate may be similar, vast differences in available monies, numbers of students and trained staff, and facilities limit educational greenhouse establishment and utilization in high schools and junior colleges. Granted, many small greenhouses also exist on homeowners' property, but their main use is for food and ornamental horticulture production.

In the last decade, horticulture curricula were formulated for each of the three states, however, less than half of the high school and junior college agricultural education departments had greenhouses operating to supplement horticultural education or traditional agriculture curricula (Fochs, 1998). Horticulture students from the Tri-State Area often have their first experience with a greenhouse management course in their junior or senior year at a major college or university. However, students graduating from a high school or junior college program do not have this opportunity. Even if a

greenhouse is established at these sites, many agricultural educators feel uncomfortable about teaching a subject for which they have received little training. The majority have felt most comfortable teaching in the areas they obtained their educational degrees in, i.e., traditional agriculture production methods (Linder, 1993). By having a ranked list of competencies contained in a greenhouse management curriculum, the agricultural educator could focus their time and education on the competencies rated most important by their qualified peers.

Various high school agricultural educators, junior college educators, and agricultural education administrators had been contacted from each state and they unanimously endorsed the need for a greenhouse management curriculum and the appropriate resource materials.

Purpose

This study defined the horticultural education competencies needed by beginning agricultural education instructors to successfully educate high school and junior college students in Greenhouse Management in the Tri-State Area.

Statement of Need

Throughout history, the focus of horticulture around the world has significantly changed as peoples' needs change. In the past, horticulture's purpose was more for food production than for ornamental purposes. The latter is true today in America as an increasing number of greenhouses, nurseries, garden centers, landscape design companies, and yard

maintenance businesses are being established as the public is willing to spend more time and money to have their home landscapes aesthetically pleasing. Hiring someone else to do their landscape work gives the homeowner more free time for recreational activities. If they do the work themselves, the homeowner also wants to know the correct procedures for plant establishment, the acclimated plant species for their climate, and the proper location for the plant in their landscape. They also expect the same knowledge, if not more, from a private horticultural business. Thus, there is a strong demand in today's world for trained horticulturists, especially in northern climates such as the Tri-State Area (Ellis, personal communication, June, 1998).

In order to justify operating a greenhouse year round in a northern climate, curriculum and resource needs for reducing operating expenses must be known and addressed to accommodate the traditional agricultural educator and their school budget. Educators are often placed in the position of teaching students about horticulture and its relation to standard production agriculture. This situation can make them feel uncomfortable in teaching a subject for which they have little formal training. If these same educators had an established greenhouse management curriculum that used an integrated approach such as combining mathematics, science, computer technology, and plant nutrition, their job would be simplified (Eames-Shealy, 1994). The curriculum would be complete with unit and lesson plans to use as a guideline. The increased ease of teaching the curriculum should have a positive effect on the educator as well as the horticulture student. High school and junior college educators and administrators are aware of these changes and are supporting new horticulture curriculums and greenhouse construction at their institutions. Godfrey (1980)

stated that "information is needed about ways of using a greenhouse in Montana in a primarily production agriculture curriculum". Although eighteen years have passed since then and horticulture curriculums have been developed for each state, the greenhouses that exist are rarely in operation for their intended role. Most function for production of material for plant sales and are not used for educational class purposes from late fall to the early spring months. Very few agricultural education greenhouses in Montana, North Dakota and Wyoming have been utilized to their fullest potential (Holloway, personal communication, August 1997). The review of literature suggested little has been done to fully integrate greenhouse management into existing horticulture curriculums in these three states. Forces affecting the integration are budgetary concerns, the northern climate, and agriculture educators who lack formal horticulture training. The implementation of a contemporary greenhouse management curriculum should increase utilization of established greenhouses and greenhouses built in the future.

Traditional and non-traditional agriculture students have been seeking new avenues for prosperous careers. The horticulture field has many job openings, which are available throughout the United States. Horticulture business owners in the Tri-State Area are continually seeking qualified, competent help in their field of work so the demand for these educated students is already evident (Ellis, personal communication, December 1997). With the proper classroom and hands-on training, the students should be able to find work in a horticulture field after graduating from a high school or junior college program. Or, they may want to continue their education at a university and start their own business after obtaining a Bachelor's degree. The starting point for the success of these students is to have

a professionally developed or designed horticulture curriculum in place early on in their education. By enrolling in the greenhouse management curriculum, the students will add to their job skills and resume. This fundamental education will increase students' chances of becoming lifelong learners in a horticultural field. In a commercial greenhouse operator needs assessment study conducted in Colorado, 68.3% of the operators had at least an Associate's degree with the majority of that figure having Bachelor degrees (Panter, 1994). The greenhouse operators surveyed were very interested in obtaining new information from different sources to add to their knowledge base.

This study will define the educational competencies needed by beginning horticulture education instructors to successfully educate students in the management and use of a greenhouse in the Tri-State Area.

Objectives

To accomplish the major purpose of this study, the following objectives were identified:

1. To determine the competencies needed by beginning agricultural education teachers in Montana, North Dakota, and Wyoming pertaining to a greenhouse management curriculum.
2. To determine the highest rated greenhouse management curriculum components dealing with agricultural educator competencies involving the five categories of Greenhouse Management, Plant Production, Plant Propagation, Pest Management and Soil Media and Fertilizers.

Assumptions

It was assumed greenhouse management teaching competencies needed by beginning vocational agricultural educators were used as a benchmark for horticulture instruction in high schools and junior colleges in Montana, North Dakota, and Wyoming. Competencies in these three states are different from other states' established curriculums due to the northern climate of the region. It was also assumed educators who were currently utilizing a greenhouse were in the best position to identify competencies needed by future educators.

Limitations

The population was limited to agricultural educators in the Tri-State area who teach students using a greenhouse as part of their instruction during the school year of 1998-99. The research was limited to the curriculum areas of Greenhouse Management, Plant Production, Plant Propagation, Soil Media and Fertilizers, and Pest Management.

Definitions

Tri-State Area is defined as the three states of Montana, North Dakota, and Wyoming.

Zone 3-4 Climates are defined as areas of similar temperatures and growing conditions with which the cultural requirements of various plants may be correlated. Plant hardiness ratings for each zone are based on the average annual minimum

temperatures, -35° to -20° F. for Zone 3 and -20° to -10° F. for Zone 4 (National Gardening Association, 1994).

Greenhouse Management is defined as the knowledge and supervision of a structure having ample light and temperature control where plant propagation and/or production is undertaken.

Greenhouse Curriculum is defined as an educational program outlining the required instruction needed to satisfy competencies in greenhouse management.

Competency is defined as the knowledge and skills attained by students for a set curriculum (McCormick, 1994).

Late respondent is defined as a survey respondent who is late in returning the completed survey for analysis beyond the time specified by the researcher.

Non-respondent is defined as a survey respondent who does not return the completed survey after several reminders.

