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GREENHOUSE GROWER SKILL REQUIREMENT:
A MULTIPLY STATE TEACHER AND INDUSTRY PERSPECTIVE

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GREENHOUSE GROWER SKILLS REQUIREMENTS: A MULTIPLE STATE TEACHER AND INDUSTRY PERSPECTIVE

By

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ABSTRACT

GREENHOUSE GROWER SKILLS REQUIREMENTS:
A MULTIPLE STATE TEACHER AND INDUSTRY PERSPECTIVE

By

Nancy Lee Higgins

One of the outcomes of recent educational reform has been the development of national skill standards. The area of agriculture has lagged seriously behind in this movement. Agriculture professionals assumed that diversity in the field – of climate, geography and crops - effectively ruled out a uniform nationwide definition of skills. The purpose of this study was to secure evidence of the existing perceptions of industry and agriscience teachers, identify standards for important skills, determine the best methods of assessment, define where the skill can be acquired, and recommend remedies. The population of the study consisted of members of the industry trade group Bedding Plants International across the nation and agriscience teachers in California, Florida and Michigan. The survey disclosed that: teachers and industry can agree on a list of skill standards required for greenhouses growers regardless of location or crop; teachers and industry thought that the best method of assessing the skills is observation and/or written examinations; industry chose on the job training and postsecondary education as the best method for acquisition of the skills, while teachers chose high school and postsecondary education. In summary, the study showed that development of a set of national skill standards is possible. It is recommended that the floriculture industry and educational institutions and organizations should open a dialogue to continue the development of national skill standards in this area.

To my husband of 33 years, Jim, your love, support and help

I appreciate beyond words and

To all the women my age that aspired to be a teacher or nurse

and never thought that anyone would ever call them doctor.

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CHAPTER I

Introduction

Unlike virtually all leading competitors, educators have no national system capable of setting high academic standards for noncollege bound students or of assessing their achievement against those standards (National Center on Education and the Economy, 1990). The citizenry of the United States is aware that we are part of a global economy attested to by the North American Free Trade Agreement, Ford Motor Company purchasing Jaguar and Land Rover and Daimler-Benz' purchase of Chrysler Corporation. And yet our students rank at the bottom on most international tests that look at mathematics, science, reading and geography. Our students rank behind students in Europe and East Asia and even behind students in some newly industrialized countries (National Center on Education and the Economy, 1990).

In the early 1980s, the U.S. Department of Education issued a report on the state of the nation's schools titled *A Nation at Risk*. The report noted that "if an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves" (National Commission on Excellence in Education, 1983).

Dan DeGrow (1999), Michigan State Senate majority leader, in an editorial said: "We need to set the bar much higher – to make it clear that even mediocre educational performance is unacceptable. Students deserve a chance for a future. Without change, many students will not have a chance at the future they deserve" (p. 7B).

For the last ten years educational reform has sought to address these issues and the issues that deal with the education of the noncollege bound student. The push for accountability

and accessibility through a system of national skill standards is taking root across the country.

National skill standards are part of a multifaceted approach of educational reform to address the needs of the 70 percent noncollege bound students. Under the national standards, industry and labor need to examine the tasks and processes performed for each job classification. There is a need for a common language between labor and industry and educators (National Center on Education and the Economy, 1990). Industrial societies and certifying boards have taken up the effort to produce the skills list. Once the list is produced educators at the secondary and postsecondary levels can begin the process of developing curricula. Industry, labor and education then need to review the curricula, and develop and define what outcomes, assessments or testing should be used to see if the skills have been accomplished at an acceptable level.

The National Skills Standard Board in Washington, D.C., looks at the skills and their assessment. It checks to make sure that labor, industry and educators are involved in the process. Civil rights experts review the skills and assessment methods. If the skills and their assessments meet all the criteria then the National Skills Board will endorse the product. This is like the Good Housekeeping Seal of Approval (Gallo, 1999).

Federal funding has assisted in the creation of career pathways. All career and technical courses are grouped in six major areas or clusters. They are agriculture and natural resources; manufacturing technology; arts and communication; business technology; human services, and health sciences. These clusters are called career pathways because the core courses (preprogram entrance requirements) needed for all careers in the cluster are similar. These pathways show students what courses to take for a specific career cluster. National skill standards for many academic areas and career and

technical education areas are already completed. Funding sources include the Carl Perkins Act, the Tech Prep Initiative, and the School-To-Work Initiative.

Statement of Problem

Many of the career and technical education (formerly vocational education) clusters have moved forward in establishing national skills standards. Manufacturing technology, business technology and health science occupations have all established national skill standards. The cluster of agriculture and natural resources has standards in only one area to date: biotechnology.

The cluster of agriculture and natural resources cite crop and product diversity, lack of funding and state and local schools' rights as reasons for not having proceeded into the skills standards (Jackson, 1999).

Is it possible for agricultural labor, industry and educators to agree on skills and methods of assessment and therefore move toward a national skill standard?

The floriculture field is as diverse as any field in agriculture. It faces international competition from the Netherlands, Italy, Spain, Israel, Kenya, Turkey, Brazil, Columbia, Costa Rica, Ecuador, Mexico, Peru, and Japan (Van Doesburg, 1991).

Floriculture crops, at the wholesale level for all growers with ten thousand dollars or more in sales, have a value that was estimated at $3.57 billion in 1997. The top three states for floriculture crops are California, Florida and Michigan. The crops are: bedding plants which include hanging baskets; flowering and foliar type plants; vegetables; geraniums; impatiens; New Guinea impatiens; garden mums; petunias and other flowering hanging baskets. Additional crops include cut cultivated greens, cut flowers, flowering potted plants, foliage plants in hanging baskets, and potted and Hawaiian specialty crops.

The diversity continues with the type of growing structures. There are diverse types of greenhouse coverings from glass, fiberglass and other rigid structures to soft structures like single- or multiple-layered film plastic. Plants may be grown totally in the greenhouse, in shaded temporary structures, or in open ground (U.S. Department of Agriculture, 1998). Greenhouse size varies from a one-person greenhouse operation to 42 acres under glass.

Greenhouse production is diverse not only in crops and structures but also in environmental and growing conditions. Many states require heating systems. Most states will need cooling systems that will vary according to the local climate. Some areas of the country will require supplemental lighting or blackout systems to produce a crop. Water quality varies from state to state. Regulations dealing with runoff and pesticide use vary from state to state.

With such diversity, is it possible for Bedding Plants International members across the country and agriscience educators from the top three greenhouse crop growing states of California, Florida and Michigan to be able to agree on a set of basic skills and assessments for the job title of greenhouse grower that might also lead to the establishment of national skills standards?

The Purpose and Objectives

The purpose of this study is to:

1. Secure evidence of existing perceptions of growers, owners, and other members of The Bedding Plants International, Inc. and agriscience educators that teach plant science, horticulture, or greenhouse skills in the top three floriculture production states of California, Florida and Michigan. (These groups were selected because of their ability to identify important skills,

where these skills can be acquired and to determine the best method of assessing the job performance of a greenhouse grower.)

2. Describe perceptions of standards for important skills, best method of assessment, and where these skills can be acquired for the job title of greenhouse grower.
3. Make recommendations for future based upon the research findings.

Specific objectives of the study were to:

1. Describe the important skills needed for employment for the job title of greenhouse grower as perceived by Bedding Plants International members and agriscience teachers in California, Florida and Michigan.
2. Describe where these skills for the job title of greenhouse grower can best be acquired as perceived by members of Bedding Plants International and agriscience teachers in California, Florida and Michigan.
3. Describe the best method of assessing the skills for the job title of greenhouse grower as perceived by members of Bedding Plants International and agriscience teachers in California, Florida and Michigan.
4. Identify national differences in the perceptions of members of Bedding Plants International and agriscience teachers in California, Florida and Michigan relating to the important skills, where the skills can be acquired or the best method of assessing the skills for the job title of greenhouse grower.

Definition of Terms

In order to provide clarity of meaning for important terms used throughout the study, the following definitions are offered:

Agriculture: The broad industry involving people engaged in the production of plants and animals for food and fiber, for the

	provision of agricultural supplies and services, and for the processing, marketing and distribution of agricultural products.
Agriculture Courses:	Classification of instructional program categories: 01. agricultural courses: business and production and 02. agricultural science. Specifically the coded programs from 01.0000 to 02.0501.
Agriscience:	The curriculum or program in agricultural education constructed for students (junior high school and/or senior high school) designed to offer students the opportunity to explore and prepare for agricultural occupations. This would include occupations in agricultural production, animal science, horticulture, floriculture, agribusiness and related fields.
Assessment:	Any method used to measure characteristics of people, programs, or objects.
Bedding Plants International (BIP):	This professional association of greenhouse owners, growers, suppliers, and educators was originally called Bedding Plants, Inc. It was founded in Michigan. The group later changed its name to the Professional Plant Growers Association and has recently become Bedding Plants International, Inc. It is headquartered in Iowa.
Career and Technical Education (CTE):	Previously called vocational education where education is based on a skill or trade.
Career Cluster:	An area of study that has core courses in common and leads to specialization. Clusters are Agriculture and Natural Resources, Business Technology, Manufacturing Technology, Human Services and Health Services.
Career Pathways:	An educational system to inform students, counselors and parents about courses needed by the students to successfully enter their chosen career path. This educational system of courses may begin in ninth grade and continue through grades 13 and 14 or community college or a training program.
Certified Agriscience or Horticulture Teacher:	Teachers that have state granted certificates or endorsements based on education and work experience to teach agriculture, agriscience, horticulture or related fields in career and technical (vocational) state approved programs.

Community College:	A publicly funded higher education institution that offers a wide range of programs to meet the ever-increasing needs of the local community for educational opportunities beyond the high school level. Most community colleges offer courses leading to less than a baccalaureate degree.
Credentialing:	The recognition of professional or technical competence. The credentialing process may require registration, certification, licensure, professional association membership or the award of a degree in the field.
FFA:	Previously called Future Farmers of America, the oldest vocational student organization.
Geographic Region Variable:	This variable was created based on the states employed: West of the Mississippi included: California, Oregon, Washington, Colorado, Idaho, Iowa, Kansas, Hawaii, New Mexico, North Dakota, Montana, South Dakota, Nebraska, and Alaska. North of the Mason-Dixon line included: Michigan, Indiana, New York, Minnesota, Pennsylvania, Illinois, Massachusetts, Wisconsin, Ohio, New Jersey, New Hampshire, Maryland and Rhode Island. South of the Mason–Dixon line included: Florida, Virginia, Mississippi, Alabama, North Carolina, Oklahoma, Tennessee, Kentucky, and Missouri. This gave a regional breakdown of: West of the Mississippi 25.1%, North 51%, South 23.9%.
Grower:	A person responsible for the propagating, growing, and harvesting of horticulture crops. This may be in a greenhouse or in open ground.
Industry:	Owner, growers and persons working in the floriculture industry.
Perception:	An idea of the relative importance of something: a view point.
Standard:	1. A concept that has been established by authority, custom, or agreement to serve as a model or rule in measurement of quality or the establishment of a practice or procedure. 2. Criteria which specify what constitutes successful completion of a prescribed performance.
Tech Prep:	Tech Prep is written into two legislative initiatives. The first is the Carl Perkins Act, and the second is the School to Work Opportunities Act of 1993 (S. T. W. O. A.).

Limitations of the Study

This study was limited to the members of Bedding of Plants International and agriscience educators in the top three greenhouse production states of California, Florida and Michigan, and their perceptions of greenhouse grower skills. This study only intended to show what the status quo was at the time of the survey.

CHAPTER II

Review of Literature

This chapter is divided into the following sections:

1. A brief history of career and technical education.
2. Statements related to the philosophy of technical education.
3. A selective history of modern educational reform leading to the national skill standards movement with an emphasis on technical education.
4. Review of agriscience curriculum.
5. Summary

A Brief History of Career and Technical Education

The skills and crafts that now comprise what is viewed as vocational or career and technical education were historically taught by fathers to their sons or to young apprentices by craft and trade guilds.

> Shortly after the turn of the twentieth century, the challenge facing teachers and school administrators was to produce a population of students entering the workforce that met the needs of the burgeoning factories and offices in which they would work. The mass production system was being introduced on wide a scale, and it was greatly reducing the need for skilled craftspeople. Only a small technical and managerial elite required serious academic preparation. Almost all the rest, the vast mass of the American workforce, could do quite well with only a seventh or eighth grade level of literacy. The system they built met that requirement handsomely, year after year. (Tucker & Codding, 1998, p. 33)

American psychologists said that only the most intelligent of our young people – about the top 15 percent or so – are capable of serious academic work. America's teachers took the view that it would be damaging to the kids to ask them to exceed their capabilities. For those in the bottom half of the distribution, the decent thing to do would be to give them high marks for making an effort – coming to school, turning in their homework, and behaving themselves. Much effort was put into deciding when youngsters

first entered school what their intellectual potential was and then assigning them to ability groups based on that judgment. Most of the rest of the world was rather skeptical of our psychologist's findings and chose to disregard them. When most jobs required little skill and less education, maybe it did not matter that we expected far less of our students than parents and teachers expected of students in other countries. Now it matters very much. Today more than ever, what you will earn will be a function of what you know and can do. The only job security in contemporary America is the job security of being highly skilled in an area of high demand and being able to learn complex new things very quickly. One obvious response to having very low implicit standards for the majority of our students is to have high explicit standards for all of them (Tucker & Codding, 1998).

Statements Related to the Philosophy of Technical Education

John Dewey and Alfred North Whitehead were educational philosophers who viewed academics and vocational (career and technical) education as a marriage of mind and hand. Today we're seeking integrated academics or contextual learning as a method of implementing this marriage of mind and hand.

In The Aims of Education by Whitehead (1958) the following thoughts occur:

- Technical education is, in the main, training in the art of utilizing knowledge for the manufacture of material products. Such training emphasizes manual skill.
- In estimating the importance of technical education we must rise above the exclusive association of book learning. Firsthand knowledge is the ultimate basis of intellectual life. To a large extent book learning conveys secondhand information, and as such can never rise to the importance of immediate practice. The secondhand world is the secret of mediocrity.
- I laid down as an educational axiom that in teaching you will come to grief as soon as you forget that your pupils have bodies.
- In simpler language, education should provide the pupil with something he knows well and something he can do well. This intimate union of practice and theory aids both. The intellectual does not work best in a vacuum. The

stimulation of creative impulse requires, especially in the case of a child, the quick transition to practice. Geometry and mechanics, followed by workshop practice, gained in the reality without which mathematics is verbiage.

- There is no alternative to technical education, which relies on hands-on application and is not an empty formula. Near passive observation is not sufficient. One acquires vivid insight into the properties of the object thereby produced. If you want to understand anything, make it yourself, is a sound rule. Your faculties will be alive, your thoughts become vivid by immediate translation into acts. Learning comes from seeing the limits of application.

- The peculiar merit of a scientific education should be the encouragement of basic thought upon firsthand observation. The merit of a technical education is that it follows the deep natural instinct to translate thought into manual skill and manual activity into thought.

- We want to consider a curricula which will place students in the position of having technical skills useful to the community.

A Selective History of Modern Educational Reform Leading to the National Skill Standards Movement with an Emphasis on Technical Education

Historically the states have granted authority over public education to local school districts, particularly in matters of curricula instruction. This gave the custody of curricula development to teachers and textbook publishers (Massell, Krist & Hoppe, 1997). But the publication of A *Nation at Risk* (National Commission on Excellence in Education, 1983) set off a fire storm of educational reform activity. Growing concern about the educational preparation of the nation's youth prompted President Bush and state governors to call an educational summit in September 1989 which produced *Goals 2000.* Congress established a bipartisan Council on Education Standards and Testing in June 1991. Six months later The National Council on Education Standards and Testing (NCEST) issued a report recommending national content standards and a national system of assessments based upon the new standards (Wixson & Dutro, 1998).

A standards-based view of reform holds that once broad agreement on what is to

be taught and learned has been achieved, everything else in the education system can be redirected toward reaching higher standards. To promote this view, the U.S. Department of Education made awards in 1991 and 1992 to broad-based groups of scholars and teachers who would develop voluntary national standards in science, history, the arts, civic, geography, foreign languages, and English language arts. The Clinton Administration in support of the same agenda made *Goals 2000* the centerpiece of its education initiatives. In 1990, The National Board for Professional Teaching Standards began a process of developing standards to guide the creation of assessments for the advanced certification of teachers (Wixson & Dutro, 1998).