Double Dip is defined as the process whereby survey respondents who do not answer the survey sent to them after several reminders are then contacted by the researcher and asked to answer the survey questions over the phone.

Rewrite using ANOVA

Survey responses were entered onto an Excel spreadsheet program. The spreadsheet information was statistically analyzed using the SPSS statistical program. Responses from each state were rated as a percent of total return. Each of the survey questions was given a numerical and % response rating according to the Likert scale. The most highly

rated responses above the Mean Score (t-test) for each question were included in the finished curriculum with the lowest rated being dropped out. Responses from each individual state were compared against each other to determine if significant differences exist. The same procedure applied to late respondents. If there were no differences, the responses were pooled into groups according to the subject matter.

CHAPTER 2

Review of Literature

A review of literature for greenhouse management instructor competencies and resource sources in northern climates is somewhat limiting. There are several greenhouse educator surveys resulting from needs assessments located at high schools and major universities from the eastern and southern United States. One of these surveys uses rated educator competency needs to develop training for curriculum instruction (Attarian, 1980). The greenhouse management curriculum and educator competencies developed from these studies (McMahon, 1992), can be adapted fairly easily to high school and junior college curriculum levels in the Tri-State Area. For example, certain floriculture species that are Zone 5 – 7, based on United States Department of Agriculture plant hardiness zone map, may be practical for only demonstration purposes. Whereas Zone 2 – 4 species can be implemented for production whose end products will be sold at plant sales, used for classroom instruction, or planted around the institution's grounds. The agricultural educator competency level will remain the same for instruction, job-related duties, and applied greenhouse management assignments. Even though instruction may occur in a northern climate, the educator may move to a different geographical area and climate. Thus, they need to be educated on a broader, nationwide scale.

Timing of agricultural educator curriculum activities relating to plant production and sales may remain the same as in eastern and southern climates, i.e., 1) poinsettias in the fall, 2) Easter lilies (bulb crop) in the winter, 3) bedding plants (seed crop) in the spring, and 4) a nursery crop (plant cutting) in the summer (Lehigh County Area Vocational-Technical School, 1983). The fourth portion of the plant production time pattern may be dependent upon how many students will be available to take proper care of the plants through summer break.

Integrated into all educator teaching methods will be current computer technology for the both the agricultural educators and students to use, such as worldwide web educational instruction, term paper/project information, and resource sources (Sistrunk, 1996). By utilizing the Internet, an educator will add to their own subject matter knowledge, be able to join horticultural discussion groups composed of both private and public experts, and keep current on the industry's newest information.

Computers will play an ever-increasing role in the horticulture industry and Greenhouse management curriculums are an excellent base for educators and students to become acquainted with computer use. Instructional methods will include applied class projects involving ordering plants and production materials and building their own homepages. Other methods being used may include: 1) instruction for proper bookkeeping procedures and various computer programs available for that use, 2) getting the latest information on new plant species and their production practices, 3) reading research articles presented at horticulture society association meetings, and 4) marketing their products beyond their region utilizing the Internet.

The amount of time a student spends on a computer has been positively correlated to higher test results in a study completed in Illinois (Zamparo, 1995). Students in a woody landscape plants identification class were tested in an integrated teaching system which used high-quality digital computer images and other instructional mediums to help students retain course material. It was assumed the same results would apply to the time an educator spent on a computer correlated to the quality of their knowledge and teaching skill.

Although computers play an important role in the today's business and educational worlds, instruction must be heavily based on application of knowledge and job skills needed in the real-world. Instruction should include every available chance for students to attain hands-on experience in the real world, both locally and regionally. One way of increasing the student's work experience through classroom education is the utilization of a high number of interdisciplinary activities in a class project. Research results indicate this method of instruction improves a student's level of education and increases their motivation toward learning (Rhodus and Hoskins, 1995). For example, a student would use a combination of their reading, mathematics, writing, and problem solving skills in successfully completing an applied greenhouse management project that covers several disciplines such as research, crop production, economics, and marketing. In South Carolina, horticulture and agricultural education students combined to complete a Teaching Fruit-Garden for a community project (Olien, et.al., 1995). The project used team activity, learning across curriculums, and hands-on learning as tools to reach final

products of a low maintenance, sustainable garden complete with self-teaching modules for K-12 teachers.

Horticulture business owners across the United States want workers who can begin and finish a job immediately after setting foot on the job site, without having to be taught the skills needed. Having to train workers after hiring reduces the owner's valuable time for managing their business and marketing their products. As part of the student's greenhouse management class requirements, internships and other experiential projects with local greenhouses and related horticulture industries should be stressed as having major importance (Stearns, 1995). The agricultural educator who contacts local horticulture businesses quite often has a win-win situation for both. The business owner is educated on the educational program being taught and often becomes a supporter of the program. The owners are also excellent sources for information on horticulture curriculum priorities that emphasize instruction pertaining to real world job experience. After the owner becomes a supporter, they often hire students from the program for summer work at that business (Fochs, personal communication, March 1999). Getting real world experience while still completing their education gives the student a better idea of the relationship that exists between the classroom and the job. The more applied job skills the student can learn, relate to, and perform while enrolled in a greenhouse management class, the more prepared they will be to enter the workforce or start their own business. Ashworth, Saxton & Buckle (1989) state that these work-based learning experiences also aid in educating a student toward a specific horticulture career or job they may want to seek later in life. Agricultural educators need to be aware of these

experiences and implement them into their greenhouse management curriculums as much as possible.

Non-traditional students are also attracted to the horticulture programs being offered in agricultural education programs throughout the Tri-State area. These students may not have farm/ranch backgrounds, but are deeply interested in horticulture subject matter such as greenhouse management, landscaping, floriculture, and nursery production. An increased enrollment of female students in agricultural education appears to be a result of horticulture instruction being offered at their high schools. High schools without available greenhouse or horticulture facilities in a traditional agricultural production program attract less non-traditional agricultural students (Siddle, personal communication, October, 1997).

The demand for horticultural education has increased significantly not only in the number of students majoring in horticulture across the United States, but also in the number of horticulture textbook sales. At Montana State University, there were 61 students majoring in horticulture in 1993 compared to 156 majors in 1999 (Pohl, personal communication, March 23, 1999). Horticulture textbook sales in the Tri-State area have also increased over the last 10 years. All textbook sales reported a 29% increase compared to a 48% increase for horticulture titles according to one publishing company executive (Pentony, Interstate Publishing, personal communication, April 16, 1999). To keep up with the increasing educational demand, the evolution of greenhouse management courses is constant and ongoing. Agricultural educators must be trained to

not only satisfy the demand, but also to make timely changes and adaptations as various factors influence subject matter.

Each state of the Tri-State area has a land-grant institution that has faculty who are trained in horticulture and greenhouse competencies. Summer teaching sessions for agricultural educators at these sites or central locations in each state in these subject matters would help the educators in successfully passing the required information to the students (Bates, personal communication, June 4, 1999).