The Secretary's Commission on Achieving Necessary Skills (SCANS) was asked to define the know-how needed in the workplace and to consider how this know-how is best assessed. This commission issued its first report in July 1991. That report, *What Work Requires of Schools*, listed basic work place competencies.

It said effective workers can productively use:

- *Resources* - they know how to allocate time, money, materials, space, and staff.
- *Interpersonal skills* - They can work on teams, teach others, serve customers, lead, negotiate, and work well with people from culturally diverse backgrounds.
- *Information* - They can acquire and evaluate data, organize and maintain files, interpret and communicate, and use computers to process information.
- *Systems* - They understand social, organizational, and technological systems; they can monitor and correct performance; and they can design or improve systems.
- *Technology* - They can select equipment and tools, apply technology to specific tasks, and maintain and troubleshoot equipment.

Under the heading of Foundation Skills, the report also said that competent workers and high-performance work places need:

- *Basic skills* - reading, writing, arithmetic and mathematics, speaking, and listening.
- *Thinking skills* - the ability to learn, to reason, to think creatively, to make decisions, and to solve problems.

- *Personal qualities* - individual responsibility, self-esteem and self-management, sociability and integrity.

The SCANS report suggests restructuring schools around teaching SCANS foundation skills and competencies so that "learning to do" is integrated with "learning to know." This is reflective of vocational philosophy.

The Report of The Commission on the Skills of the American Workforce, produced by the National Center on Education and the Economy in 1990 titled, *America's Choice: High Skills or Low Wages,* states:

- No nation has produced a highly qualified technical workforce without first providing its workers with strong general education. But our children rank at the bottom on most international tests – behind children in Europe and East Asia and even behind children in some newly industrialized countries.

- Unlike virtually all of our leading competitors, we have no national system capable of setting high academic standards for the noncollege bound or of assessing their achievement against those standards.

- Other nations help virtually all their students reach a high educational standard. We do not.

- They provide professional education to noncollege bound students to prepare them and ease their school to work transition. We do not.

- Two factors stand in the way of producing a highly educated workforce: we lack clear standards and few students are motivated to work hard in school. One reason that students going right to work after school have little motivation to study hard is that they see little or no relationship between how well they do in school what kind of job they get after school. Other industrial nations have stringent performance standards that virtually all students must meet and that directly affect their employment prospects.

- We recommend: a new educational performance standard should be set for all students. This standard should be established nationally and benchmarked to the highest in the world. We also recommend the creation of a new performance based examination for which students can explicitly prepare. The assessment system would provide multiple opportunities for success rather than a single high-stakes moment of

possible failure. Most important, the examination is not intended as a sorting mechanism on the pattern of virtually all major tests now in use. Our goal is to set top standards that almost everyone will reach but not necessarily in the same time period. The system would establish objective standards for students and educators and would give employers an objective means to evaluate the accomplishments of students.

- Students could pursue these programs at a wide variety of institutions accredited to offer them, including high schools and community colleges. The system should be designed to make it possible for students to move easily between high school and college.

- Each occupational program should combine school and work based learning and balance general education and industry specific requirements. Clear qualifications in career progression should be established within each occupation.

Review of Agriscience Curriculum

Many state horticulture (agriscience) curriculum were created by teams of teachers in the field with assistance from their respective land grant universities. Such was the case in Texas, Michigan and Missouri.

Oklahoma formed the Oklahoma Occupational Competency Guide Committee that provided specific industry requirements for the career pathways. The committee represented a diverse cross-section of the state. Representatives were from rural and urban communities as well as small and large organizations. The committee identified occupational competencies, from both a state and national perspective, that students need to be successful in the workplace (Horticulture Occupational Competency Guide, 1996).

Illinois formed the Illinois Occupational Skill Standard and Credentialing Council representing business, industry and labor and working with the Illinois State Board of Education, in partnership with the Illinois Community College Board, Illinois Board of Higher Education, Illinois Department of Employment Security and Illinois Department of Commence and Community Affairs. Their vision was to develop a statewide system of industry-defined and recognized skill standards and credentials for all major skilled occupations providing strong employment and earning opportunities in Illinois (Illinois

Occupational Skill Standards, Greenhouse/Nursery Cluster, 1997).

Ohio's Division of Vocational and Adult Education created the Occupational Competency Analysis Profiles. The competency lists were verified by expert workers. The competencies evolved from a modified DACUM job analysis process involving business, industry, labor and community agencies throughout Ohio. The analysis identifies occupational, academic and employability skills needed to enter an occupation. They list core and advanced skills (Occupational Competency Analysis Profile: Horticulture, 1995).

The format of the Missouri curriculum (Horticulture Competency Profile, Greenhouse Competency Profile, 1993) was unique and user friendly. The competencies were listed on cardboard sheets with check boxes for a rating scale.

Texas describes its curriculum guide as an instruction delivery outline to graphically show how the various areas of instruction may be applied. It includes the unit and/or topic, hours of instruction, a cross walk to the Texas Essential Knowledge and Skills, and Instructional Material Service materials that may be used. The second section states the unit and topic goals and objectives to be met upon completion of each topic.

Illinois curriculum lists each skill standard, the conditions of performance, work to be performed, performance criteria, performance elements and assessment criteria.

Ohio lists the competencies and an extensive list of competency builders which are activities. Next are the employability skills formatted as competencies and competency builders. Academic job profiles and Work Keys levels are given for language arts, mathematics and science.

Summary

At the turn of the century the elite were educated and the common man worked on

farms or in factories. Today is the era of technology and the "common" man on farms and in factories need new skills. The only job security in contemporary America is being highly skilled and being able to learn complex new things very quickly (Tucker & Codding, 1998).

Education reform has been exploding since "A Nation At Risk" was published in 1983. Performance standards, credentialing and industry input has changed career and technical education. Most career clusters have adopted Nation Skills Standards except agriculture. The National Skill Standards Board in Washington, D.C. looks at skills and their assessment and checks that labor, industry and educators are involved in the development process. A Civil Rights expert does the final review of the skills and assessments.

Several states Horticulture curriculum was reviewed to develop the instrument. Many of the curriculum were developed by involving industry labor and educators within their state. The missing piece is a national perspective of industry, labor and educators from multiple states combined into one curriculum addressing skills and assessment.

CHAPTER III

Methodology

The Purpose

The purpose of this study was to:

1. Determine the perceptions of members of The Bedding Plants International, Inc. and agriscience educators about greenhouse grower skill requirements.
2. Identify standards for important skills, best method of assessment, and where the skills can be acquired for the job title of greenhouse grower.

Specific objectives of the study were to:

1. Identify the important skills needed for employment for the job title of greenhouse grower as perceived by Bedding Plants International members and agriscience teachers in California, Florida and Michigan.
2. Describe where these skills for the job title of greenhouse grower can best be acquired as perceived by members of Bedding Plants International and agriscience teachers in California, Florida and Michigan.
3. Determine the best method of assessing the skills for the job title of greenhouse grower as perceived by members of Bedding Plants International and agriscience teachers in California, Florida and Michigan.
4. Identify any national differences in the perceptions of members of Bedding Plants International and agriscience teachers in California, Florida and Michigan relating to the important skills, where the skills can be acquired or the best methods of assessing the skills for the job title of greenhouse grower.

Research Design

The design of this study is a descriptive survey. The purpose of descriptive investigation is: (a) to secure evidence concerning an existing situation or current condition; (b) to identify standards or norms with which to compare current conditions, in order to plan other steps; and (c) to determine how to make the next step. This type of research does not involve administration or control of a treatment (Ben-Horim and Levy,

1984, p.1-2).

This design was used to collect and describe: specific skills of a greenhouse grower; detailed subsets or benchmarks (objectives) of the skills; where the skills can best be taught; and, how to assess if the skill level has been attained at an employable level as perceived by members of Bedding Plants International and high school agriscience teachers in California, Florida and Michigan. Demographic information from both groups was obtained. A mail survey following Dillman (1978) procedures was used in this study because of the large number of subjects to be contacted.

Populations and Samples

Bedding Plants International (BPI) is an organization of greenhouse owners, workers, educators and suppliers. A list of members that are greenhouse owners and workers who are not suppliers or educators was provided by BPI. Bedding Plants International membership in the year 2000 was 860 members with 498 being greenhouse owners and workers. International members were removed from the population list. Multiple names at any business address were reduced to one for the population list. After narrowing the population using these selection criteria, a random sample was used to draw a sample of 295 BPI members, who received survey packets.

Teachers' lists were generated from the top three greenhouse production states in the United States according to rankings based on the United States Department of Agriculture Statistics for Floriculture 1998. The top three production states were California, Florida and Michigan. The Agricultural Educators Directory (1999) was used to obtain addresses. The three states' Departments of Education were contacted to limit the mailings to high school agriscience teachers who taught plant science or horticulture curriculum.

The California Department of Education could identify those teachers certified to teach horticulture. California requires additional course work to receive certification. The State Department of Education in California provided a list of certified horticulture teachers from which the random sample was drawn. In Michigan and Florida, all teachers are certified for agriscience. The entire agriscience teacher population of these states made up the list from which the random sample was drawn using a proportional sample from each state. Because of the greater number of teachers from Florida, an oversampling of teachers was made from California and Michigan, with teachers in Florida undersampled. The total available population in each state from which the samples were drawn was: California 117, Florida 245 and Michigan 113. A total of 331 surveys were sent to agriscience teachers: 95 California horticulture teachers, 144 Florida agriscience teachers and 92 Michigan agriscience teachers.

Agriscience certified teachers in Florida and Michigan may teach natural resources, animal science, crop production, agricultural mechanics, plant science or horticulture. Since Florida and Michigan teachers may have received the survey but did not teach plant science or horticulture, the following question was on the instruction page of the survey:

Agriscience teachers only: Do you teach horticulture or plant science?
Check one: (a) yes (b) no.
If no, please return the survey unanswered.

Development of the Instrument

Development of the survey instrument occurred in these stages: (a) construction of instrument (b) review of instrument by a panel of experts (c) revisions and rewriting of the instrument (d) field testing of the instrument (e) revisions and final reproduction.

The Instrument

The survey instrument questions relating to skills was created based on: curricula from Illinois (1997), Ohio (1995), Texas (1998), Oklahoma (1996) and Missouri (1993); text books (McMahon, 1992; Reiley and Shry, 1991; Richardson and Moore, 1980); the Dictionary of Occupations; horticulture credential granting tests (National Occupational Center for Testing Inc.), and *Defining A Grower's Responsibilities* (Biernbaum, 1995). Curriculum from the following states were used to identify tasks, duties, exit skills, objectives and competencies for the skills list: Occupational Competency Analysis Profile: Horticulture (Ohio 1995); Curriculum Guide, Horticultural Plant Production, Agriscience 362 (Texas 1998); Horticulture Occupational Competency Guide (Oklahoma 1996); Illinois Occupational Skill Standards, Greenhouse/Nursery Cluster, (Illinois 1997); Horticulture Competency Profile, Greenhouse Competency Profile (Missouri 1993), and an unpublished greenhouse curriculum for Michigan (1993). The instrument was divided into two sections (see appendix C).

Section I

1. How important is the skill. There were 19 skills listed. The responses were a Likert-type scale; very important, important, no opinion, not very important, and not important at all.

2. Are these items necessary parts of the skill? Three to eight benchmarks (objectives) were listed for each skill. The responses were: yes, no and I don't know.

3. This skill can best be acquired through which of the following methods? Check one. The responses were: in a high school horticulture (agriscience) program, in a certificate or associate degree program, in a bachelor degree program, in an advanced degree program, on the job training, or other (specify).

4. What is the best way to assess (determine) if a person knows this skill at an acceptable employment level? Check one. The responses were: written exam, oral exam, timed hands-on exam, observation and has a certificate or degree.

5. A space was provided to list additional skills not contained in the survey.

6. A space was provided for comments.

Section II

Demographic questions for industry and teachers included: state in which employed; number of years employed; what should be the minimum education of a greenhouse grower; beginning and experienced wages of a greenhouse grower; and what type of covering is used for growing.

Teachers were additionally asked: if they had a school greenhouse; the greenhouse size in square feet; and what do your students do after graduation.

BIP members were additionally asked: the number of people employed in peak season; the number of people employed all year; size of their operation under cover; their education level; what state their growing conditions was most like; and their job title.

The Expert Panel

The instrument was presented to experts including the Faculty of Michigan State University departments of Agricultural and Extension Education, Horticulture and Education, a commercial greenhouse specialist with Michigan Cooperative Extension Service, a certified Michigan agriscience teacher, and an assessment specialist (Appendix D).

Revisions and Rewriting

All revisions, formatting and rewriting were based upon feedback from the expert panel and field testing.

Field Testing

A field test was taken by six selected greenhouse growers and seven persons assisting or teaching high school horticulture that were not part of the survey sample

(Appendix E).

Validity

Validity refers to the extent to which an instrument measures what it is intended to measure. Reliability is the extent to which the measuring device is consistent in measuring whatever it measures (Ary, Jacobs & Razavieh 1990, p. 256). The validity was addressed through a review by the expert panel.

Content – Related Evidence

Content-related evidence was gathered for the validity of the survey used in this study. It was important that the sample be representative of the total content universe, that is, to ensure that it was a valid sample (Ary, Jacobs & Razavieh, 1990).

Content-related evidence was not expressed in a numerical form. Gathering such evidence is essentially based on judgment. It involves a careful and critical examination to determine if the content and objectives measured by the questions are representative of those that constitute the content domain. The items in the survey were determined to represent the course and objectives as stated in the curriculum guides, a syllabus and text (Ary, Jacobs, & Razavieh 1990).

The skills list was constructed from these sources: selected and reviewed multiple states' agriscience and horticulture curricula; an unpublished curricula; text books; credential granting tests; the Dictionary of Occupations, and an article from *Greenhouse Growers*.

The methods of assessment list was constructed from personal teaching experience, assessment workshops and educational colleagues.

The list of places where greenhouse growers can acquire the necessary skills was constructed from personal knowledge of the field, Internet searches and discussions with

agriscience career and technical advisors employed in various State Departments of Education and Land-grant university faculty.

To obtain the external evaluation of content validity, a panel of experts examined the question content systematically and evaluated its relevancy to the specific universe. All agreed that the questions represented the content domain adequately. The instrument was then sent for field testing to have the validity of the instrument assessed.

A characteristic of criterion–related evidence is that a criterion must be reliable. This means that the criterion must be a consistent measure of the attribute over time or from situation to situation (Ary, Jacobs, & Razavieh 1990). Field testing addressed this issue.

A content criterion should be free from bias. That is, the scoring of a criterion measure should not be influenced by subjective factors. In order to avoid bias, criterion explicit instructions were given about the characteristic to be rated and how the rating was to be done. The more objective the rating procedure, the less biased it will be in the criterion (Ary, Jacobs, & Razavieh 1990).

Reliability

Reliability was addressed through field testing. Cronbach's alpha coefficients were used to determine the internal consistency of the reliability of the items measuring the 19 skills on the surveys. The resultant alpha coefficient of .83 indicated the skills had adequate internal consistency to be considered reliable.

Data Collection and Analysis

Data Collection

Permission from the University Committee for Research on Human Subjects was received July 2, 1999 and renewed on June 28, 2000 (Appendix A).

To manage incoming data, teacher surveys had a green cover and industry surveys had a yellow cover. Teacher surveys were mailed in May, 2000. The second mailing was accomplished in the fall because not all agriscience teachers are employed during the summer. With the second package to nonrespondents mailed in November of 2000 followed by a postcard. The industry dates were selected based on crop schedule downtimes. Surveys were mailed in July of 2000 followed by a postcard. A second complete package was mailed to nonrespondents in November 2000 (Appendix B).

Following Dillman's recommendation a token pen was included in the first mailing.