Many professional organizations also have Education and Extension sessions at their annual meetings for training members. For example, at the 1998 meeting of the Horticultural Science Society of America, presentations included using problem-based approaches for learning (Haque and VanderMey, 1998). Attendance at professional meetings also gives the agricultural educator an opportunity to communicate one on one with horticultural specialists from all over the world.

The Native American junior colleges can benefit from these greenhouse curriculum activities since a recently completed study indicates an education/research greenhouse facility rated in the top 25% of responses when advisory board members were queried about the possibility of new facility construction at their sites (Hofferber, 1997). Combining traditional Native American knowledge and production practices pertaining to native and introduced plant species and current non-traditional production practices to those species will help develop a multicultural science curriculum and respect for diversity at those sites.

Junior college horticulture instruction will be more comprehensive than at the high school level. Students will be able to choose one of two options of study. They are: 1) to obtain an associate's degree and after graduation seek employment in their field, 2) to continue their education at a major university and graduate with a baccalaureate degree in their field (Fisher, personal communication, July, 1998).

The agricultural educator should be prepared to successfully instruct high school and junior college students in horticulture subjects, such as greenhouse management. To accomplish this objective in the Tri-State area, beginning educator competencies need to be prioritized first for this field of study. Secondly, the proper subject matter training needs to be offered so the vocational educator can return to their classroom and students with the knowledge and tools necessary for successful transferal of horticultural knowledge (Frantz, Jr., N., 1994).

CHAPTER 3

Methodology

This descriptive study was designed to determine the greenhouse management competency needs for beginning agricultural education teachers in Montana, North Dakota, and Wyoming. The three methodology procedures used for completion of the study are described in this chapter. They were 1) population, 2) instrument design and validation, and 3) data collection and analysis.

Sample Population

The selection of the sample population resulted from an e-mail sent to the State Supervisor of Agricultural Education in each of the three states in the Tri-State Area. They were asked to send the names and addresses of agricultural educators in their state operating a greenhouse as part of a horticulture curriculum. Montana had 29 agricultural educators, North Dakota had 15, and Wyoming had 19 who were operating a greenhouse according to the State Supervisors. Agricultural educators in the Tri-State Area who did not have a greenhouse on site were excluded from the study as it was felt they might not have the expertise to respond.

Instrument Design and Validation

A survey instrument based on the Tri-State Area's and other states' horticulture curriculum guides and other states' horticulture worker and educator competency surveys (Mississippi Curriculum Framework for Horticulture, 1996, and Lamberth, 1983) was developed. In addition, instructions from Dr. Van Shelhamer's Educational Research Methods class, Agriculture and Technology Education – 506 at MSU-Bozeman were implemented. The survey was both an open and closed form instrument based on the survey research design by Borg and Gall (1989).

The survey instrument (63 questions) was formulated and mailed to the 63 agricultural educators. The focus of the survey covered five main competency areas, which were Greenhouse Management, Plant Production, Plant Propagation, Pest Management, and Soil Media and Fertilizers. Competencies were placed into the 5 above-mentioned categories according to the researcher's 16 years of experience in the field.

Survey items included greenhouse management competencies and what resources were needed to accomplish curriculum objectives. The survey instrument was designed to answer Objectives 1 & 2 of this study (See Chapter 1). The rough draft of the instrument was reviewed by the researcher's graduate committee for face and content validity and then given or mailed to a greenhouse manager/horticulture professor at a college/university in each of the three states to conduct another face and content validity test of the survey. The survey was redesigned with very minor corrections following

their suggestions for improvement. A demographic survey (Appendix B), composed of 14 questions was mailed to the population with the second competency survey reminder.

Data Collection and Analysis

An introductory postcard (Appendix C) letting the respondents know the competency survey would be arriving within one week was mailed to the sample population. A cover letter (Appendix D), a letter of introduction printed on Montana State University stationery and signed by the researcher and Dr. Marty Frick, chair of graduate committee, and a self-addressed, stamped envelope were enclosed with each competency survey mailed to the target population. Confidentiality was maintained by placing a number code on the surveys. When surveys were not returned within ten days, a postcard reminder (Appendix E) was sent to non-respondents asking them again to respond. After another ten days, a reminder letter (Appendix F) and the demographic survey were sent to non-respondents. Sample numbers returned for the competency survey were adequate after 20 days from the survey's first mailing. After another ten days, a reminder postcard (Appendix G) was sent to the non-respondents of the demographic survey. Sample numbers after another ten days were adequate. The results were then tabulated.

Competency survey responses were entered onto a Microsoft© Excel spreadsheet program. The data were statistically analyzed using the SPSS statistical program for Analysis of Variance (ANOVA) for significant differences between individual states.

Responses from each state were rated as a percent of total return. Montana had 12 (35%) responses, North Dakota had 12 (35%) and Wyoming had 10 (30%). A Likert-type scale, ranging from 1 being Least Important to 5 being Most Important allowed respondents to rate each of the 63 survey competencies. Total group responses were analyzed using descriptive statistics to determine valid competencies. The same procedure applied to late respondents versus early respondents.

CHAPTER 4

Results of the Study

The following results are presented to satisfy the study's objectives. A survey sent to agricultural educators on greenhouse management competencies was used to collect data on which the results were based.

Data collected came from two groups in each of the three states: 1) high school agricultural educators and 2) junior college agricultural educators. The results are only generalizable to the agricultural educators of the greenhouse management competency survey.

Demographics

A total of 28 (52%) out of 54 demographic surveys were completed, returned, and used for data analysis. Due to only one qualified response from the Tri-State Area junior college group, it was felt they were not represented adequately and thus data shown is only a representation of the high school group. However, the data from the one junior college response was used in the analysis section. It did not differ significantly from the other group responses with the exception of freshman and sophomore college classes being taught in addition to all high school grades. The demographics of the four

subgroups (Montana, North Dakota, Wyoming, and Summary) are detailed in Tables 1-4. There were 14 respondents from Montana, 9 from North Dakota, and 5 from Wyoming.

The respondents' gender was overwhelmingly male with 24 (86%) of 28 respondents in that category. Montana had three (11%) females who returned the survey, North Dakota zero, and Wyoming one (3.5%).

Nineteen (67%) of the respondents had been a teacher for 10 years or more, four (14%) had 4-9 years experience, and 5 (18%) had 1-3 years of experience. Thirteen (46%) of the twenty-eight respondents reported they had taught horticulture 4-9 years, eight (29%) had taught 10 or more years, and seven (25%) having taught 1-3 years.