The respondents in both groups were classified into two groups based on when they returned their surveys. Among teachers (n=77, 64.7%), surveys returned in May and June were considered early returns, with responses received in July and August considered early returns for industry (n=89, 65.4%). Surveys received in November and December were included in the late returns. Forty-seven (34.6%) were received during these months from industry and 42 (35.3%). The two groups, early and late returns, were used as independent variables in t-tests for two independent samples to determine if there was a difference on the 19 skills based on when the participants returned their surveys. Statistically significant differences were found on two of the 19 skills. The first skill with a significant difference was "How important is the plant propagation skill?" The comparison of the mean scores indicated that late returners had a mean score of 1.61 (n=.77) which was significantly higher than the mean score of 1.30 (SD=.46) obtained for the early returners t (250) = -4.04, p<.001. The second skill with a significant difference was "How important is the knowledge of plant physiology and growth?" When the two groups were compared, late returnees had a mean score of 1.69 (SD=.79), which was

significantly higher than the mean score for the early returnees ($\underline{M}$=1.42, SD=.59); $\underline{t}$ (242) = -3.01, p=.003. The remaining skills did not differ among the early and late returnees. Based on the lack of significant results between early and late returnees, the two groups (early and late returnees) can be combined for both teachers and industry for use in subsequent analyses. See Appendix J for results of the data analysis.

Analysis of Data

A total of 331 teacher surveys was distributed, with 144 teacher surveys received for a response rate of 43%. Three had the wrong address, three were unusable, and 19 had checked that they did not teach plant science or horticulture. A total of 119 teacher surveys was analyzed. A total of 295 industry surveys was distributed and 141 industry surveys were received for a response rate of 48%. Five surveys were unusable, with industry returns from 36 states. A total of 255 cases was analyzed, including 136 (53.3%) industry and 119 (46.7%) teacher cases.

Industry members were asked which state their growing conditions were most like in hopes of running a regional analysis. The breakdown was as follows: California 14.9%, Florida 22% and Michigan 63.1%. A new geographic region variable was created based on the states in which the respondents were employed.

> West of the Mississippi included: California, Oregon, Washington, Colorado, Idaho, Iowa, Kansas, Hawaii, New Mexico, North Dakota, Montana, South Dakota, Nebraska, and Alaska.
>
> North of the Mason-Dixon line included: Michigan, Indiana, New York, Minnesota, Pennsylvania, Illinois, Massachusetts, Wisconsin, Ohio, New Jersey, New Hampshire, Maryland and Rhode Island.
>
> South of the Mason-Dixon line included: Florida, Virginia, Mississippi, Alabama, North Carolina, Oklahoma, Tennessee, Kentucky and Missouri.

This gave a regional breakdown of: West of the Mississippi 25.1%, North 51%, South 23.9%.

The survey asked that wages be reported as hourly wages. Some respondents wrote minimum wage, which was coded as $5.25. If respondents gave annual wages, the amount was divided by 2,080 (52 weeks x 40 hours per week).

Not all respondents answered each question. Some gave multiple answers which were coded as missing, except on questions where the skill can best be acquired (taught) and how to assess if a person has the skills at an employable level.

Statements from the survey instrument were coded and transferred to a personal computer. The data was analyzed using the Statistical Package for Social Sciences (SPSS), Grad Package Version 8. Descriptive statistics such as means, modes, medians, standard deviation, standard error, cross tabulations, frequencies, Chi Squares, and nonparametric tests were used to analyze the data. In summary, due diligence was employed and all recommended procedures were followed to obtain useful, accurate results to fulfill the purpose of the study.

CHAPTER IV

Findings

This study asked Bedding Plants International members (industry) and agriscience educators (teachers) in California, Florida and Michigan: what are the important skills necessary for the job title of greenhouse growers; where these skills can best be acquired (taught); and how these skills can best be assessed. Demographic information was also collected.

Chapter IV is divided into five sections.

1. Description of the demographic information of respondents.
2. What are the important skills necessary for the job title of greenhouse grower.
3. Where these skills can best be acquired (taught).
4. How to assess if a person knows the skills at an employable level.
5. Identification of regional differences.

Description of Demographics

The total analyzed cases for this survey were 255, 136 (53.3%) were industry and 119 (46.7%) were teachers.

State Employed

Teacher respondents were employed in three states, California, Florida and Michigan. The number of teacher respondents were; Michigan (N=48), Florida (N=43) and California (N=28). (Table 1)

Table: 1

States Where Teachers Were Employed

State	N	%
California	28	23.6
Florida	43	36.1
Michigan	48	40.3
Total	119	100.0

Industry respondents were employed in 36 states. The states were: Alabama; Alaska; California; Colorado; Florida; Hawaii; Idaho; Illinois; Iowa; Kansas; Kentucky; Maryland; Massachusetts; Michigan; Minnesota, Mississippi, Missouri; Montana; Nebraska; New Hampshire; New Jersey; New Mexico ;New York; North Carolina; North Dakota; Ohio; Oklahoma; Oregon; Pennsylvania; Rhode Island South Dakota; Tennessee; Virginia; Washington; and Wisconsin. The largest group was from Michigan representing 16.2% of the total industry surveys. (Table 2)

Table 2

States Represented by Industry Respondents

State	N	%	State	N	%
Alabama	2	1.5	Montana	6	4.4
Alaska	1	0.7	Nebraska	1	0.7
California	4	2.9	New Hampshire	4	2.9
Colorado	6	4.4	New Jersey	2	1.5
Florida	5	3.7	New Mexico	1	0.7
Hawaii	2	1.5	New York	8	5.9
Idaho	1	0.7	North Carolina	3	2.2
Illinois	6	4.4	North Dakota	1	0.7
Indiana	4	2.9	Ohio	5	3.7
Iowa	4	2.9	Oklahoma	1	0.7
Kansas	1	0.7	Oregon	4	2.9
Kentucky	1	0.7	Pennsylvania	7	5.1
Maryland	2	1.5	Rhode Island	1	0.7
Massachusetts	3	2.2	South Dakota	1	0.7
Michigan	22	16.2	Tennessee	1	0.7
Minnesota	11	8.1	Virginia	3	2.2
Mississippi	1	0.7	Washington	3	2.2
Missouri	1	0.7	Wisconsin	7	5.1
Total				119	100.0

Years Employed

Teachers reported their years of employment as M=14.71 with a Standard Deviation of 9.66. The minimum time employed was 6 months and the maximum was 36 years.

Industry reported the years employment as M=25.99 with a Standard Deviation of 11.15. The minimum years reported was 2 and the maximum was 55.

Table: 3

Years Employed

Type of Respondent	Mean	SD	Range	
			Minimum	Maximum
Teacher	14.71	9.66	0.5	36
Industry	25.99	11.15	2.0	55

Size of Industry Operation Under Cover

Industry reported the size of their operation under cover. The survey offered the choice of less than one acre and the next size was two to five acres. The largest group of industry respondents' operations were two to five acres (42.2%) followed by one acre or less (31.1%). The West (19.4%), South (16.7%) and North (8.6%) had operations of eleven acres or more.

Table: 4

Size of Industry Operation Under Cover

Size of Operation	West		South		North		Combined	
	N	%	N	%	N	%	N	%
Less than two acres	14	38.9	2	11.1	26	32.1	42	31.1
Two to five acres	12	33.3	8	44.4	37	47.7	57	42.2
Six to ten acres	3	8.3	5	27.8	11	13.6	19	14.1
Eleven or more acres	7	19.4	3	16.7	7	8.6	17	12.6
No response	0	0.0	0	0.0	1	1.2	1	0.7
Total	36	100.0	18	100.0	83	100.0	136	100.0

Agriscience Teachers with Greenhouses

High school agriscience teachers (n=97) responded to the yes/no question: Do you have a high school greenhouse? The total yes responses were 82.2%. Of the 97 teachers responding, the percentage of yes answers by state was: California 100%, Florida 83.3%

and Michigan 70.8%.

Table: 5

Agriscience Teachers with Greenhouses

State	N	%
California	28	100.0
Florida	35	83.3
Michigan	34	70.8
Total	97	82.2

Size of High School Greenhouse

Teachers with greenhouses reported the square foot size of their greenhouses. The Mode was 800 square feet, the minimum was 20 square feet and the maximum was 174,240 square feet. One teacher in Florida reported having an acre under cover. The Mode for each state was: California 800 square feet, Florida 1,000 square feet and Michigan 3,000 square feet.

Table: 6

Size of High School Greenhouses in Square Feet

	Mode	Minimum	Maximum
All Teachers	800	20	174,240
In California	800	60	20,000
In Florida	1000	150	174,240
In Michigan	3000	20	10,000

What Do Your Student Do After High School Graduation

Teachers were asked what their students do after high school graduation expressed

in percentages. The responses were: obtain a job M=51.55, SD 30.98; obtain work in the horticulture industry M=18.19, SD 22.44; attend a horticulture certificate program M=5.06, SD 13.77; attend a community college to pursue horticulture studies M=5.93, SD 10.15; attend a university to pursue studies in horticulture M=3.55, SD 5.26.

Table: 7

What Do Your Students Do After High School Graduation (Percentage)?

Students after graduation	N	Mean	SD
Obtain a job	103	51.55	30.98
Work in the horticulture industry	101	18.19	22.44
Attend a certificate program for horticulture	99	5.06	13.77
Attend a community college for horticulture	99	5.93	10.15
Attend a university for horticulture	97	3.55	5.26

Type of Covering

Industry reported the following types of cover for their operation: fiberglass or rigid (N=60, 44.1%); glass (N=44, 32.4%); film plastic (N=77, 93.4%), and shade cloth (N=23, 16.9%). Teachers reported their greenhouses growing areas were: fiberglass or rigid (N=64, 53.8%); glass (N=14, 11.8%); film plastic (N=30, 25.2%), and shade cloth (N=20, 16.8%).

Regionally the fiberglass or rigid covering was used more in the west (N=23, 63.9%) and north(N=33, 40.2%) by industry. Teachers in the west (N=26, 92.9%) used fiberglass or rigid covering twice as much as teachers in the south (N=18, 41.9%) and north (N=20, 41.7%). Film plastic was used most often by industry in all regions west (N=33, 91.7%),south (N=17, 94.4%) and north (N=77, 93.9%).

Table: 8

Type of Greenhouse Covering Used

	Industry							
	West N=36		South N=18		North N=82		Total N=136	
Covering	N	%	N	%	N	%	N	%
Fiberglass	23	63.9	4	22.2	33	40.2	60	44.1
Glass	9	25.0	4	22.2	31	37.8	44	32.4
Film Plastic	33	91.7	17	94.4	77	93.9	127	93.4
Shade Cloth	8	22.2	5	27.8	10	12.2	23	16.9
	Teacher							
	West N=28		South N=43		North N=48		Total N=119	
Covering	N	%	N	%	N	%	N	%
Fiberglass	26	92.9	18	41.9	20	41.7	64	53.8
Glass	1	3.6	4	9.3	9	18.8	14	11.8
Film Plastic	4	14.3	12	27.9	14	29.2	30	25.2
Shade Cloth	6	21.4	13	30.2	1	2.1	20	16.8

Industry Job Titles

Industry reported their job titles: owner (N=51, 37.5%); grower (N=16, 11.8%); owner and grower (N=42, 30.9%); business manager (N=6, 4.4%), and other (N=21, 15.4%). Other job titles specified by respondents were: nursery service manager; all of the above and then some; buyer; production manager/vice president; production manager; buyer/department manager; retired active manager; grower/general manager, and plant production manager-I'm only the grower.

Table: 9

Industry Job Title

Job title	N	%
Owner	51	37.50
Grower	16	11.80
Owner and grower	42	30.90
Business Manager	6	4.40
Other (specify)	21	15.40
Total	136	100.00

Industry's Highest Level of Education Completed

Industry members reported that (N=62, 45.6%) had a bachelors degree. The next highest level (N=19, 14.0%) had some college. Most of the industry people responding to the survey were owners or owner growers. Bachelor degrees by region were: West (N=22, 61.1%); South (N=11, 61.1%), and North (N=29, 35.4%).

Table: 10

Industry's Highest Level of Education Completed

Education	N	%
Some high school	2	1.50
Graduated from high school	16	11.80
Some college	19	14.00
A certificate program	12	8.80
An associate degree	8	5.90
A bachelor's degree	62	45.60
Some graduate school	8	5.90
A graduate degree	9	6.60
Total	136	100.00

Number of Industry Employees All Year and During Peak Season

The industry (N=136) reported that during the entire season the number of employees at their operation was: M= 32.1 (SD= 63.6); Median = 12; Minimum = 0, Maximum = 600. During the peak seasons the figure rose to: Mean 63.3, Standard Deviation 104.8; Median 32.5; Minimum 2, Maximum 1,000.

Regionally the number of employees all year broke down as follows. West: Mean 35.5, SD 45; Minimum 1, Maximum 200. South: Mean 49.3, SD 66.1; Minimum 8, Maximum 250. North: Mean 26.7, SD 69.5; Minimum 0, Maximum 600.

Regionally the number of employees during the peak season in the West was: Mean 69.8, SD 81.2; Minimum 2, Maximum 350. South: Mean 79.8, SD 97.7; Minimum 9, Maximum 400. North: Mean 56.8, SD 115.4; Minimum 2, Maximum 1000.

Table: 11

Number of Industry Employees At Your Operation All Year

	N	M	SD	Min	Max
Industry	136	32.1	63.6	0	600
West	36	35.5	45.0	1	200
South	18	49.3	66.1	8	250
North	82	26.7	69.5	0	600

Table: 12

Number of People Employed At Your Operation During Peak Season

	N	M	SD	Min	Max
Industry	136	63.3	104.8	2	1000
West	36	69.8	81.2	2	350
South	18	79.8	97.7	9	400
North	82	56.8	115.4	2	1000

Your Growing Conditions are Most Like Which State

Industry was asked, "Your growing conditions are most like which state?" They responded: California (N=10, 7.4%), Florida (N=13, 9.6%), Michigan (N=113, 83.1%).

Table: 13

Your Growing Conditions are Most Like Which State

	N	%
California	10	7.4
Florida	13	9.6
Michigan	113	83.1
Total	136	100.0

Minimum Education of Greenhouse Growers

Industry and agriscience teachers were asked: What do you think should be the minimum educational background for greenhouse growers? Industry responded that the minimum education for greenhouse growers should be: an associate degree (N=36, 26.5%); graduate from high school (N=33, 24.3%); a bachelors degree (N=24, 17.6%), and a certificate program (N=17, 12.5%). Teachers responded: a certificate program (N=37, 31.1%); graduate from high school (N=34, 28.6%), and an associate degree (N=19, 16.0%).

Table: 14

What Do You Think Should be the Minimum Educational Background for Greenhouse Growers

	Industry		Teacher	
	N	%	N	%
Some high school	3	2.2	2	1.7
Graduated from high school	33	24.3	34	28.6
Some college	18	13.2	7	5.9
A certificate program	17	12.5	37	31.1
An associate degree	36	26.5	19	16.0
A bachelor's degree	24	17.6	9	7.6
Some graduate school	3	2.2	6	5.0
A graduate degree	0	0.0	0	0.0
No response	2	1.5	5	4.2
Total	136	100.0	119	100.0

Salary Range of Greenhouse Growers

Industry reported the beginning hourly wage of growers at a Mean of $10.43 with a standard deviation of $3.05. They reported the wages for an experienced grower to be at a Mean of $18.26 with a standard deviation of $6.27.

Teachers reported a beginning wage at a Mean of $9.08 with a standard deviation of $3.38. They reported wages for experienced growers at a Mean of $17.44 with a standard deviation of $9.89.

Table: 15

Beginning Wages and Wages for Experienced Greenhouse Growers

	Industry beginning wage of growers	Teacher beginning wage of growers	Industry wages of experienced growers	Teacher wages of experienced growers
N	120	102	118	102
Mean	$10.43	$9.08	$18.26	$17.44
SD	$3.05	$3.38	$6.27	$9.89

What are the Important Skills Necessary for the Job Title of Greenhouse Grower.

To address the first object industry and teachers were asked to rate how important the skills listed were on a 1-5 scale, with 1 being very important and 5 being not important at all. The following skills were considered very important or important by 90% or more of the respondents: plant propagation; work relationships; select, grade and harvest plants for delivery; knowledge of plant physiology and growth; height control/cultural manipulation; prepare soil and growing media; crop irrigation; monitor and operate environmental equipment; grow plants; fertilize plants; diagnose insect, cultural and disease problems; correct insect cultural and disease problems; plant identification; scheduling of crops, maintain, repair, and safely operate equipment and maintain a safe work environment. The Mean scores ranged from: 1.22 to 1.75 for work relationships and maintain, repair and safely operate equipment respectively. Two other skills were rated important: monitor, manage and analyze financial performance of greenhouse M=1.87, SD 0.84, and receive, unpack and place incoming plants and materials M=1.80, SD 0.78. The only skill not thought to be important for greenhouse growers was: assists in erecting greenhouses, film houses and similar facilities M=2.55, SD 1.05. Table 16 lists all the skills.

Table 16

How Important is the Following Skill

1 = very important; 2 = important; 3 = no opinion; 4 = not very important; 5 = not important at all									
Skills	Combined (N=255)			Industry (n=136)			Teacher (n=119)		
	N	M	SD	N	M	SD	N	M	SD
Work relationships	250	1.22	0.44	135	1.26	0.49	115	1.17	0.37
Fertilize plants	239	1.25	0.51	126	1.22	0.52	113	1.28	0.49
Crop irrigation	246	1.28	0.49	134	1.11	0.32	112	1.48	0.57
Grow plants	248	1.28	0.61	133	1.17	0.54	115	1.40	0.66
Diagnose insect, cultural, and disease problems	241	1.28	0.51	128	1.21	0.46	113	1.36	0.55
Maintain a safe work environment	248	1.29	0.46	133	1.39	0.49	115	1.17	0.38
Correct insect, cultural, and disease problems	241	1.30	0.51	127	1.21	0.41	114	1.40	0.59
Scheduling of crops	250	1.37	0.54	135	1.24	0.43	115	1.54	0.61
Plant propagation	253	1.40	0.60	135	1.51	0.69	117	1.26	0.45
Knowledge of plant physiology and growth	244	1.51	0.68	129	1.60	0.76	115	1.42	0.56
Plant identification	239	1.56	0.63	126	1.71	0.65	113	1.40	0.56
Height control/cultural manipulation	241	1.57	0.61	128	1.37	0.52	113	1.81	0.62
Select, grade, and harvest plants for delivery	240	1.59	0.70	18	1.64	0.75	112	1.54	0.63
Prepare soil and growing media	243	1.60	0.81	127	1.74	0.92	116	1.45	0.65
Monitor and operate environmental equipment	240	1.74	0.74	127	1.66	0.76	113	1.83	0.71
Maintain, repair, and safely operate equipment	246	1.75	0.77	132	1.80	0.79	114	1.68	0.75
Receive, unpack, and place incoming plants and materials	244	1.80	0.78	127	1.81	0.82	117	1.79	0.74
Monitor, manage, and analyze the financial performance of greenhouses	247	1.87	0.84	133	193	0.94	114	1.79	0.70
Assist in erecting greenhouses, film houses, and similar faciltites	244	2.55	1.05	128	2.73	1.11	116	2.35	0.95

Industry and teachers responded to a question about the necessary parts of the skills. These "parts" are benchmarks (objectives) of the skill. Industry and teachers could respond yes, no or I don't know to the parts of the skills.

Ninety benchmarks (objectives) were supported (answered yes, they were part of the skills) by 70% or more of the respondents. Benchmarks (objectives) with less than 70% yes answers were considered to be not necessary by industry. These were: propagate by bulb; propagate by tissue culture; is involved with marketing; monitor runoff and percolation rates of excess water; use ebb and flow systems (subirrigation and recirculation); check weight to determine appropriate watering; operate a plug seeder, foot candle meter, recording thermometers; blackout systems; using light integral or sum of all the light for each day; using graphical tracking (based on plant measurement);using leaf unfolding graphs; keeping nutrient level graphs; use hydroponics system; identification of plants by scientific name; frame construction; replacing glass (reglazing); floor installation; install environmental controls and bench construction.

Benchmark (objectives) with below 70% yes answers were not considered necessary parts of the skill by teachers. They were: propagation by tissue culture; use ebb and flow systems (subirrigatin and recirculation); foot candle meters; blackout systems; using graphical tracking (based on plant measurement); using leaf unfolding graphs; plant identification by cultivar and floor installation. (Table 17)

Table 17

Are These Necessary Parts of the Skills?

Necessary Parts of the Skills	Combined					
	Yes		No		Don't Know	
	N	%	N	%	N	%
1: Plant Propagation	212	85.5	32	12.9	4	1.6
Propagate by seeds (open tray)	204	81.9	35	14.1	10	4.0
Propagate by seed for plug production	245	96.8	8	3.2	0	0.0
Propagate by cuttings	144	60.8	73	30.8	20	8.4
Propagate by bulb	103	43.5	100	42.2	34	14.3
Propagate by tissue culture						
2: Monitor, manage, and analyze the financial performance	196	80.7	30	12.3	17	7.0
Uses the proper computer software	174	71.6	21	8.6	48	19.8
Understands the concept of square foot weeks	219	90.1	5	2.1	19	7.8
Understands fixed costs	211	86.8	12	4.9	20	8.2
Understands how to calculate variable costs	184	75.5	41	16.9	18	7.4
Is involved in marketing						
3: Work relationships	251	99.6	1	0.4	0	0.0
Works well with others	200	79.4	34	13.5	18	7.1
Provides written action plan and/or schedules for each crop	227	90.4	6	2.4	18	7.2
Communicates if crop size or market dat cannot be met	253	100.0	0	0.0	0	0.0
Manages and communicates with co-workers						
4. Receives, unpacks, and places incoming plant material	240	98.0	2	0.8	3	1.2
Inspects incoming plants for insects	240	97.6	2	0.8	4	1.6
Inspects incoming plants for diseases	233	95.1	7	2.9	5	2.0
Checks incoming plant root health						
5. Selects, grades, harvests, and prepares plants for delivery	206	85.8	19	7.9	15	6.3
Decreases fertilizer level if necessary	228	95.0	8	3.3	4	1.7
Responsible for moist media and dry foliage	219	91.6	13	5.4	7	2.9
Maintain proper spacing	207	86.6	15	6.3	17	7.1
Communicate packing methods	215	90.0	14	5.9	10	4.2
C0ommunicate light and temperature requirements						

Table 17 (cont'd).

Necessary Parts of the Skills	Combined					
	Yes		No		Don't Know	
	N	%	N	%	N	%
6. Knowledge of plant physiology and growth						
Photosynthesis	220	90.5	17	7.0	6	2.5
Respiration	221	90.9	13	5.3	9	3.7
Transpiration	222	91.7	13	5.4	7	2.9
Light intensity	299	95.9	6	2.5	4	1.6
Temperature requirements	238	97.5	4	1.6	2	0.8
Photoperiod	229	94.2	7	2.9	7	2.9
Water relationships	242	99.2	0	0.0	2	0.8
Plant nutrients	240	98.4	1	0.4	3	1.2
7. Height control/cultural manipulation						
Chemical or growth regulators	231	95.5	6	2.5	5	2.1
Proper planting depth	218	90.8	20	8.3	2	0.8
Position and spacing of seedlings and rooted cuttings	228	94.6	9	3.7	4	1.7
Pinching	236	97.9	4	1.7	1	0.4
Plant support/staking	196	81.7	29	12.1	15	6.3
8. Prepares soil and growing media						
Quality and uniformity of media	241	98.8	3	1.2	0	0.0
Understands uses of soil components, such as peat and perlite	234	96.7	5	2.1	3	1.2
Understands amendments, such as lime, fertilizer, and wetting agents	235	96.7	5	2.1	3	1.2
9. Crop irrigation						
Knows when, how, and how much water to use	248	100.0	0	0.0	0	0.0
Minimize water use	214	87.0	25	10.2	7	2.8
Monitor run-off and percolation rates of excess water	170	69.4	43	17.6	32	13.1
Test for water quality	218	89.0	21	8.6	6	2.4
Check uniformity of application	235	95.9	5	2.0	5	2.0
Use an ebb and flow system (subirrigation and recirculation)	143	59.1	67	27.7	32	13.2
Check weight to determine appropriate watering	169	69.5	47	19.3	27	11.1

Table 17 (cont'd).

Necessary Parts of the Skills	Combined					
	Yes		No		Don't Know	
	N	%	N	%	N	%
10. Maintain, repair, and safely operate equipment						
Water filtration systems	193	77.8	39	15.7	16	6.5
pH meter	226	91.5	13	5.3	8	3.2
Check fertilizer injectors with electrical conductive meters	207	83.8	24	9.7	16	6.5
Check fertilizer injectors by monitoring stock solution	219	89.0	16	6.5	11	4.3
Operate a plug seeder	165	67.1	58	23.6	23	9.3
Water treatment	174	71.3	46	18.9	24	9.8
Pesticide delivery system	226	91.1	15	6.0	7	2.8
11. Monitor and operate environmental controls						
Foot-candle meter	148	60.9	57	23.5	38	15.6
Recording thermometer	186	76.5	38	15.6	19	7.8
Sensor for environmental computer control	180	73.8	36	14.8	28	11.5
Use computer controls	180	74.1	37	15.2	26	10.7
Blackout system	155	64.9	48	20.1	36	15.1
Supplemental lighting system	199	82.6	28	11.6	14	5.8
Heating and cooling systems	228	94.6	7	2.9	6	2.5
12. Grow plants						
Using DIF (differences between day and night temperature)	210	84.7	24	9.7	14	5.6
Using light integral or sum of all the light for each day	158	64.5	52	21.2	35	14.3
Using graphical tracking (based on plant measurement)	144	58.3	55	22.3	48	19.4
Using leaf unfolding graphs	121	49.2	68	27.6	57	23.2
Monitor bud development	197	79.8	19	7.7	31	12.6
13. Fertilize plants						
Accurate and routine on-site or laboratory tests of media and plants to verify nutrient levels.	203	82.5	32	12.5	11	4.5
Careful analysis of test results	211	86.1	22	9.0	12	4.9
Keep nutrient level graphs	146	60.1	65	26.7	32	13.2
Thorough interpretation of results and implement changes, if necessary	209	86.4	18	7.4	15	6.2
Use of ebb and flow type systems (subirrigation and recirculation)	133	55.2	68	28.2	40	16.6
Use of injection systems	221	90.6	10	4.1	13	5.3
Use of hydroponic systems	112	46.3	91	37.6	39	16.1

Table 17 (cont'd).

Necessary Parts of the Skills	Combined					
	Yes		No		Don't Know	
	N	%	N	%	N	%
14. Diagnose insect, cultural, and disease problems	228	93.1	11	4.5	6	2.4
Use IPM and crop management strategies	233	94.7	9	3.7	4	1.6
Use scouting technique with yellow sticky cards	202	82.4	25	10.2	18	7.3
Monitor biological controls	247	100.0	0	0.0	0	0.0
Knowledge of common insects	247	100.0	0	0.0	0	0.0
Knowledge of common diseases	245	100.0	0	0.0	0	0.0
Knowledge of common crop cultural problems	228	93.4	11	4.5	5	2.0
Records of activities related to crops						
15. Correct insect, cultural, and disease problems	239	97.2	3	1.2	4	1.6
Using chemicals	226	92.2	10	4.1	9	3.7
Nonchemical means	243	98.8	1	0.4	2	0.8
Sanitation	213	87.7	15	6.2	15	6.2
Quarantine	211	86.8	17	7.0	15	6.2
Biological control	241	98.4	2	0.8	2	0.8
Weed control						
16. Identification of plant material	243	98.0	4	1.6	1	0.4
By common name, example: poinsettia	139	56.7	85	34.7	21	8.6
By scientific name, example: Euphorbia pulcherrima Wild	153	63.0	64	26.3	26	10.7
by cultivar, example: SUPJIBI						
17. Assist in erecting greenhouses, then film houses	162	68.5	50	21.2	24	10.2
Frame construction	136	58.1	71	30.3	27	11.5
Replacing glass (glazing)	188	79.7	31	13.1	17	7.2
Replacing film (reskinning)	121	52.2	80	34.5	31	13.4
Floor installation	148	63.2	57	24.4	29	12.4
Install environmental controls	173	73.6	42	17.9	20	8.5
Bench construction						

Table 17 (cont'd).

Necessary Parts of the Skills	Combined					
	Yes		No		Don't Know	
	N	%	N	%	N	%
18. Scheduling of crops	246	97.6	4	1.6	2	0.8
Determine finish date	242	96.0	6	2.4	4	1.6
Determine dates for market window	270	98.0	4	1.6	1	0.4
Determine planting dates	247	98.4	2	0.8	2	0.8
Proper temperature for development	241	96.0	8	3.2	2	0.8
Determine flowering dates	246	97.6	4	1.6	2	0.8
Determine when to pinch	247	98.0	4	1.6	1	0.4
Schedule fertilizer applications	242	96.0	8	3.2	2	0.8
Determine schedule for pest control						
19. Maintain a safe work environment	248	98.4	3	1.2	1	0.4
Knowledge of chemicals	252	99.2	0	0.0	2	0.8
Knowledge of protection standards for workers and self	249	98.4	2	0.8	2	0.8
Proper clothing	245	96.8	5	2.0	3	1.2
Proper and locked storage	249	98.0	2	0.8	3	1.2
Signs of re-entry for workers	246	97.2	5	2.0	2	0.8
Safety for public	244	96.4	4	1.6	5	2.0
Limit contamination of environment from excess fertilizer	249	98.4	3	1.2	1	0.4
Knowledge of safe disposal of chemicals						

Industry and educators had an opportunity to write in other necessary skills not listed in the survey. The most frequent responses were: six for training in business; three for common sense; four listed work ethics and six responded and suggested a second language-Spanish. All responses are in Appendix G.

Where these skills can best be acquired (taught)

To address the second research objective, respondents were asked to select one method of acquiring each skill. The choices were: In a high school horticulture (agriscience) program; in a certificate or associate degree program; in a bachelor degree program; in an advanced degree program; on the job training; other (specify). Support above 50% for any of the options was seldom reported by industry or teachers.

Industry chose on the job training as their first or second choice for most skills. They selected postsecondary education for the skills; monitor, manage and analyze the financial performance of a greenhouse; knowledge of plant physiology and growth; prepare soils and growing media; growing plants; fertilize plants; diagnose insect, cultural and disease problems; correct insect, cultural and disease problems; and scheduling of crops.

Teachers chose high school agriscience programs and postsecondary education as their first and second choices.

Industry and teachers had the option of listing other specific methods of acquiring the skill. Most often they used that option to select a combination of postsecondary and on the job training. For the skill, work relationships, one industry respondent listed Dale Carnegie Courses or Toast Masters. Some listed their sales representatives as sources of acquiring a skill, reading journals, and The Extension Service was mentioned once. A Teacher responded that Tech Prep was the best method.

Table 18

Methods to Acquire Skills

This skill can best be acquired through:	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 1: Plant Propagation	79	31.0	5	3.7	74	62.2
In a high school horticulture (agriscience) program	35	13.7	25	18.4	10	8.4
In a certificate or associate degree program	31	12.2	27	19.9	4	3.4
In a bachelor degree program	2	0.8	1	0.7	1	0.8
In an advanced degree program	76	29.8	67	49.3	9	7.6
On-the-job training	15	5.9	6	4.4	9	7.6
Other (specify)	16	6.3	5	3.7	11	9.2
Multiple responses	1	0.4	0	0.0	1	0.8
No Response	255	100.0	136	100.0	119	100.0
Total						
Skill 2: Monitor, manage, and analyze financial performance of a green house.						
In a high school horticulture (agriscience) program	28	11.0	4	2.9	24	20.2
In a certificate or associate degree program	72	28.2	33	24.3	39	32.8
In a bachelor degree program	87	34.1	63	46.3	24	20.2
In an advanced degree program	8	3.1	7	5.1	1	0.8
On-the-job training	21	8.2	14	10.3	7	5.9
Other (specify)	14	5.5	7	5.1		5.9
Multiple responses	16	6.3	5	3.7	11	9.2
No Response	9	3.5	3	2.2	6	5.0
Total	255	100.0	136	100.0	119	100.0
Skill 3: Work relationships						
In a high school horticulture (agriscience) program	45	17.6	2	1.5	43	36.1
In a certificate or associate degree program	47	18.4	27	19.9	20	16.8
In a bachelor degree program	25	9.8	17	12.5	8	6.7
In an advanced degree program	1	0.4	1	0.7	0	0.0
On-the-job training	92	36.1	65	47.8	27	22.7
Other (specify)	31	12.2	21	15.4	10	8.7
Multiple responses	12	4.7	3	2.2	9	7.6
No Response	2	0.8	0	0.0	2	1.7
Total	255	100.0	136	100.0	119	100.0

Table 18 (cont'd).