Table 1. Demographics of Agricultural Educators in the Greenhouse Management Competency Survey

Gender, Teaching Status and Teaching Experience	Montana	North Dakota	Wyoming	Total- all Three States
Total number of respondents	14	9	5	28
	50%	32%	18%	100%
Gender:				
Female	3 (11%)	0	1 (4%)	4 (15%)
Male	11 (39%)	9 (32%)	4 (14%)	24(85%)
Current Teaching Status:				
1-3 yrs. experience in ag. ed.	4 (14%)	1 (4%)	0	5 (18%)
4-9 yrs. experience in ag ed.	2 (7%)	1 (4%)	1 (4%)	4 (15%)
10 or more yrs. experience in ag ed.	8 (28%)	7 (25%)	4 (14%)	19(67%)
Years of Teaching Horticulture:				
1-3 years	5 (17%)	1 (4%)	1 (4%)	7 (25%)
4-9 years	5 (17%)	4 (14.5%)	4 (14.5%)	13(46%)
10 or more years	4 (14.5%)	4 (44.5%)	0	8 (29%)

The demographic data for educational background and work-related experience is shown in Table 2. Twenty-seven (96%) of the twenty-eight held an agricultural education degree. Within that demographic, fourteen (54%) had Bachelor of Science degrees and 13 (46%) had a Master's degree. North Dakota led this latter category with 7 (78%) of 9 educators having a Master's. Two respondents from Montana had 2 Bachelor of Science degrees, while the junior college respondent from Montana did not have a degree.

Sources for training as a horticulture instructor revealed surprising results. A large number, 24 (41%) responses (respondents could check more than one answer), reported they were self-taught. North Dakota only had 1 (11%) of 9 who reported being trained on the job. Both Montana, 7 (50%), and Wyoming, 3 (60%), had a much larger percentage of their instructors reporting being trained on the job. The next largest training source was a college/university program,13 (22%) of 59, and on the job training, 11 (19%) of 59. Other responses included agricultural educator update courses, 6 (10%) of 59, adult education programs, 3 (5%) of 59, and owning their own greenhouse and using a sister's knowledge from a horticulture degree had 1 response each (3%) of 59.

The majority of respondents had never been employed in a non-teaching role in a horticulture-related industry, 21 (75%) out of 28, 2 (7%) had two years employment in a non-teaching role, and there was 1 (3.5%) response each for 3,4,13, and 43 years of employment respectively. One respondent did not answer this item.

Table 2. Demographics of Agricultural Educators in the Greenhouse Management Competency Survey.

Gender, Teaching Status and Teaching Experience	Montana	North Dakota	Wyoming	Total- all Three States
Total number of respondents	14	9	5	28
Major in Highest Degree Attained:				
Ag Education	13 (93%)	9 (100%)	5 (100%)	27(96%)
Biology	2 (14%)	0	0	2 (7%)
Horticulture	0	0	0	0
Bachelor's	11 (79%)	2 (22%)	3 (60%)	16(57%)
Master's	4 (29%)	7 (68%)	2 (40%)	13(46%)
Where Did You Get Your Source of Training as a Horticultural Instructor:				
On the Job	7 (50%)	1 (11%)	3 (60%)	11(39%)
High School Program	1 (7%)	0	0	1 (4%)
College/University Program	5 (36%)	6 (67%)	2 (40%)	13(46%)
Adult Education Program	0	1 (11%)	2 (40%)	3 (10%)
Self-Taught	12 (86%)	8 (89%)	4 (80%)	24(86%)
Other:				
Update Courses	3 (10%)	3 (33%)	1 (20%)	7 (25%)
Owned Own Greenhouse	0	0	1 (20%)	1 (4%)
Sibling w/ Hort. Degree	0	0	1 (20%)	1 (4%)
Years of Non-Teaching Work in a Horticulture Related Industry:				
No experience	10 (71%)	7 (78%)	4 (80%)	21(75%)
1 year	0	2 (22%)	0	2 (7%)
2 years	1 (7%)	0	0	1 (3%)
3 years	1 (7%)	0	0	0
5 years	1 (7%)	0	0	0
13 years	0	0	1 (20%)	1 (3%)
43 years	1 (7%)	0	0	1 (3%)

The responses for horticultural class type, number taught per day, length in semester and grade level being taught are listed in Table 3. Horticulture programs began at high schools in the Tri-State Area in the late 1970's and continued through 1999. Montana had 3 (21%) years, North Dakota had 2 (14%) and Wyoming had 2 (14%) years

during which 2 programs were started in one year. Montana had 8 (29%) years in which one program started per year, North Dakota had 7 (25%) of 1 per year, and Wyoming had 1 (3%) of 1 per year.

Data in Table 3 reveal Greenhouse management classes were being taught by the majority of educators 22 (79%). This survey item had the option of more than one answer. Other classes being taught were floriculture - 16 (57%), Horticulture Mechanics – 8 (29%), Landscape Horticulture – 10 (36%), Nursery Production – 10 (36%), Turf Technology – 3 (11%), and Native Plants and Garden Production each receiving 1 (3.5%) response. Landscape horticulture classes had a higher priority in North Dakota than the other states with 7 (78%) out of 9 respondents indicating they taught the subject matter. Montana had 2 (7%) of 14 and Wyoming had 1 (3.5%) of 5 responses for the landscape horticulture class.

The classes were normally taught once per day, 17 (61%), with twice per day at 8 (29%) responses (Table 3). Only one response (junior college) indicated horticulture being taught 5 times per day and two respondents reported they incorporated the instruction into their existing classes.

Every respondent 28 (199%) taught horticulture during the spring semester, while 12 (42%) also taught horticulture during the fall semester. Seventeen (61%) of twenty-eight said courses lasted only one semester while 11 (39%) reported the courses lasting two semesters.

The courses were mainly presented to juniors, 25 (89%), and seniors, 26 (93%), in high school. Closely following those levels were high school sophomores, 19 (68%),

with freshman, 10 (36%), being the high school class with the lowest numbers. Freshman and sophomores in college were only being taught at one (3.5%) site in Montana. There were no qualified responses from junior colleges in North Dakota or Wyoming.

Each state had only 2 years during that time period when more than 1 program began during the same year (4/state), 12 (43%) of 28. Montana had 8 (29%) of 28 responses of 1 per stated year, North Dakota had 7 (25%) of 28 of 1 per stated year, and Wyoming had 1 (3%) of 28 of 1 per stated year.

Table 3. Demographics of Agricultural Educators in the Greenhouse Management Competency Survey.