This skill can best be acquired through:	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 4: Receive, unpack, and place incoming plants and materials						
In a high school horticulture (agriscience) program	52	20.4	8	5.9	44	37.0
In a certificate or associate degree program	56	22.0	27	19.9	29	24.4
In a bachelor degree program	25	9.8	19	14.0	6	5.0
In an advanced degree program	1	0.4	0	0.0	1	0.8
On-the-job training	89	34.9	68	50.0	21	17.6
Other (specify)	11	4.3	5	3.7	6	5.0
Multiple responses	12	4.7	3	2.2	9	7.6
No Response	9	3.5	6	4.4	3	2.5
Total	255	100.0	136	100.0	119	100.0
Skill 5: Select, grade, harvest, and prepare plants for delivery						
In a high school horticulture (agriscience) program	32	12.5	0	0.0	32	26.9
In a certificate or associate degree program	62	24.3	25	18.4	37	31.1
In a bachelor degree program	32	12.5	23	16.9	9	7.6
In an advanced degree program	1	0.4	0	0.0	1	0.8
On-the-job training	90	35.3	71	52.2	19	16.0
Other (specify)	11	4.3	4	2.9	7	5.9
Multiple responses	12	4.7	2	1.5	10	8.4
No Response	15	5.9	11	8.1	4	3.4
Total	255	100.0	136	100.0	119	100.0
Skill 6: Knowledge of plant physiology and growth						
In a high school horticulture (agriscience) program	63	24.7	5	3.7	58	48.7
In a certificate or associate degree program	43	16.9	29	21.3	14	11.8
In a bachelor degree program	86	33.7	69	50.7	17	14.3
In an advanced degree program	9	3.5	6	4.4	3	2.5
On-the-job training	12	4.7	10	7.4	2	1.7
Other (specify)	13	5.1	4	2.9	9	7.6
Multiple responses	16	6.3	4	2.9	12	10.1
No Response	13	5.1	9	6.6	4	3.4
Total	255	100.0	136	100.0	119	100.0

Table 18 (cont'd).

This skill can best be acquired through:	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 7: Height control/cultural manipulation						
In a high school horticulture (agriscience) program	44	17.3	3	2.2	41	34.5
In a certificate or associate degree program	66	25.9	39	28.7	27	22.7
In a bachelor degree program	35	13.7	24	17.6	11	9.2
In an advanced degree program	0	0.0	0	0.0	0	0.0
On-the-job training	68	26.7	53	39.0	15	12.6
Other (specify)	16	6.3	7	5.1	9	7.6
Multiple responses	12	4.7	2	1.5	10	8.4
No Response	14	5.5	8	5.9	6	5.0
Total	255	100.0	136	100.0	119	100.0
Skill 8: Prepare soil and growing media						
In a high school horticulture (agriscience) program	70	27.5	8	5.9	62	52.1
In a certificate or associate degree program	63	24.7	42	30.9	21	17.6
In a bachelor degree program	47	18.4	37	27.2	10	8.4
In an advanced degree program	1	0.4	1	0.7	0	0.0
On-the-job training	39	15.3	34	25.0	5	4.2
Other (specify)	12	4.7	4	2.9	8	6.7
Multiple responses	11	4.3	2	1.5	9	7.6
No Response	12	4.7	8	5.9	4	3.4
Total	255	100.0	136	100.0	119	100.0
Skill 9: Crop irrigation						
In a high school horticulture (agriscience) program	43	16.9	2	1.5	41	34.5
In a certificate or associate degree program	54	21.2	27	19.9	27	22.7
In a bachelor degree program	34	13.3	17	12.5	17	14.3
In an advanced degree program	3	1.2	0	0.0	3	2.5
On-the-job training	86	33.7	77	56.6	9	7.6
Other (specify)	13	5.1	6	4.4	7	5.9
Multiple responses	14	5.5	4	2.9	10	8.4
No Response	8	3.1	3	2.2	5	4.2
Total	255	100.0	136	100.0	119	100.0

Table 18 (cont'd).

This skill can best be acquired through:	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 10: Maintain, repair, and safely operate equipment	25	9.8	5	3.7	20	16.8
In a high school horticulture (agriscience) program	76	29.8	37	27.2	39	32.8
In a certificate or associate degree program	40	15.7	25	18.4	15	12.6
In a bachelor degree program	10	3.9	2	1.5	8	6.7
In an advanced degree program	76	29.8	59	43.4	17	14.3
On-the-job training	11	4.3	4	2.9	7	5.9
Other (specify)	10	3.9	1	0.7	9	7.6
Multiple responses	7	2.7	3	2.2	4	3.4
No Response	255	100.0	136	100.0	119	100.0
Total						
Skill 11: Monitor and operate enviornmental controls	21	8.2	5	3.7	16	13.4
In a high school horticulture (agriscience) program	70	27.5	28	20.6	42	35.3
In a certificate or associate degree program	46	18.0	21	15.4	25	21.0
In a bachelor degree program	10	3.9	3	2.2	7	5.9
In an advanced degree program	74	29.0	63	46.3	11	9.2
On-the-job training	12	4.7	7	5.1	5	4.2
Other (specify)	11	4.3	4	2.9	7	5.9
Multiple responses	11	4.3	5	3.7	6	5.0
No Response	255	100.0	136	100.0	119	100.0
Total						
Skill 12: Growing plants	21	8.2	0	0.0	21	17.6
In a high school horticulture (agriscience) program	61	23.9	31	22.8	30	25.2
In a certificate or associate degree program	84	32.9	49	36.0	35	29.4
In a bachelor degree program	12	4.7	2	1.5	10	8.4
In an advanced degree program	47	18.4	41	30.1	6	5.0
On-the-job training	10	3.9	5	3.7	5	4.2
Other (specify)	9	3.5	2	1.5	7	5.9
Multiple responses	11	4.3	6	4.4	5	4.2
No Response	255	100.0	136	100.0	119	100.0
Total						

Table 18 (cont'd).

This skill can best be acquired through:	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 13: Fertilize plants	24	9.4	1	0.7	23	19.3
In a high school horticulture (agriscience) program	66	25.9	34	25.0	32	26.9
In a certificate or associate degree program	83	32.5	51	37.5	32	26.9
In a bachelor degree program	11	4.3	1	0.7	10	8.4
In an advanced degree program	38	14.9	33	24.3	5	4.2
On-the-job training	14	5.5	8	5.9	6	5.0
Other (specify)	9	3.5	1	0.7	8	6.7
Multiple responses	10	3.9	7	5.1	3	2.5
No Response	255	100.0	136	100.0	119	100.0
Total						
Skill 14: Diagnose insect, cultural, and disease problems	41	16.1	2	1.5	39	32.8
In a high school horticulture (agriscience) program	61	23.9	34	25.0	27	22.7
In a certificate or associate degree program	69	27.1	44	32.4	25	21.0
In a bachelor degree program	7	2.7	4	2.9	3	2.5
In an advanced degree program	37	14.5	32	23.5	5	42.0
On-the-job training	14	5.5	8	5.9	6	5.0
Other (specify)	17	6.7	5	3.7	12	10.1
Multiple responses	9	3.5	7	5.1	2	1.7
No Response	255	100.0	136	100.0	119	100.0
Total						
Skill 15: Correct insect, cultural, and disease problems	43	16.9	4	2.9	39	32.8
In a high school horticulture (agriscience) program	81	31.8	46	33.8	35	29.4
In a certificate or associate degree program	47	18.4	31	22.8	16	13.4
In a bachelor degree program	6	24	2	1.5	4	3.4
In an advanced degree program	42	16.5	36	26.5	6	5.0
On-the-job training	15	5.9	8	5.9	7	5.9
Other (specify)	11	4.3	2	1.5	9	7.6
Multiple responses	10	3.9	7	1.5	3	2.5
No Response	255	100.0	136	100.0	119	100.0
Total						

Table 18 (cont'd).

This skill can best be acquired through:	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 16: Identification of plant material	60	23.5	8	5.9	52	43.7
In a high school horticulture (agriscience) program	61	23.9	38	27.9	23	19.3
In a certificate or associate degree program	44	17.3	28	20.6	16	13.4
In a bachelor degree program	6	2.4	2	1.5	4	3.4
In an advanced degree program	50	19.6	44	32.4	6	5.0
On-the-job training	13	5.1	6	4.4	7	5.9
Other (specify)	11	4.3	2	1.5	9	7.6
Multiple responses	10	3.9	8	5.9	2	1.7
No Response	255	100.0	136	100.0	119	100.0
Total						
Skill 17: Assist in erecting greenhouses, film houses, and similar facilities						
In a high school horticulture (agriscience) program	32	12.5	12	8.8	20	16.8
In a certificate or associate degree program	38	14.9	12	8.8	26	21.8
In a bachelor degree program	24	9.1	7	5.1	17	14.3
In an advanced degree program	6	2.4	2	1.5	4	3.4
On-the-job training	105	41.2	75	55.1	30	25.2
Other (specify)	14	5.5	9	6.6	5	4.2
Multiple responses	11	4.3	2	1.5	9	7.6
No Response	25	9.8	17	12.5	8	6.7
Total	255	100.0	136	100.0	119	100.0
Skill 18: Scheduling of crops						
In a high school horticulture (agriscience) program	30	11.8	0	0.0	30	25.2
In a certificate or associate degree program	63	24.7	35	25.7	28	23.5
In a bachelor degree program	76	29.8	51	37.5	25	21.0
In an advanced degree program	6	2.4	1	0.7	5	4.2
On-the-job training	48	18.8	38	27.9	10	8.4
Other (specify)	12	4.7	6	4.4	6	5.0
Multiple responses	15	5.9	3	2.2	12	10.1
No Response	5	2.0	2	1.5	3	2.5
Total	255	100.0	136	100.0	119	100.0

Table 18 (cont'd).

This skill can best be acquired through:	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 19: Maintain a safe work environment						
In a high school horticulture (agriscience) program	49	19.2	3	2.2	46	38.7
In a certificate or associate degree program	87	34.1	54	39.7	33	27.7
In a bachelor degree program	43	16.9	33	24.3	10	8.4
In an advanced degree program	3	1.2	2	1.5	1	0.8
On-the-job training	44	17.3	34	25.0	10	8.4
Other (specify)	11	4.3	5	3.7	6	5.0
Multiple responses	3	5.1	3	2.2	10	8.4
No Response	5	2.0	2	1.5	3	2.5
Total	255	100.0	136	100.0	119	100.0

How to Assess if a Person Knows the Skills at an Employable Level

Respondents were asked to describe the best method of assessing the skills for the job title of greenhouse grower. The choices were: written exam; oral exam; timed hands-on exam; observation; and has a certificate or degree. Respondents were asked to select one method of assessment but many chose two or more. Most methods of assessment were supported by 61% or less of the respondents. Observation was chosen for thirteen skills and written exam was chosen for six skills. Written exams were chosen for monitor, manager and analyze the financial performance of the greenhouse; knowledge of plant physiology and growth; Fertilize plants; diagnose insect, cultural and disease problems; plant identification and scheduling crops (Table 19).

Identify any National Differences

The fourth objective of this study aimed to describe any national differences in the perceptions of members of Bedding Plants International and agriscience teachers in California, Florida and Michigan relating to the important skills, where the skills can be acquired and the best methods of assessment.

To determine if there were national differences on the 19 skills that were included on the survey, the responses on these skills were crosstabulated by region. The regions were north (north of Mason-Dixon line and east of the Mississippi River), south (south of the Mason-Dixon line and east of the Mississippi River), and west (west of the Mississippi River). Chi-square tests for independence were used to determine if there was an association between the regions and their ratings on the 19 skills. No statistically significant results were obtained on these analyses, indicating that the regions were independent of the ratings on the skills. As a result, it appears that location of the respondent did not influence the outcomes of the analysis. Appendix I provides a table

with the frequencies for these analyses. Responses for where the skills could be acquired and the best method for assessing these skills were not analyzed as the data were too fragmented to allow for results that could be useful in addressing these issues.

Table 19

What is the Best Way to Assess If a Person Knows this Skill At an Acceptable Employment Level?

Best Way to Assess if a Person Knows This Skill at an Acceptable Employment Level	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 1: Plant propagation						
Written exam	7	27.0	1	0.7	6	5.0
Oral exam	29	11.4	25	18.4	4	3.4
Timed hands-on exam	55	21.6	19	14.0	36	30.3
Observation	140	54.9	76	55.9	64	53.8
Has a certificate or degree	8	3.1	7	5.1	1	0.8
Multiple responses	12	4.7	6	4.4	6	5.0
No Response	4	1.6	2	1.5	2	1.7
Total	255	100.0	136	100.0	119	100.0
Skill 2: Monitor, manage, and analyze financial performance of greenhouse						
Written exam	100	39.2	44	32.4	56	47.1
Oral exam	30	11.8	25	18.4	5	4.2
Timed hands-on exam	25	9.8	15	11.0	10	8.2
Observation	47	18.4	27	19.9	20	16.8
Has a certificate or degree	30	1.8	16	11.8	14	11.8
Multiple responses	9	3.5	6	4.4	3	2.5
No Response	14	5.5	3	2.2	11	9.2
Total	255	100.0	136	100.0	119	100.0
Skill 3: Work relationships						
Written exam	6	2.4	4	2.9	2	1.7
Oral exam	35	13.7	20	14.7	15	12.6
Timed hands-on exam	6	2.4	3	2.2	3	2.5
Observation	190	74.5	100	73.5	90	75.6
Has a certificate or degree	6	2.4	3	2.2	3	2.5
Multiple responses	8	3.1	5	3.7	3	2.5
No Response	4	1.6	1	.7	3	2.5
Total	255	100.0	136	100.0	119	100.0
Skill 4: Receive, unpack, and place incoming plants and materials	12	4.7	7	5.1		
Written exam	26	10.2	16	11.8	5	4.2
Oral exam	38	14.9	15	11.0	10	8.4
Timed hands-on exam	150	58.8	83	61.0	23	19.3
Observation	8	3.1	3	2.2	67	56.3
Has a certificate or degree	12	4.7	6	4.4	5	4.2
Multiple responses	9	3.5	6	4.4	6	5.0
No Response	255	100.0	136	100.0	3	2.5
Total					119	100.0
Skill 5: Selects, grades, and harvests plants for delivery	24	9.4	10	7.4		
Written exam	25	9.8	13	9.6	14	11.8
Oral exam	27	10.6	10	7.4	12	10.10
Timed hands-on exam	139	54.5	84	61.8	17	14.3
Observation	15	5.9	3	2.2	55	46.2
Has a certificate or degree	9	3.5	4	2.9	12	10.1
Multiple responses	16	6.3	12	8.8	5	4.2
No Response	255	100.0	136	100.0	4	3.4
Total					119	100.0

Table 19 (cont'd).

Best Way to Assess if a Person Knows This Skill at an Acceptable Employment Level	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 6: Knowledge of plant physiology and growth						
Written exam	119	46.7	38	27.9	81	68.1
Oral exam	30	11.8	25	18.4	5	4.2
Timed hands-on exam	12	4.7	7	5.1	5	4.2
Observation	38	14.9	28	20.6	10	8.4
Has a certificate or degree	30	11.8	23	16.9	7	5.9
Multiple responses	13	5.1	6	4.4	7	5.9
No Response	13	5.1	9	6.6	4	3.4
Total	255	100.0	136	100.0	119	100.0
Skill 7: Height control/cultural manipulation						
Written exam	37	14.5	19	14.0	18	15.1
Oral exam	25	9.8	18	13.2	7	5.9
Timed hands-on exam	39	15.3	13	9.6	26	21.8
Observation	115	45.1	66	48.5	49	41.2
Has a certificate or degree	15	5.9	8	5.9	7	5.9
Multiple responses	9	3.5	4	2.9	5	4.2
No Response	15	5.9	8	5.9	7	5.9
Total	255	100.0	136	100.0	119	100.0
Skill 8: Prepares soil and growing media						
Written exam	57	22.4	29	21.3	28	23.5
Oral exam	37	14.5	25	18.4	12	10.1
Timed hands-on exam	33	12.9	8	5.9	25	21.0
Observation	85	33.3	49	36.0	36	30.3
Has a certificate or degree	19	7.5	13	9.6	6	5.0
Multiple responses	12	4.7	4	2.9	8	6.7
No Response	12	4.7	8	5.9	4	3.4
Total	255	100.0	136	100.0	119	100.0
Skill 9: Crop Irrigation						
Written exam	24	9.4	4	2.9	20	16.8
Oral exam	25	9.8	12	8.8	13	10.9
Timed hands-on exam	39	15.3	20	14.7	19	16.0
Observation	131	51.4	91	66.9	40	33.6
Has a certificate or degree	15	5.9	6	4.4	9	7.6
Multiple responses	13	5.1	2	1.5	11	9.2
No Response	8	3.1	1	0.7	7	5.9
Total	255	100.0	136	100.0	119	100.0
Skill 10: Maintain, repair, and safely operate equipment						
Written exam	27	10.6	9	6.6	18	15.1
Oral exam	24	9.4	16	11.8	8	6.7
Timed hands-on exam	49	19.2	21	15.4	28	23.5
Observation	120	47.1	75	55.1	45	37.8
Has a certificate or degree	15	5.9	9	6.6	6	5.0
Multiple responses	11	4.3	2	1.5	9	7.6
No Response	9	3.5	4	2.9	2	4.2
Total	255	100.0	136	100.0	119	100.0

Table 19 (cont'd).

Best Way to Assess if a Person Knows This Skill at an Acceptable Employment Level	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 11: Monitor and operate environmental controls						
Written exam	48	18.8	14	10.3	34	28.6
Oral exam	20	7.8	16	11.8	4	3.4
Timed hands-on exam	27	10.6	10	7.4	17	14.3
Observation	111	43.5	75	55.1	36	30.3
Has a certificate or degree	25	9.8	12	8.8	13	109
Multiple responses	13	5.1	4	2.9	9	7.6
No Response	11	4.3	5	3.7	6	5.0
Total	255	100.0	136	100.0	119	100.0
Skill 12: Growing plants						
Written exam	59	23.1	17	12.5	42	35.3
Oral exam	31	12.2	24	17.6	7	5.9
Timed hands-on exam	21	8.2	12	8.8	9	7.6
Observation	91	35.7	55	40.4	36	30.3
Has a certificate or degree	33	12.8	20	14.7	13	10.9
Multiple responses	10	3.9	3	2.2	7	5.9
No Response	10	3.9	5	3.7	5	4.2
Total	255	100.0	136	100.0	119	100.0
Skill 13: Fertilizing plants						
Written exam	69	27.1	27	19.9	42	35.3
Oral exam	28	11.0	20	14.7	8	6.7
Timed hands-on exam	28	11.0	12	8.8	16	13.4
Observation	76	29.8	46	33.8	30	25.2
Has a certificate or degree	31	12.2	20	14.7	11	9.2
Multiple responses	10	3.9	4	2.9	6	5.0
No Response	13	5.1	7	5.1	6	5.0
Total	255	100.0	136	100.0	119	100.0
Skill 14: Diagnose insect, cultural, and disease problems						
Written exam	75	29.4	28	20.6	47	39.5
Oral exam	24	9.4	13	9.6	11	9.2
Timed hands-on exam	32	12.5	18	13.2	14	11.8
Observation	66	25.9	44	32.4	22	18.5
Has a certificate or degree	34	13.3	20	14.7	14	11.8
Multiple responses	14	5.5	6	4.4	8	6.7
No Response	10	3.9	7	5.1	3	2.5
Total	255	100.0	136	100.0	119	100.0
Skill 15: Correct insect, cultural, and disease problems						
Written exam	64	25.1	22	16.2	42	35.3
Oral exam	27	10.6	18	13.2	9	7.6
Timed hands-on exam	26	10.2	13	9.6	13	10.9
Observation	86	33.7	51	37.5	35	29.4
Has a certificate or degree	29	11.4	19	14.0	10	8.4
Multiple responses	12	4.7	5	3.7	7	5.9
No Response	11	4.3	8	5.9	3	2.5
Total	255	100.0	136	100.0	119	100.0

Table 19 (cont'd).

Best Way to Assess if a Person Knows This Skill at an Acceptable Employment Level	Combined		Industry		Teacher	
	N	%	N	%	N	%
Skill 16: Plant identification						
Written exam	82	32.2	33	24.3	49	41.2
Oral exam	52	20.4	28	20.6	24	20.2
Timed hands-on exam	34	13.3	16	11.8	18	15.1
Observation	51	20.0	41	30.1	10	8.4
Has a certificate or degree	12	4.7	7	5.1	5	4.2
Multiple responses	13	5.1	3	2.2	10	8.4
No Response	11	4.3	8	5.9	3	2.5
Total	255	100.0	136	100.0	119	100.0
Skill 17: Assists in erecting greenhouses, film houses, and similar facilities						
Written exam	13	5.1	2	1.5	11	9.2
Oral exam	26	10.2	24	17.6	2	1.7
Timed hands-on exam	25	9.8	7	5.1	18	15.1
Observation	146	57.3	81	59.6	65	54.6
Has a certificate or degree	11	4.3	5	3.7	6	5.0
Multiple responses	11	4.3	2	1.5	9	7.6
No Response	23	9.0	15	11.0	8	6.7
Total	255	100.0	136	100.0	119	100.0
Skill 19: Maintain a safe work environment						
Written exam	119	46.7	56	41.2	63	52.9
Oral exam	26	10.2	18	13.2	8	6.7
Timed hands-on exam	10	3.9	7	5.1	3	2.5
Observation	55	21.6	34	25.0	21	17.6
Has a certificate or degree	30	11.8	17	12.5	13	10.9
Multiple responses	11	4.3	3	2.2	8	6.7
No Response	4	1.6	1	0.7	3	2.5
Total	255	100.0	136	100.0	119	100.0

CHAPTER V

Conclusions and Recommendations

Based upon the findings presented in Chapter Four the following conclusions and recommendations were formed from the demographics and the research objectives.

Demographics

Review of Findings

Industry respondents, members of Bedding Plants International, were from 36 states and agriscience teachers represented the three top floriculture growing states of California, Florida and Michigan. The number of industry (n=136) respondents to the survey were slightly higher than that of teachers (n=119).

The industry respondents were diverse in their job titles, states in which they were employed, number of years employed and education. The industry operations of the respondents were diverse in climate, size of operation, types or covering, and the number of employees. Bedding Plants International members showed a willingness to communicate.

Agriscience teacher respondents were diverse in the state employed, years employed, whether or not they had a greenhouse and its size and type of covering.

Only 80% of the teachers responding had high school greenhouses. Regionally teachers having high school greenhouses were: California (100%), Florida (81.4%) and Michigan (70.8%).

Teachers reported that after graduation only 18% of agriscience students obtained jobs in the horticulture industry, 5.9% attended community college for horticulture, 5% attended a certificate program and 3% attended a university for a horticulture related field.

When asked what should be the minimum educational background of greenhouse growers, industry's top three choices were associate degree, high school and bachelors degree. Teacher's top three choices were certificate program, high school and an associate degree.

Conclusions

1. Industry is willing to contribute to the dialogue related to educational matters.
2. Agriculture education can move forward, with input from industry and agriscience teachers, to develop national skill standards if we look at the process and not the specific crops.
3. Twenty percent of the 97 agriscience teachers that answered the question are teaching horticulture or plant science without a greenhouse.
4. Students taking agriscience courses have a low rate of employment in the field. Very few attend a postsecondary institution to major in horticulture.

Recommendations

1. Dialogue between industry and agriscience teachers should continue for the development of a comprehensive set of national skill standards.
2. Based on the curriculum reviewed and the desirability of learning the list of skills by activities and not only by reading books, all plant science or horticulture teachers should have access to a greenhouse or comparable plant growing area.
3. Industry organizations and associations locally and nationally should prepare marketing materials and strategies to help increase enrollment for high school agriscience progress. Recruitment of students seriously considering

horticulture as a career will assist employers by providing better trained workers.

Research Objective I

Describe the important skills needed for employment for the job title of greenhouse grower as perceived by Bedding Plants International members and agriscience teachers in California, Florida and Michigan.

Review of Findings

A majority of the skills were considered very important or important by 90% or more of the respondents. These skills were: plant propagation; work relationships; selects, grades, harvests and prepares plants for delivery; knowledge of plant physiology and growth; height control/cultural manipulation; prepares soil and growing media; crop irrigation; maintain, repair and safely operate equipment; monitor and operate environmental controls; grow plants; fertilize plants; diagnose insect, cultural and disease problems; correct insect, cultural and disease problems; identification of plants, scheduling of crops; and maintain a safe work environment.

The skills monitor, manage and analyze the financial performance of the greenhouse, and receives, unpacks and places incoming plants and material, were said to be very important or important in the 80 percent range. The skill assist in erecting greenhouses, film houses and similar facilities was said to be very important or important by 61.9% of the respondents.

Benchmarks (objectives) receiving less than 70% support were not considered to be part of the skills. Several benchmark (objectives) varied in support between industry and agriscience teachers by 19% or more. Many of these related to newer technical skills and record keeping such ebb and flow systems, foot-candle meter; using graphical tracing (based on plant measurement); using leaf unfolding graphs; keep nutrient level graph; use

hydroponics systems; scientific plant names, propagate by bulbs and tissue culture.

Additional skills not listed in the survey but suggested by the respondents were: training in business, common sense, work ethics and a recommendation that growers know a second language, Spanish.

Conclusions

The curricula from Illinois, Oklahoma and Ohio that were reviewed to develop the instrument, had been written with industry input. Oklahoma stated that their curriculum was developed with industry to get a state and national perspective of skills needed. None of the reviewed curriculum obtained industry or educator input from outside their state. This survey had teacher respondents from three states and industry respondents from 36 states to provide a national perspective.

1. The skills and benchmarks (objectives) contained in this survey as perceived by members of Bedding Plants International and agriscience teachers in California, Florida and Michigan are approaching a comprehensive list for the job title of greenhouse grower with inclusion of complex ability skills, business skills and Spanish.
2. Agriculture skill standards for the job title of greenhouse grower can be universally applied, despite environmental differences and crop diversity.
3. Most of the benchmarks (objectives) not supported were related to university research and record keeping recommendations.

Recommendations

1. National organizations and associations should initiate further dialogue with industry and agriscience teachers to create national skill standards.
2. The research supported skills and benchmarks (objectives) list used in this

survey could be used as a foundation piece for developing national skill standards for the job title of greenhouse grower. It could also be used by various states for analysis and modification of their existing curricula.

3. Universities should determine the economic feasibility and usefulness of their recommendations for industry.
4. Industry needs should be addressed by universities that provide in-service training for current agriscience teachers and/or agriscience teacher education to facilitate better understanding.
5. The national FFA floriculture skills contest needs to examine its requirement that the scientific names of plants be known if the skills contest is to be based on industry needs.

Research Objective II

Describe where skills for the job title of greenhouse grower can best be acquired as perceived by members of Bedding Plants International and agriscience teachers in California, Florida and Michigan.

Review of Findings

Respondents identified a variety of methods for acquiring the skills reported. The choices were: in a high school horticulture (agriscience) program; in a certificate or associate degree program; in a bachelor degree program; in an advanced degree program; on the job training; other (specify). Industry most often chose postsecondary or on the job training. Agriscience teachers chose high school horticulture (agriscience) and postsecondary.

Conclusions

1. Industry supported on the job training and postsecondary education as the best methods of acquiring the skills.

2. Agriscience teachers supported high school horticulture (agriscience) programs and postsecondary education as the best methods of acquiring the skills.
3. The level of education varied greatly within single skills. Example: plant propagation skill benchmarks (objectives) ranged from open tray seeding to tissue culture.

Recommendations

1. More communication between high school agriscience teachers and industry to coordinate training from high school to work and to communicate what skills will be taught at what level.
2. An alignment of high school to postsecondary agriscience curricula.
3. More involvement of industry members with career and technical education advisory committees and curricular review committees for high school and postsecondary programs.
4. More opportunities for high school agriscience teachers to spend time learning first hand from industry.
5. More hands-on experience and/or on the job training or internships for serious high schools students.

Research Objective III

Describe the best method of assessing the skills for the job title of greenhouse grower as perceived by members of Bedding Plants International and agriscience teachers in California, Florida and Michigan.

Review of Findings

There was not a high level of consensus on the methods of assessment. The fact that the benchmarks (objectives) often require different levels of education may have

contributed to the lack of consensus when assessing the skills.

Observation and/or written examination were the most consistent responses given. Written exams for assessment and postsecondary education as method of acquiring the skill was chosen for the following skills: monitor, manage and analyze the financial performance of a greenhouse; knowledge of plant physiology and growth; fertile plants and scheduling of crops.

Conclusions

Methods of assessment to determine the competency of each skill must be in place for the creation of national skill standards. Therefore individual rubrics for each benchmark (objective) must be developed through further dialogue.

Recommendations

1. Industry and agriscience teachers should develop rubrics to assess all skills and benchmarks (objectives).
2. Written assessments should be developed and agreed upon by industry and agriscience teachers for some of the skills. A credentialing test could be developed.
3. Observation, as a method of assessment, needs to be defined by industry and agriscience teachers. This method, to be equitable, needs check-off lists, defined procedures, outcomes and in some cases a time factor.
4. National teacher and industry organizations should bring together teacher and industry to develop assessment models.

Research Objective IV

Identify any national differences in the perceptions of members of Bedding Plants International and agriscience teachers in California, *Florida and Michigan* relating to the important skills, where the skills can *be acquired* or the best method of assessing the skills for the job title of

greenhouse grower.

Conclusions

Analysis of the data by region showed that where the teacher or industry members were employed did not appear to influence their responses.

Recommendation

1. National Skill Standards should be developed by industry and agriscience teachers.
2. National organizations and associations should facilitate meetings for teacher and industry to develop national skill standards.

Recommendations for Further Research

1. A comparison of high school and postsecondary curricula to develop an alignment.
2. Most industry respondents have bachelors degrees. Question to be asked: did they take agriscience in high school? Is there another reason why they appear to be unfamiliar with the high school curricula? Why do they think that on the job training is the best method for learning so many of the skills?
3. Who are the students taking high school agriscience classes and what are their career goals? How can we increase the percentage of high school students that obtain jobs in horticulture or pursue horticulture postsecondary education.
4. What are the education levels of workers being hired as growers?
5. Why are there differences in some benchmark (objective) areas between industry and teachers?
6. How and why are new methods adopted by industry?

7. A replication using another industry group and teachers in other states.

Reflections

Educational attitudes about diversity in local crops and environmental conditions are blinders that have prevented agriculture from moving forward with national skill standards. Even the states that used industry input to develop their curriculum selected only industries located in their state. Agriculture needs to be less territorial and more encompassing. A paradigm shift is needed to look at the process, not the product, as industry has had to do with Quality Standards 9000.

I was pleased and surprised with the industry response rate and the time growers took to add comments and letters. They showed willingness to assist in this project. Many teachers also took the extra time to provide additional information. The problem with teachers' response rate could be that they are the target of multiple surveys, especially in the area of curricular research.

I hope that some national agriscience teachers' organization or agriculture organization or association steps forward to continue the dialogue between teachers and industry to develop national skill standards.

All career and technical education programs, such as agriscience, have had the stigma that their classes were not for the students with postsecondary potential. It has taken a long time to convince people that college was the key to economic success. Now we need to look at lifelong learning and adopt a new paradigm: economic security can be achieved with less than a bachelors degree in many fields.

It is unfortunate that anyone would be teaching plant science or horticulture without a greenhouse. Hopefully, these teachers have some type of growing area for hands-on activities.