Gender, Teaching Status and Teaching Experience	Montana	North Dakota	Wyoming	Total- all Three States
Total number of respondents	14	9	5	28
When did a Horticulture Program of Instruction Begin at Your School:				
1978	0	1 (11%)	0	1 (4%)
1979	0	1 (11%)	0	1 (4%)
1980	1 (7%)	1 (11%)	0	2 (7%)
1983	2 (14%)	0	0	2 (7%)
1984	1 (7%)	0	0	1 (4%)
1985	2 (14%)	2 (22%)	0	4 (14%)
1986	2 (14%)	0	0	2 (7%)
1989	0	0	2 (40%)	2 (7%)
1990	1 (7%)	2 (22%)	0	3(11%)
1992	0	1 (11%)	0	1 (4%)
1993	1 (7%)	0	0	1 (4%)
1994	1 (7%)	0	1 (20%)	2 (7%)
1995	1 (7%)	0	0	1 (4%)
1996	1 (7%)	0	0	1 (4%)
1997	1 (7%)	1 (11%)	0	2 (7%)
1999	0	0	2 (40%)	2 (7%)

Table 3. Demographics of Agricultural Educators in the Greenhouse Management Competency Survey. (Continued)

Gender, Teaching Status and Teaching Experience	Montana	North Dakota	Wyoming	Total- all Three States
Main Horticulture Areas You Currently Teach:				
Greenhouse Management	11 (79%)	8 (89%)	3 (60%)	22(79%)
Floriculture	6 (43%)	8 (89%)	2 (40%)	16(57%)
Horticulture Mechanics	6 (43%)	2 (22%)	0	8 (29%)
Landscape Horticulture	2 (14%)	7 (78%)	1 (20%)	10(36%)
Nursery Production	6 (43%)	4 (44%)	0	10(36%)
Turf Technology	1 (11%)	2 (22%)	0	3 (11%)
Other:				
Native Plants	1 (11%)	0	0	1 (4%)
Garden Production	1 (11%)	0	0	1 (4%)
Indicate the Number of Daily Sections You Teach Horticulture:				
1	8 (57%)	6 (67%)	3 (60%)	17(61%)
2	3 (21%)	3 (33%)	2 (40%)	8 (29%)
5 or more	1 (7%)	0	0	1 (4%)
Incorporate into Classes	2 (14%)	0	0	2 (4%)
Indicate the Number of Semesters You Teach Horticulture in One Year:				
Fall Semester	4 (29%)	5 (56%)	3 (60%)	12(43%)
Spring Semester	14 (100%)	9 (100%)	5 (100%)	28(100%)
Does any Course Last More Than One Semester:				
Yes	6 (43%)	3 (33%)	2 (40%)	11(39%)
No	8 (57%)	6 (67%)	3 (60%)	17(61%)
Indicate the Class Year of Your Horticulture Students in High School or Junior College:				
Freshman (High School)	5 (36%)	3 (33%)	2 (40%)	10(39%)
Sophomore (High School)	12 (86%)	4 (44%)	3 (60%)	19(68%)
Junior	13 (93%)	9 (100%)	3 (60%)	25(89%)
Senior	13 (93%)	9 (100%)	4 (80%)	26(93%)
Freshman (College)	1 (7%)	0	1 (20%)	2 (7%)
Sophomore (College)	1 (7%)	0	1 (20%)	2 (7%)

Responses for type of greenhouse and seasonal use are in Table 4. Greenhouses used by the respondents were either freestanding, 21 (75%) of 28, or built as an addition to an existing building, 7 (25%) of 28. Montana, 10 (71%) of 14, Wyoming, 4 (80%) of 5, and North Dakota, 7 (78%) of 9, used a freestanding greenhouse. Respondents from Montana, 4 (25%) of 14, North Dakota, 2 (22%) and Wyoming, 1 (20%) reported having built a greenhouse as an addition to an existing building. A surprising number of these greenhouses were used year-round, 15 (54%) out of 28. Both North Dakota reported 7 (78%) of 9, Wyoming, 3 (60%) of 5, reported horticulture classes using a greenhouse through the entire year. On the other hand, Montana responded with only 5 (36%) of 14 being used year round.

Table 4. Demographics of Agricultural Educators in the Greenhouse Competency Survey

	Montana n=14	North Dakota n=9	Wyoming n=5	Total-Three States n=28
What Type of Greenhouse do You Use in Your Program:				
Free-standing	10 (71%)	7 (78%)	4 (80%)	21(75%)
Built as an Addition to Existing Bldg	4 (29%)	2 (22%)	1 (20%)	7 (25%)
Is Your Greenhouse Used Year Round:				
Yes	5 (36%)	7 (78%)	3 (60%)	15(54%)
No	9 (64%)	2 (22%)	2 (40%)	13(46%)

The greenhouse management competency survey (see Appendix A) resulted in 44 (70%) out of 63 agricultural educators responding. However, due to ten of those respondents not using greenhouses for horticultural instruction, they were excluded from the data collected for a final tally of 34 (64%) out of 53.

Significant differences were found between F values for early and late responders in six survey questions using Levene's Test for Equality of Variance. Please refer to Table 5 to review the items found to be different. There were 28 early responders and 6 late responders. Montana had 3 late responders, North Dakota 2 and Wyoming 1. The questions statistically different were 7, 12, 22, 26, 46, and 49. Question 7 had significant correlation with question 12 only. For question 12, there was significant correlation with 7, 22, and 46. For question 22, there was significant correlation with 12 and 49. There was no correlation between question 26 and any of the other 5 questions. Question 46 had significant correlation with question 49 only. Random error was considered as the factor that caused these 6 items to be significantly different between early and late responders. The data from late responders was included in the competency survey data.

Table 5. Early Versus Late Responder Significant Differences for Six Competency Questions

No.	Competency	F Values	Significance (2-tailed, .05)
7.	Needs of growing specialty crops such as poinsettias, lilies, etc.	6.475	.016
12.	Potential safety hazards and their elimination.	4.855	.035
22.	How disease are spread to and among plants.	5.661	.023
26.	Knowing the correct stage for greenhouse plants to be harvested.	4.420	.043
46.	Parts of an herbaceous plant used in propagation.	4.684	.038
49.	Specialized plant organs used for asexual propagation.	6.530	.016

Competency survey data represents the total of the three states' responses when compared individually rather than by group. Using Pearson's correlation statistic, all of the competencies exhibited significant correlation with at least one other item in their category. However, there were no significant differences between data categories.

Competencies were analyzed to determine valid (most important) or invalid (least important) status. To reach a valid status and to retain for a future greenhouse management curriculum, the competency would have to be rated a 4 (Important) or 5 (Most Important) by more than 50% of the respondents. Those competencies described as valid are listed in Tables 6-10 by competency subject area. Refer to Table 6 for a list of valid Greenhouse Management Competencies; Table 7 for Plant Propagation; Table 8 for Pest Management; Table 9 for Plant Propagation; and Table 10 for Soil Media and Fertilizer.

Table 6. Mean and Percent Frequency Scores for Valid Greenhouse Management Competencies

No.	Competency	Mean	Percent Frequency[a]
1.	Potential safety hazards	3.92	70.6
2.	Common and greenhouse plant identification	4.00	73.6
15.	Correct greenhouse ventilation requirements	4.08	64.7
31.	Common greenhouse term definitions	4.00	73.5
62.	Use of a computer for seeking information on the Internet	4.42	58.8

[a] Percent scores indicated the percentage of respondents rating a competency a 4 (Important) or 5 (Most Important).

Table 7. Mean & Percent Frequency Scores for Plant Propagation Competencies

No.	Competency	Mean	Percent Frequency[a]
34.	Common plant propagation terms	4.00	85.3
35.	Plant parts and processes relating to sexual reproduction	4.33	91.2
36.	Asexual and sexual reproduction parts and processes	4.33	91.2
39.	Environmental needs of newly propagated plants	4.17	70.6
45.	Proper methods of cuttings taken from woody plants	4.08	70.6
46.	Parts of a herbaceous plant used in making cuttings	4.25	61.8
47.	Plant layering processes	3.75	52.
49.	Specialized organs for asexual reproduction	3.75	55.9
50.	Separating plants correctly for plant propagation	4.08	61.8
51.	Budding and grafting terms	3.83	58.8
52.	Uses of budding and grafting	4.08	64.7
57.	Dormancy factors and methods to break them	3.83	70.6

[a] Percent scores indicated the percentage of respondents rating the competency a 4 (Important) or 5 (Most Important).

Table 8. Mean and Percent Frequency Scores for Pest Management Competencies

No.	Competency	Mean	Percent Frequency[a]
10.	Common diseases, insect pests and control methods	4.17	82.4
20.	Common greenhouse insects and damage symptoms	4.50	94.1
21.	Common disease organisms, diseases they cause and damage to plants	4.17	70.6
22.	Way diseases spread among plants	4.08	58.9
23.	Disease control in a greenhouse	4.17	67.7
24.	Pesticide label information	4.50	79.4

[a] Percent scores indicated the percentage of respondents rating the competency a 4 (Important) or 5 (Most Important).

Table 9. Mean & Percent Frequency Scores for Plant Production Competencies

No.	Competency	Mean	Percent Frequency[a]
5.	Production schedules for bedding plants and flowers	3.67	61.8
6.	Light, soil and temperature requirements for houseplants	3.33	73.6
11.	Stock plant selection for cuttings and seedlings	4.17	76.5
12.	Correct procedures for cutting, thinning, pruning, typing and disbudding plants	4.17	79.4
13.	Correct procedures for watering plants	4.50	85.3
14.	Greenhouse crop production schedule	3.58	61.7

Table 9. Mean & Percent Frequency Scores for Plant Production Competencies (Continued)

No.	Competency	Mean	Percent Frequency[a]
26.	Correct stage for greenhouse crop harvest	3.67	53.0
58.	Preparation, planting and care of seeds and seedlings	4.75	91.2
59.	Seedling transplanting procedures	4.08	85.3

[a] Percent scores indicated the percentage of respondents rating the competency a 4 (Important) or 5 (Most Important).

Table 10. Means and Percent Frequency Scores for Soil Media and Fertilizer Competencies

No.	Competency	Mean	Percent Frequency[a]
3.	Soil mixes for common plants	4.00	70.6
4.	Procedures for mixing soil media	3.58	58.8
8.	Rates of fertilizer needed by specialty crops	3.67	58.8
17.	Influence essential elements have on plant growth	3.83	73.5
18.	Deficiency symptoms of essential elements	4.00	67.7
37.	Types and characteristics of various plant soil media	3.58	52.9
38.	Soil media requirements for seedling transplants and propagated material	3.75	61.7

[a] Percent scores indicated the percentage of respondents rating the competency a 4 (Important) or 5 (Most Important).

It was interesting to note while competency 6 in Table 9 3.33 mean rating, 50% of the respondents rated it a 4 or 5. The Soil Media and Fertilizer category had no invalid competencies.

For the invalid competencies very close to the 50% cutoff point, a Pearson correlation analysis was used to determine if they were significantly correlated to a valid competency. It was determined that competencies 17, 42 and 55 were exactly at the 50% frequency rating. Competency 17 had significant correlation with valid competency 15 at the .05 level (.000). Competency 42 had significant correlation with valid competency 31 (.043) and competency 55 had significant correlation with valid competency 50 (.005). These items were dropped from the valid competency list.

Table 11. Mean and Percent Frequency Scores for Invalid Greenhouse Management Competencies

No.	Competency	Mean	Percent Frequency[a]
15.	Heating requirements and fuel cost for greenhouses	3.17	41.2
17.	Cooling methods for a greenhouse	3.50	50.0
31.	Greenhouse shapes, designs and parts	3.17	29.4
32.	Advantages and disadvantages of greenhouse building materials	3.42	35.4
39.	Environmental concerns and pollution problems	3.67	44.1
61.	Computer use for greenhouse production records	3.92	44.1

[a] Percent scores indicated the percentage of respondents rating the competency a 4 (Important) or 5 (Most Important).

Table 12. Mean and Percent Frequency Scores for Invalid Plant Propagation Competencies

No.	Competency	Mean	Percent Frequency[a]
39	Propagating structures and equipment	3.58	44.1
42	Label propagated material	3.83	50.0
43	Types of woody plant cuttings	3.50	47.1
44	Tools, equipment and materials needed for woody plant cuttings	3.83	47.1
45	Separation, division and offset in plant propagation	3.42	38.2
53.	Process of making a completed graft union	4.00	47.1
54.	Types of grafts and budding procedures	3.92	44.1
55	Flower and vegetable seed ID	3.33	50.0
56	Reliable seed sources	3.50	40.1

[a] Percent scores indicated the percentage of respondents rating the competency a 4 (Important) or 5 (Most Important).

Table 13 Mean and Percent Frequency Scores for Invalid Pest Management Competencies

No.	Competency	Mean	Percent Frequency[a]
7	Basic needs of specialty crops	3.33	47.1
25.	Common greenhouse weeds and their control	3.58	35.3
60	Computer use for pesticide records	3.67	41.1

[a] Percent scores indicated the percentage of respondents rating the competency a 4 (Important) or 5 (Most Important).

Table 14. Mean and Percent Frequency Scores for Invalid Plant Production Competencies

No.	Competency	Mean	Percent Frequency[a]
7.	Photo-period and time requirements for specialty crops	3.42	44.1
26.	Grades and quality of plants according to industry standards	3.42	29.4
27.	Labeling and packaging greenhouse plants	3.25	26.4
28.	Removal of dead and diseased plant material while in storage	3.33	44.2
29.	Proper storage conditions for flowers, prolonging life	3.58	41.2
63.	Computer use for ordering supplies, equipment, and plants	3.33	38.2

[a] Percent scores indicated the percentage of respondents rating the competency a 4 (Important) or 5 (Most Important).

Respondents had suggestions for other competencies as well. They were: 1) integrate agriculture and science departments through greenhouse activities, 2) identify and discuss handling procedures of common pesticides used in the greenhouse, 3) utilize and discuss Integrated Pest Management, 4) uses for a greenhouse in elementary education, 5) practices used in constructing greenhouses, 6) develop a student horticulture portfolio, 7) develop a marketing plan for greenhouse plants (2), 8) determine prices and pricing methods for greenhouse plants, 9) requirements of certain plants for proper germination, 10) materials for and types of greenhouse benches, 11)

plant spacing, shade cloth, and white washing, 12) use of hot beds and cold frames, and 13) knowledge of local native plants.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The purpose of the study was to determine the horticultural education competencies needed by beginning agricultural education instructors to successfully educate students in Greenhouse Management. Results are based on agricultural educator responses to a 63-item survey instrument. The population for this descriptive study came from agricultural educators who operated a greenhouse as part of their instruction at high schools and junior colleges in the three states of Montana, North Dakota and Wyoming.

To complete the purpose of the study, agricultural educators were surveyed to fulfill the following objectives:

1. To determine the competencies needed by beginning agricultural education teachers in Montana, North Dakota and Wyoming pertaining to a greenhouse management curriculum.
2. To determine the highest rated greenhouse management curriculum components dealing with agricultural educator competencies involving the five category areas of greenhouse management, plant production, plant propagation, pest management, and soil media and fertilizers.

Conclusions

1. Thirty-nine valid competencies were found to be needed by a beginning agricultural educator. The category breakdown had Greenhouse Management with 5, Plant Propagation with 12, Pest Management with 6, Plant Production with 9 and Soil Media and Fertilizer with 7.
2. Demographic data showed over 50% of the greenhouses in the Tri-State Area are used year-round for activities including plant production education, greenhouse management instruction and student plant sales in the spring.
3. A large majority of the agricultural educators operating greenhouses were self-taught according to demographic data.
4. Free standing greenhouses are the most commonly used facility for teaching greenhouse management.

Implications

Beginning agricultural educators are increasingly in need of horticultural training to successfully complete their role of answering an increased demand for horticultural instruction in high schools and junior colleges.

Recommendations

The following recommendations are for future research, curriculum development, and agricultural educator education:

1. The study's thirty-nine valid competencies should be used as a needed horticulture education guide for agricultural education majors who are planning to teach at high schools and junior colleges in the Tri-State Area.
2. Increased hands-on horticulture seminars, using the study's valid competencies as a guide, need to be implemented at each annual state agriculture educator training update. These seminars should be for one full day or a full week in length. In addition, agriculture educators should continue their admirable work ethic in educating themselves on horticulture.
3. The researcher suggests the study's valid competencies should be used as a foundation in future development of a greenhouse management curriculum for high schools and junior colleges in the Tri-State Area.
4. Additional horticulture research for education at the elementary and high school level is recommended for the northern climate of the Tri-State Area.
5. The researcher recommends that increased efforts be made to tie horticultural instruction year-round with other science and mathematics classes at each educational institution. Again, the valid competencies from the study should be used as a guide.

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APPENDICES

APPENDIX A

SURVEY DOCUMENT

COMPETENCY SURVEY

TECHNICAL COMPETENCIES IN GREENHOUSE NEEDED BY AGRICULTURAL IN MONTANA, NORTH DAKOTA AND

In the right hand column, indicate a response to each question by filling in the circle you

COMPETENCIES	Level of Mastery Teachers Greenhouse LEAST IMPORTAN 1 2 3 4 5 MOST IMPORTANT
1. Identify potential safety hazards and to eliminate those hazards in a	
2. Identify common houseplants and	
3. Identify correct soil mix for common	
4. Demonstrate correct procedure in mixing	
5. Prepare production schedules for plants and	
6. Identify light, soil, and temperature common	
7. Identify and describe the basic needs of crops such as poinsettias, Easter lilies, or	
8. Calculate rates of fertilizer needed	
9. Determine the photo-period and specialty crops.	
10. Identify common diseases, insect for their control in	
11. Select good stock plants for	
12. Demonstrate correct procedures pruning, typing, and	
13. Demonstrate correct procedure for	
14. Prepare a complete production greenhouse	

COMPETENCIES	LEAST IMPORTAN 1	2	3	4	MOST IMPORTANT 5
15. Determine correct ventilation greenhouse.					
16. Compare heating requirements for various size of					
17. Compare cooling methods for a					
18. Describe the influence each of the has on plant					
19. Identify deficiency symptoms of chemical					
20. Identify common greenhouse insects and each					
21. Identify common disease organisms, the cause, and describe their damage					
22. Identify ways diseases are spread					
23. Identify methods used in house					
24. Name and interpret all the pesticide label.					
25. Identify common weeds and a among greenhouse					
26. Identify the correct stage during which should be					
27. Identify grades and quality of industry					
28. Correctly demonstrate procedure packaging greenhouse					
29. Identify and remove dead and leaves on plants in					
30. Identify proper storage conditions materials that may be used to					
31. Define common greenhouse terms					

COMPETENCIES	LEAST IMPORTAN 1	2	3	4	MOST IMPORTANT 5
32. Identify types of greenhouse define common greenhouse parts					
33. List advantages and greenhouse building					
34. Define common plant propagation					
35. Identify sexual organs and process in a complete					
36. Identify parts and processes in reproduction and state reasons for propagation for various					
37. Identify types and characteristics growing media.					
38. List requirements of media used seedlings and asexually					
39. Describe environmental needs of					
40. Describe environmental concerns pollution problems regarding a					
41. Compare types of propagating equipment					
42. Label propagated					
43. Differentiate between the common from woody					
44. Identify tools, equipment, and proper handling of					
45. Demonstrate proper methods for from woody					
46. Identify parts of a used in making					
47. Identify, define and demonstrate plant					

COMPETENCIES	LEAST IMPORTAN 1	2	3	4	MOST IMPORTANT 5
48. Define separation, propagating					
49. Identify specialized organs by reproduce					
50. Separate plants correctly for					
51. Define terms related to grafting					
52. Explain uses for grafting					
53. Explain the process involved in union on a completed					
54. Successfully demonstrate different different budding					
55. Identify different flower and					
56. List reliable sources of					
57. List factors affecting dormancy of breaking dormancy of					
58. Prepare, plant, and care for seed					
59. List steps when					
60. Use a computer to accurately keep					
61. Use a computer to accurately keep production					
62. Use a computer to seek information on the					
63. Use a computer to order supplies, plants needed for					

OTHER:

_____

_____

_____

APPENDIX B

DEMOGRAPHIC QUESTIONNAIRE

Demographic Questionnaire

Greenhouse Management Competencies for Beginning Agriculture Educators
in Montana, North Dakota and Wyoming

Instructions

Questions require a check (✓) mark or short answer. PLEASE ANSWER ALL QUESTIONS AS ACCURATELY AS POSSIBLE. Any information received will be held in the strictest of confidence. Code #s will be used for follow-up on responses.

Please return the COMPLETED form in the SASE as quickly as your busy schedule permits. THANK YOU!

1. Gender
   ____ FEMALE
   ____ MALE

2. Current status:
   ____TEACHER, 1-3 YEARS EXPERIENCE IN AGRICULTURAL EDUCATION
   ____TEACHER, 4-9 YEARS EXPERIENCE IN AGRICULTURAL EDUCATION
   ____TEACHER, 10 + YEARS EXPERIENCE IN AGRICULTURAL EDUCATION

Years of teaching horticulture:
   ____ 1 – 3 YEARS
   ____ 4 – 9 YEARS
   ____ 10 OR MORE YEARS

4. Major in highest degree attained:

____ AGRICULTURAL EDUCATION	____ BS	____ MS	____ PhD
____ BIOLOGY OR BOTANY	____ BS	____ MS	____ PhD
____ HORTICULTURE	____ BS	____ MS	____ PhD
____ OTHER (specify) _____	____ BS	____ MS	____ PhD

5. Years of non-teaching work in a horticulture-related industry.
   ____ YEARS (write in)

6. Check the main horticulture areas you currently teach:
   ____ GREENHOUSE MANAGEMENT
   ____ FLORICULTURE
   ____ HORTICULTURE MECHANICS
   ____ LANDSCAPE HORTICULTURE
   ____ NURSERY PRODUCTION
   ____ TURF TECHNOLOGY
   ____ OTHER (specify) _____

7. Indicate the number of daily sections you teach horticulture:
   ____ 1
   ____ 2
   ____ 3
   ____ 4
   ____ 5 or more

8. Indicate the number of semesters you teach horticulture in one year:
   ____ FALL SEMESTER
   ____ SPRING SEMESTER

9. Does any course(s) subject last more than 1 semester?
   ____ YES
   ____ NO

10. Indicate the class year of your horticulture students in high school or junior college: (check all answers that apply)
   ____ FRESHMAN (HIGH SCHOOL)
   ____ SOPHOMORE (HIGH SCHOOL)
   ____ JUNIOR
   ____ SENIOR
   ____ FRESHMAN (COLLEGE)
   ____ SOPHOMORE (COLLEGE)

11. When did a horticulture program of instruction begin at your school?
   ____ (YEAR)

12. Where did you get your source of training as a horticulture instructor:
   (check all answers that apply)
   ____ ON THE JOB
   ____ HIGH SCHOOL PROGRAM
   ____ COLLEGE/UNIVERSITY PROGRAM
   ____ ADULT EDUCATION PROGRAM
   ____ SELF-TAUGHT
   ____ OTHER (specify) _____

13. What type of greenhouse do you use in your program?
   ____ FREE STANDING
   ____ BUILT AS AN ADDITION ON AN EXISTING BUILDING

14. Is your greenhouse used year round?
   ____ YES
   ____ NO

APPENDIX C

NOTIFICATION POSTCARD

NOTIFICATION POSTCARD

Dear

Within a week I will be sending you a questionnaire concerning my thesis which is on the greenhouse management competencies for vocational agriculture teachers in Montana, N. Dakota, and Wyoming. You will be sent a copy of the results and the information received will be used to formulate a greenhouse management "cookbook" for the respondents in the future. Please take the time to fill out the questionnaire as your valuable input is greatly needed.

Sincerely,

Roger Hybner
Master's Candidate
Agricultural Education
Montana State University

APPENDIX D

COVER LETTER

MONTANA STATE UNIVERSITY
BOZEMAN, MT 59717
College of Agriculture
Dept. of Agricultural Education

April 5, 1999

Dear ,

In an effort to develop a greenhouse management curriculum to aid in high school and junior college horticulture instruction in Montana, North Dakota and Wyoming, we are requesting your assistance.

Please take 10 to 15 minutes of your valuable time and establish what you feel are essential skills and competencies that horticulture teachers need to know for successful instruction of a greenhouse management curriculum in a northern climate.

Currently, we are compiling data for a Master's dissertation. Time is very critical as the Master's candidate has only a 1-year leave of absence from his job as Supt. of the University of Wyoming's Sheridan Research and Extension Center. We would be most grateful if you would complete the following questionnaire and mail it in the enclosed, stamped, self-addressed envelope no later than April 15.

Thank you for your contributions for an important study. We hope we haven't taken too much of your valuable time, but we do feel your input on greenhouse management is urgently needed. The project will do a great deal in formulating a hands-on, applied curriculum that vocational agricultural teachers in these 3 states can use in their programs.

Sincerely,

Roger Hybner
Master's Candidate

Sincerely,

Dr. Martin Frick
Assoc. Professor
Agricultural Education

APPENDIX E

1st COMPETENCY SURVEY REMINDER POSTCARD

1st COMPETENCY SURVEY
REMINDER POSTCARD

Montana State University
College of Agriculture
Dept of Agricultural Education
406-994-2132

May 15, 1999

Dear ,

We sent you a survey to solicit your opinions of the important factors involved in a greenhouse management program for high schools and junior colleges in Montana, North Dakota, and Wyoming. The study will do much to improve current and future horticulture programs for students.

Since we haven't received your survey, this postcard will be a reminder to you. We would be most grateful to receive your response ASAP.

If you need another copy of have questions, please call.

Again, thanks for your time.

Sincerely,

Roger Hybner
Master's Candidate

Marty Frick
Assistant Professor
Agricultural Education

APPENDIX F

2nd REMINDER FOR COMPETENCY SURVEY & INTRODUCTION OF DEMOGRAPHIC SURVEY

2nd REMINDER FOR COMPETENCY SURVEY &
INTRODUCTION OF DEMOGRAPHIC SURVEY

MONTANA STATE UNIVERSITY
1893 CENTENNIAL 1993

Department of Agricultural and Technology Education
Cheever Hall
Montana State University
Bozeman, MT 59717-0374
406-994-3201 or 994-3691

May 25, 1999

Dear ,

You should have received a greenhouse management competency survey for agricultural educators from me last month along with a reminder postcard several weeks ago. *If you have not filled the survey out and sent it back yet, please do so at this time.* To those educators who have returned it, again, Thank You Very Much!

Enclosed you will find a demographic survey that will take less than 5 minutes of your valuable time and will establish characteristics of my survey populations. Please fill it out and mail it back to me in the enclosed SASE envelope.

Thank you for your contributions for an important study. I do feel your input on greenhouse management is very valuable and urgently needed.

Sincerely,

Roger Hybner
Master's Candidate

Marty Frick
Assistant Professor
Agricultural Education

MSU is an equal opportunity/affirmative action institution

APPENDIX G

1st POSTCARD REMINDER FOR DEMOGRAPHIC SURVEY

1st POSTCARD REMINDER FOR DEMOGRAPHIC SURVEY

A survey on agricultural educator demographics was mailed your way recently. If you have not received the survey, please contact me at your earliest convenience so I can send you a replacement. If you have not completed the survey, please take 5 minutes of your valuable time and do so. If you have completed and mailed the survey back, **Thank You Very Much!!**

Roger Hybner
Master's Candidate
MSU- Ag Education
Box 173750
Bozeman, MT 59715-0374

Phone: 406-994-2132
Fax: 406-994-6696
email: rhybner@trex2.oscs.montana.edu

MONTANA STATE UNIVERSITY - BOZEMAN
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