This survey did not lend itself to powerful statistical analysis, but I feel that I've added to the general knowledge and produced pioneering baseline data in agriculture education.

The results of this survey raised many interesting additional questions that should be addressed. I found industry's lack of support for high school agriscience programs as methods of acquiring skill surprising. Industry often chose written assessment for skills they said could be acquired at the postsecondary level and tended to prefer observation as a means of assessment for skills that they say can best be acquired through on the job training. Does industry have written levels of objectives for on the job training or observation? How is observation conducted? Is it a written check list or internal criteria? Is the observation made at specific times or are mental or written notes taken during a casual pass by?

Teachers had more difficulty in selecting only one answer for a method of assessment. Could this be a reflection of their knowledge of diverse learning styles? Part of the difficulty may have been that industry and teachers were asked to assess the skills instead of the individual benchmarks (objectives) that may lend themselves to conclusive types of assessment.

The present educational reform movement has viewed high school and postsecondary career and technical programs as places to prepare students for the workforce. But should industry needs totally control what we teach? Of course not. There are still basic skills like open tray seeding and fun skills like hydroponics, bulb propagation and learning scientific names that make classes more interesting for students.

The purpose of this study was to find out whether industry and agriscience teachers could agree upon a list of skills, where the skills can best be taught and method

of assessment. The results show that a skills list can be achieved. Now, hopefully, agriculture education can move forward, as other career and technical education clusters have, and create national skill standards.

APPENDICIES

Appendix A

University Committee for Research Involving Human Subjects

MICHIGAN STATE
UNIVERSITY

July 2, 1999

TO: Dr. Frederick WHIMS
410 Agriculture Hall

RE: IRB# 99277 CATEGORY: 1-C
APPROVAL DATE: July 2, 1999
TITLE: GREENHOUSE GROWER SKILL REQUIREMENTS: A NATIONAL PERSPECTIVE

The University Committee on Research Involving Human Subjects' (UCRIHS) review of this project is complete and I am pleased to advise that the rights and welfare of the human subjects appear to be adequately protected and methods to obtain informed consent are appropriate. Therefore, the UCRIHS approved this project.

RENEWALS: UCRIHS approval is valid for one calendar year, beginning with the approval date shown above. Projects continuing beyond one year must be renewed with the green renewal form. A maximum of four such expedited renewals possible. Investigators wishing to continue a project beyond that time need to submit it again for a complete review.
REVISIONS: UCRIHS must review any changes in procedures involving human subjects, prior to initiation of the change. If this is done at the time of renewal, please use the green renewal form. To revise an approved protocol at any other time during the year, send your written request to the UCRIHS Chair, requesting revised approval and referencing the project's IRB# and title. Include in your request a description of the change and any revised instruments, consent forms or advertisements that are applicable.
PROBLEMS/CHANGES: Should either of the following arise during the course of the work, notify UCRIHS promptly: 1) problems (unexpected side effects, complaints, etc.) involving human subjects or 2) changes in the research environment or new information indicating greater risk to the human subjects than existed when the protocol was previously reviewed and approved.

If we can be of further assistance, please contact us at 517 355-2180 or via email: UCRIHS@pilot.msu.edu. Please note that all UCRIHS forms are located on the web: http://www.msu.edu/unit/vprgs/UCRIHS/

Sincerely,

David E. Wright, Ph. D.
UCRIHS Chair

DEW: db
cc: Nancy Higgins

OFFICE OF
RESEARCH AND GRADUATE STUDIES
University Committee on Research Involving Human Subjects (UCRIHS)
Michigan State University
246 Administration Building
East Lansing, Michigan
48824-1046
517/355-2180
FAX: 517/353-2976

MICHIGAN STATE
UNIVERSITY

June 29, 2000

TO: Frederick WHIMS
410 Agriculture Hall

RE: IRB # 99-277 CATEGORY: 1-C
RENEWAL APPROVAL DATE: June 28, 2000

TITLE: GREENHOUSE GROWER SKILL REQUIREMENTS: A NATIONAL PERSPECTIVE

The University Committee on Research Involving Human Subjects' (UCRIHS) review of this project is complete and I am pleased to advise that the rights and welfare of the human subjects appear to be adequately protected and methods to obtain informed consent are appropriate. Therefore, the UCRIHS APPROVED THIS PROJECT'S RENEWAL.

RENEWALS: UCRIHS approval is valid for one calendar year, beginning with the approval date shown above. Projects continuing beyond one year must be renewed with the green renewal form. A maximum of four such expedited renewal are possible. Investigators wishing to continue a project beyond that time need to submit it again for complete review.

REVISIONS: UCRIHS must review any changes in procedures involving human subjects, prior to initiation of the change. If this is done at the time of renewal, please use the green renewal form. To revise an approved protocol at any other time during the year, send your written request to the UCRIHS Chair, requesting revised approval and referencing the project's IRB# and title. Include in your request a description of the change and any revised instruments, consent forms or advertisements that are applicable.

PROBLEMS/CHANGES: Should either of the following arise during the course of the work, notify UCRIHS promptly: 1) problems (unexpected side effects, complaints, etc.) involving human subjects or 2) changes in the research environment or new information indicating greater risk to the human subjects than existed when the protocol was previously reviewed and approved.

If we can be of further assistance, please contact us at 517 355-2180 or via email: UCRIHS@pilot.msu.edu.

Sincerely,

David E. Wright

David E. Wright
Chair, UCRIHS

DEW: ks
cc:

OFFICE OF
RESEARCH
AND
GRADUATE
STUDIES

University Committee on
Research Involving
Human Subjects

Michigan State University
246 Administration Building
East Lansing, Michigan
48824-1046

517/355-2180
FAX: 517/353-2976
Web: www.msu.edu/user/ucrihs
E-Mail: ucrihs@msu.edu

Appendix B

Cover Letters and Postcard

MICHIGAN STATE
UNIVERSITY

May 17, 2000

Dear Agriscience Teacher,

As education reform has become a national issue, the career and technical education area is looking at national skills and methods of assessment. In the area of agriculture we are behind most other career and technical areas in developing national skills. Diversity in our field is one reason we have not moved forward at a national level. These are issues I am addressing in my doctoral dissertation.

This survey looks at the skills needed for the job title of greenhouse grower. There are nineteen skill questions. This survey will take approximately 15 minutes to complete. Because this is a national survey your input is statistically important. You have been randomly selected to participate.

You may be assured of complete confidentiality. The survey has an identification number for mailing purposes only. This is so that we may check off your name from the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire. You indicate your voluntary agreement to participate by completing and returning this survey.

The results of this survey will be available later this year to members of the Bedding Plant Industry and to agriscience educators in a national agriculture educator publication.

Please return your completed survey in the stamped self-addressed envelope by May 31, 2000. Do not put a return address on the envelope.

Please accept the enclosed pen as a token of appreciation.

Thank you for your assistance.

Sincerely,

Fred Whims

Dr. Fred Whims
Professor

Nancy L. Higgins

Nancy L. Higgins
Doctoral Student

MICHIGAN STATE
UNIVERSITY

July 17, 2000

Dear Bedding Plant International Member,

As education reform has become a national issue, the career and technical education area is looking at national skills and methods of assessment. In the area of agriculture we are behind most other career and technical areas in developing national skills. Diversity in our field is one reason we have not moved forward at a national level. These are issues I am addressing in my doctoral dissertation.

This survey looks at the skills needed for the job title of greenhouse grower. There are nineteen skill questions. This survey will take approximately 15 minutes to complete. Because this is a national survey your input is statistically important. You have been randomly selected to participate.

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The results of this survey will be available later this year to members of the Bedding Plant Industry and to agriscience educators in a national agriculture educator publication.

Please return your completed survey in the stamped self-addressed envelope by July 31, 2000. Do not put a return address on the envelope.

Please accept the enclosed pen as a token of appreciation.

Thank you for your assistance.

Sincerely,

Fred Whims

Dr. Fred Whims
Professor

Nancy L. Higgins

Nancy L. Higgins
Doctoral Student

Nov. 24, 2000

Dear Agriscience Teacher

Last semester you should have received a survey titled Greenhouse Grower Skills Requirements: A National Perspective. As of today, I have not received your completed survey. If you have already returned the survey I would like to thank you.

In case you misplaced the first survey, I have enclosed another one for your convenience. Because this is a national survey your input is statistically important. You have been randomly selected to participate.

You may be assured of complete confidentiality. The survey has an identification number for mailing purposes only. This is so that we may check off your name from the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire. You indicate your voluntary agreement to participate by completing and returning this survey.

Please take a few minutes to complete and return your survey in the stamped self-addressed envelope by December 9, 2000. Do not put a return address on the envelope.

Thank you for your assistance.

Sincerely,

Nancy L. Higgins
Doctoral Student

Nov. 24, 2000

Dear Bedding Plant Industry Member,

In July you should have received a survey titled Greenhouse Grower Skills Requirements: A National Perspective. As of today, I have not received your completed survey. If you have already returned the survey I would like to thank you.

In case you misplaced the first survey, I have enclosed another one for your convenience. Because this is a national survey your input is statistically important. You have been randomly selected to participate.

You may be assured of complete confidentiality. The survey has an identification number for mailing purposes only. This is so that we may check off your name from the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire. You indicate your voluntary agreement to participate by completing and returning this survey.

Please take a few minutes to complete and return your survey in the stamped self-addressed envelope by December 9, 2000. Do not put a return address on the envelope.

Thank you for your assistance.

Sincerely,

Nancy L. Higgins

Nancy L. Higgins
Doctoral Student

Dear Agriscience Teacher:

A week or two ago you received a survey, ***Greenhouse Grower Skills Requirements: A National Perspective.***

If you have returned the survey, thank you. If not, please do so as soon as possible. Everyone's input is important on a national survey.

Sincerely,
Nancy L. Higgins
Doctoral Student

Appendix C

Survey Instrument

Greenhouse Grower Skills Requirements:

A National Perspective

This doctoral research survey asks industry and educators to assess the importance of various skills that are required for greenhouse growers; where the skills can best be taught and how to assess if a person knows the skill at an employable level.

Nancy L. Higgins
408 Agriculture Hall
Michigan State University
East Lansing, MI 48824

ID #_____

SECTION I

INSTRUCTIONS:

Be sure to answer each question as accurately as you can.
All answers will be kept completely confidential.

Section I contains nineteen skills. For each skill you will be asked if the skill is important, what are necessary parts of the skill, where this skill can best be taught and how to assess if a person has this skill.

Section II contains demographic information.

Example:

Skill One: Hydroponics

1. **How important is hydroponics as a skill?** Check one:
   ☐ (a) very important ☑ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

   Are these necessary parts of the above skill?

a. NFT system	☑ (a) yes	☐ (b) no	☐ (c) I don't know
b. Nutrient solution monitoring	☐ (a) yes	☑ (b) no	☐ (c) I don't know
c. Ebb and flow system	☑ (a) yes	☐ (b) no	☐ (c) I don't know

2. **This skill can best be acquired through which of the following methods:** Check one:
   ___ (a) in a high school horticulture (agriscience) program
   ___ (b) in a certificate or associate degree program
   ✓ (c) in a bachelor degree program
   ___ (d) in an advanced degree program
   ___ (e) on the job training
   ___ (f) other (specify) _____

3. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?** Check one:
   ☐ (a) written exam ☑ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Agriscience teachers only:

Do you teach horticulture or plant science?
Check one:
☐ (a) yes ☑ (b) no
If no, please return the survey unanswered.

Thank you for your assistance.

SECTION I

Skill One: Plant Propagation

1. **How important is the plant propagation skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Propagate by seeds (open tray)	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Propagate by seed for plug production	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Propagate by cuttings	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Propagate by bulb	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Propagate by tissue culture	☐ (a) yes	☐ (b) no	☐ (c) I don't know

2. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

3. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Two: Monitor, Manage and Analyze the Financial Performance of the Greenhouse

4. **How important is monitoring, managing and analyzing the financial performance of the greenhouse as a skill?**
Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Uses the proper computer software	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Understands the concept of square foot weeks	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Understands fixed cost	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Understands how to calculate variable cost	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Is involved in marketing	☐ (a) yes	☐ (b) no	☐ (c) I don't know

5. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

6. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Three: Work Relationships

7. **How important is the work relationship skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Works well with others	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Provides written action plan and/or schedules for each crop	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Communicates if crop size or market date cannot be met	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Manages and communicates with co-workers	☐ (a) yes	☐ (b) no	☐ (c) I don't know

8. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

9. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Four: Receives, Unpacks and Places Incoming Plants and Material

10. **How important is the receiving, unpacking and placing incoming plants and material skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Inspects incoming plants for insects	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Inspects incoming plants for diseases	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Checks incoming plant root health	☐ (a) yes	☐ (b) no	☐ (c) I don't know

11. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

12. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?** Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Five: Selects, Grades, Harvests and Prepares Plants for Delivery

13. **How important is selecting, grading, harvesting and preparing plants for delivery skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Decreases fertilizer level if necessary	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Responsible for moist media and dry foliage	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Maintain proper spacing	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Communicate packing methods	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Communicate light and temperature requirements	☐ (a) yes	☐ (b) no	☐ (c) I don't know

14. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

15. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?** Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Six: Knowledge of Plant Physiology and Growth

16. **How important is the knowledge of plant physiology and growth skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Photosynthesis	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Respiration	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Transpiration	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Light intensity	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Temperature requirements	☐ (a) yes	☐ (b) no	☐ (c) I don't know
f. Photoperiod	☐ (a) yes	☐ (b) no	☐ (c) I don't know
g. Water relationships	☐ (a) yes	☐ (b) no	☐ (c) I don't know
h. Plant nutrients	☐ (a) yes	☐ (b) no	☐ (c) I don't know

17. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

18. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Seven: Height Control/Cultural Manipulation

19. **How important is the height control/cultural manipulation skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Chemical or growth regulators	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Proper planting depth	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Position and spacing of seedlings and rooted cuttings	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Pinching	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Plant support/staking	☐ (a) yes	☐ (b) no	☐ (c) I don't know

20. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

21. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Eight: Prepare Soil and Growing Media

22. **How important is the preparing soil and growing media skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Quality and uniformity of media	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Understands uses of soil components such as peat and perlite	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Understands amendments such as lime, fertilizer and wetting agents	☐ (a) yes	☐ (b) no	☐ (c) I don't know

23. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

24. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Nine: Crop Irrigation

25. **How important is the crop irrigation skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Know when, how and how much water to use	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Minimize water use	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Monitor runoff and percolation rates of excess water	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Test for water quality	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Check uniformity of application	☐ (a) yes	☐ (b) no	☐ (c) I don't know
f. Use an ebb and flow system (subirrigation and recirculation)	☐ (a) yes	☐ (b) no	☐ (c) I don't know
g. Check weight to determine appropriate watering	☐ (a) yes	☐ (b) no	☐ (c) I don't know

26. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

27. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?** Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Ten: Maintain, Repair and Safely Operate Equipment

28. **How important is the maintaining, repairing and safely operating equipment skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Water filtration systems	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. pH meter	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Check fertilizer injectors with electrical conductive meters	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Check fertilizer injectors by monitoring stock solution	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Operate a plug seeder	☐ (a) yes	☐ (b) no	☐ (c) I don't know
f. Water treatment	☐ (a) yes	☐ (b) no	☐ (c) I don't know
g. Pesticide delivery systems	☐ (a) yes	☐ (b) no	☐ (c) I don't know

29. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

30. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?** Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Eleven: Monitor and Operate Environmental Controls

31. **How important is the monitoring and operating environmental controls skill?** Check one:
❑ (a) very important ❑ (b) important ❑ (c) no opinion ❑ (d) not very important ❑ (e) not important at all

Are these necessary parts of the above skill?

a. Foot-candle meter	❑ (a) yes	❑ (b) no	❑ (c) I don't know
b. Recording thermometer	❑ (a) yes	❑ (b) no	❑ (c) I don't know
c. Sensor for environmental computer control	❑ (a) yes	❑ (b) no	❑ (c) I don't know
d. Use computer for controls	❑ (a) yes	❑ (b) no	❑ (c) I don't know
e. Blackout system	❑ (a) yes	❑ (b) no	❑ (c) I don't know
f. Supplemental lighting system	❑ (a) yes	❑ (b) no	❑ (c) I don't know
g. Heating and cooling systems	❑ (a) yes	❑ (b) no	❑ (c) I don't know

32. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

33. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
❑ (a) written exam ❑ (b) oral exam ❑ (c) timed hands-on exam ❑ (d) observation ❑ (e) has a certificate or degree

Skill Twelve: Grow Plants

34. **How important is the growing plants skill?** Check one:
❑ (a) very important ❑ (b) important ❑ (c) no opinion ❑ (d) not very important ❑ (e) not important at all

Are these necessary parts of the above skill?

a. Using DIF (differences between day and night temperature)	❑ (a) yes	❑ (b) no	❑ (c) I don't know
b. Using light integral or sum of all the light for each day	❑ (a) yes	❑ (b) no	❑ (c) I don't know
c. Using graphical tracking (based on plant measurement)	❑ (a) yes	❑ (b) no	❑ (c) I don't know
d. Using leaf unfolding graphs	❑ (a) yes	❑ (b) no	❑ (c) I don't know
e. Monitor bud development	❑ (a) yes	❑ (b) no	❑ (c) I don't know

35. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

36. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
❑ (a) written exam ❑ (b) oral exam ❑ (c) timed hands-on exam ❑ (d) observation ❑ (e) has a certificate or degree

Skill Thirteen: Fertilize Plants

37. **How important is the fertilizing of plants skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Accurate and routine onsite or laboratory test of media and plants to verify nutrient levels	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Careful analysis of test results	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Keep nutrient level graphs	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Thorough interpretation of results and implement changes if necessary	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Use of ebb and flow types system (subirrigation and recirculation)	☐ (a) yes	☐ (b) no	☐ (c) I don't know
f. Use of injection systems	☐ (a) yes	☐ (b) no	☐ (c) I don't know
g. Use of hydroponics systems	☐ (a) yes	☐ (b) no	☐ (c) I don't know

38. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

39. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Fourteen: Diagnose Insect, Cultural and Disease Problems

40. **How important is the diagnosing insect, cultural and disease problems skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Use IPM and crop management strategies	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Use scouting technique with yellow sticky cards	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Monitor biological controls	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Knowledge of common insects	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Knowledge of common diseases	☐ (a) yes	☐ (b) no	☐ (c) I don't know
f. Knowledge of crop cultural problems	☐ (a) yes	☐ (b) no	☐ (c) I don't know
g. Records of activities related to crop	☐ (a) yes	☐ (b) no	☐ (c) I don't know

41. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

42. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Fifteen: Correct Insects, Cultural and Disease Problems

43. **How important is the correcting insects, cultural and disease problems skill?** Check one:
❑ (a) very important ❑ (b) important ❑ (c) no opinion ❑ (d) not very important ❑ (e) not important at all

Are these necessary parts of the above skill?

a. Using chemicals	❑ (a) yes	❑ (b) no	❑ (c) I don't know
b. Non-chemical means	❑ (a) yes	❑ (b) no	❑ (c) I don't know
c. Sanitation	❑ (a) yes	❑ (b) no	❑ (c) I don't know
d. Quarantine	❑ (a) yes	❑ (b) no	❑ (c) I don't know
e. Biological control	❑ (a) yes	❑ (b) no	❑ (c) I don't know
f. Weed control	❑ (a) yes	❑ (b) no	❑ (c) I don't know

44. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

45. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?** Check one:
❑ (a) written exam ❑ (b) oral exam ❑ (c) timed hands-on exam ❑ (d) observation ❑ (e) has a certificate or degree

Skill Sixteen: Identification of Plant Material

46. **How important is the identification of plant material skill?** Check one:
❑ (a) very important ❑ (b) important ❑ (c) no opinion ❑ (d) not very important ❑ (e) not important at all

Are these necessary parts of the above skill?

a. By common name, example: poinsettia	❑ (a) yes	❑ (b) no	❑ (c) I don't know
b. By scientific name, example: *Euphorbia pulcherrima Willd*	❑ (a) yes	❑ (b) no	❑ (c) I don't know
c. By cultivar, example: *SUPJIBI*	❑ (a) yes	❑ (b) no	❑ (c) I don't know

47. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

48. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?** Check one:
❑ (a) written exam ❑ (b) oral exam ❑ (c) timed hands-on exam ❑ (d) observation ❑ (e) has a certificate or degree

Skill Seventeen: Assist in Erecting Greenhouses, Film Houses and Similar Facilities

49. **How important is the assisting in erecting greenhouses, film houses and similar facilities skill?** Check one:
❑ (a) very important ❑ (b) important ❑ (c) no opinion ❑ (d) not very important ❑ (e) not important at all

Are these necessary parts of the above skill?

a. Frame construction	❑ (a) yes	❑ (b) no	❑ (c) I don't know
b. Replacing glass (glazing)	❑ (a) yes	❑ (b) no	❑ (c) I don't know
c. Replacing film (reskinning)	❑ (a) yes	❑ (b) no	❑ (c) I don't know
d. Floor installation	❑ (a) yes	❑ (b) no	❑ (c) I don't know
e. Install environmental controls	❑ (a) yes	❑ (b) no	❑ (c) I don't know
f. Bench construction	❑ (a) yes	❑ (b) no	❑ (c) I don't know

50. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

51. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?** Check one:
❑ (a) written exam ❑ (b) oral exam ❑ (c) timed hands-on exam ❑ (d) observation ❑ (e) has a certificate or degree

Skill Eighteen: Scheduling of Crops

52. **How important is the scheduling of crops skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Determined finish date	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Determine dates for market window	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Determine planting dates	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Proper temperature for development	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Determine flowering dates	☐ (a) yes	☐ (b) no	☐ (c) I don't know
f. Determine when to pinch	☐ (a) yes	☐ (b) no	☐ (c) I don't know
g. Schedule fertilizer applications	☐ (a) yes	☐ (b) no	☐ (c) I don't know
h. Determine schedule for pest control	☐ (a) yes	☐ (b) no	☐ (c) I don't know

53. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

54. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

Skill Nineteen: Maintain a Safe Work Environment

55. **How important is the maintaining a safe work environment skill?** Check one:
☐ (a) very important ☐ (b) important ☐ (c) no opinion ☐ (d) not very important ☐ (e) not important at all

Are these necessary parts of the above skill?

a. Knowledge of chemicals	☐ (a) yes	☐ (b) no	☐ (c) I don't know
b. Knowledge of protection standards for your workers and self	☐ (a) yes	☐ (b) no	☐ (c) I don't know
c. Proper clothing	☐ (a) yes	☐ (b) no	☐ (c) I don't know
d. Proper and locked storage	☐ (a) yes	☐ (b) no	☐ (c) I don't know
e. Signs for re-entry for workers	☐ (a) yes	☐ (b) no	☐ (c) I don't know
f. Safety for the public	☐ (a) yes	☐ (b) no	☐ (c) I don't know
g. Limit contamination of environment from excess fertilizer	☐ (a) yes	☐ (b) no	☐ (c) I don't know
h. Knowledge of safe disposal of chemicals	☐ (a) yes	☐ (b) no	☐ (c) I don't know

56. **This skill can best be acquired through which of the following methods:** Check one:
____ (a) in a high school horticulture (agriscience) program
____ (b) in a certificate or associate degree program
____ (c) in a bachelor degree program
____ (d) in an advanced degree program
____ (e) on the job training
____ (f) other (specify) _____

57. **What is the best way to assess (determine) if a person knows this skill at an acceptable employment level?**
Check one:
☐ (a) written exam ☐ (b) oral exam ☐ (c) timed hands-on exam ☐ (d) observation ☐ (e) has a certificate or degree

58. Please list any other skills that you think are necessary for greenhouse growers: _____

_____

_____

_____

_____

_____

SECTION 2

Background (demographics) for teachers

59. **In what state are you employed?** _____

60. **How many years have you taught?** _____ years

61. **What do you think should be the minimum educational background of "growers"?**
    a. Some high school
    b. Graduated from high school
    c. Some college
    d. A certificate program
    e. An associate's degree
    f. A bachelor's degree
    g. Some graduate school
    h. A graduate degree

62. **What do you think is the salary range of greenhouse growers?** (Hourly wages)
    a. Beginning _____
    a. Experienced _____

63. **Do you have a greenhouse where your teach?** Circle one
    a. Yes
    a. No

64. **The size of your school greenhouse in square feet is** _____.

65. **Type of covering?** Circle all that apply:
    a. Glass
    b. Fiberglass or rigid
    c. Film plastic
    d. Shade cloth

66. **What do your students do after graduation?**
    Please estimate the percentage, based on 100% of the students enrolled in your class this school year, for each area.
    a. Obtain a job _____.
    b. Obtain work in the horticulture industry _____.
    c. Attend a horticulture certificate program _____.
    d. Attend a community college to pursue horticulture _____.
    e. Attend a university to pursue horticulture _____.

67. **Comments:**

_____
_____
_____
_____
_____

If you have any questions or comments for the researcher or would like to receive a copy of results, you may contact me by e-mail. Please list the subject of the e-mail as survey. The address is higginsjn@aol.com

Section 2

Background (demographics) for industry

59. **In what state are you employed?** _____

60. **How many years have you worked in the industry?** _____ years

61. **What do you think should be the minimum educational background of "growers"?**
    a. Some high school
    b. Graduated from high school
    c. Some college
    d. A certificate program
    e. An associate's degree
    f. A bachelor's degree
    g. Some graduate school
    h. A graduate degree

62. **How many people (head count) work for your business operation?**
    _____ in peak season _____ all year

63. **Your growing conditions are most like which state:** Circle one
    a. California
    b. Florida
    c. Michigan

64. **The size of your operation under cover:** Circle one
    a. Less than one acre
    b. Two to five acres
    c. Six to ten acres
    d. Eleven or more acres

65. **Type of covering?** Circle all that apply:
    a. Glass
    b. Fiberglass or rigid
    c. Film plastic
    d. Shade cloth

66. **What is the highest level of education that <u>you</u> have completed?** Circle one
    a. Some high school
    b. Graduated from high school
    c. Some college
    d. A certificate program
    e. An associate's degree
    f. A bachelor's degree
    g. Some graduate school
    h. A graduate degree

67. **Your job title is:** Circle one
    a. Owner
    b. Grower
    c. Owner and grower
    d. Business manager
    e. other _____ (specify)

68. **What is the salary range of a greenhouse grower?** (Hourly wages)
    a. Beginning _____
    b. Experienced _____

69. **Comments:** _____

    _____

If you have any questions or comments for the researcher or would like to receive a copy of results, you may contact me by e-mail. Please list the subject of the e-mail as <u>survey</u>. The address is higginsjn@aol.com

Appendix D

Expert Panel

Expert Panel

Dr. Fred Whims, ANR Education and
Communications Systems,
Michigan State University

Dr. Frank Brewer, ANR Education and
Communications Systems,
Michigan State University

Dr. Murari Suvedi, ANR Education and
Communications Systems,
Michigan State University

Dr. Perry Lanier, Department of Education,
Michigan State University

Dr. John Biernbaum, Department of Horticulture,
Michigan State University

Dr. Dean Krauskopf, Commercial
Greenhouse Specialist,
Michigan State University Extension

Susan Lum, MS, Agriscience Teacher,
Randolph CTE, Detroit, MI

Judy Delgado, MS, Assessment Committee,
Wayne County Community College,
Detroit, MI

Appendix E

Field Test Group

Field Test Group

David Mayor, Horticulture Teacher,
Dearborn High School, Dearborn , MI

David Cooper, Horticulture Teacher,
Edsel Ford High School Dearborn ,MI

Re'nee Bryant, Teaching Assistant Agriscience,
Golightly CTE, Detroit, MI

Alice Pry, Teaching Assistant Agriscience,
Randolph CTE, Detroit , MI

Tammy Grimms, Teaching Assistant
Agriscience, Roosevelt High School, Wyandotte, MI

Judy Servins, Teaching Assistant Horticulture,
Burger School for the Autistic, Garden City, MI

Diane Andersen, Teacher horticulture, Burger School
for the Autistic, Garden City, MI

Jean Anderson, Greenfield Village Historic Gardens,
Dearborn, MI

Mary Hunter, Greenfield Village Historic Gardens,
Dearborn , MI

Mike Sands, Belle Isle Conservatory, Detroit, MI

James Justus, Director, Belle Isle Conservatory,
Detroit ,MI

Brain Marvaso, Marvaso Greenhouses, Romulus, MI

Jean Duggen, Seniors Greenhouse, Wayne ,MI

Appendix F

Personal Telephone Interviews

Personal Telephone Interviews

Wm. Jay Jackman, executive director, National Association of Agricultural Educators, Inc.

Roscoe Vaughn, National Association of Agricultural Educators, Inc.

Dr. William Carlson, Michigan State University, Department of Horticulture

John Brienbaum, Michigan State University, Department of Horticulture

Sherry Johnson, manager of Bedding Plants International

Charles Arensmeir, Michigan State University, Agriculture Education

Dr. Dean Krauskopf, Michigan State University Extension

Keith Zamzow, horticulturist Texas A&M

Jimmy Mullins, horticulturist Virginia State University

Veronica Fielner, University of Missouri

Denis Kervin, Ohio Florist Association

Barbara Kaufmann, The Institute for Educational Leadership, Washington, DC

Frank Gallo and Amy Pass, researchers for the National Skills Standard Board, Washington, DC

Jean Landeen, California Department of Education

Halyna Bialczyk, Wayne County Regional Educational Service Agency, School-to-Work consultant

Craig Wiget, Ohio Agriculture Education Service

Tracy Hoover, University of Florida, Agriculture education and Communications

Dr. Ben Shaw, Texas Education Agency

Appendix G

Other Necessary Skills Not in Survey

Industry other skills:

- A combination of practical work and some degree of education. *I mean* hands-on (experience) and a good attitude – that's most important.
- Bilingual and (knowledge of Spanish), the Microsoft Excel computer program, the Word computer program, Internet capability, social skills for working with teams and problem-solving.
- Personnel management, attitude development and personal growth – people skills.
- Cross training – understanding the effects of their actions on other stages of production.
- Common sense.
- The ability to integrate scientific fact with intuition is what makes a good grower. It is as much an art as a science. The best growers seem to be people that have a strong scientific background combined with attention to detail and willingness to work.
- A thorough comprehension of the five essentials for plant growth including the interaction of light, temperature, water, gases and fertilizer.
- Promptness, dependability, ownership and pride in one's work.
- We are a very small business. I do most of the seeding, propagation, fertilizing and insect control. Most important to me is a compatible crew who are open-minded and work well together. Our best method to control disease is to be tidy and keep our growing and selling areas free of debris.
- A strong work ethic.
- Computer training in accounting and billing situations.
- A knowledge of plant quality (requires years of experience). Accuracy in positioning and placement within the greenhouse environment, air movement and disease monitoring.
- All schools offer different levels of teaching so there is no way to determine the best way these skills can be obtained. Schools can offer a lot but on the job training is probably the most important as each greenhouse is different.
- Spanish language skills. Problem-solving skills.
- Common sense.
- Another language – Spanish.

- Some awareness of retail merchandising and what the buying public is looking for, industry trends, etc.

- Organizational – The most important (thing) which affects their ability to perform most of the tasks – a green thumb, a general love for growing plants is a skill that may not be trainable.

- I did this based on our greenhouse. I don't know about the skills necessary for growers in large facilities.

- Understanding and speaking some Spanish. Awareness of Hispanic culture. Working with deadlines and warm temperatures and weekends from time to time. Traveling to other greenhouses and local meetings to look, listen, learn.

- Sense of humor!

- Experience – a touch for plants.

- It is very important that the grower be able to get along with other people. They have to work with and along side of and sometimes in opposition to the other workers. Example: the crop needs it warm and workers complain about the temperature. Or the crop needs water and workers want it dry.

- If the grower only has book training and no ability and common sense they're destined to failure. Books cannot grow plants. People – the grower – must be in touch with their senses to accomplish growing.

- Bilingual – Spanish in California.

- Truck driving and a second language (Michigan).

- Business administration. Foreign language, i.e., Spanish (Colorado).

- How to calculate different amounts of chemicals and fertilizer when only one measurement is known. Prepare packaged plants for transport. Could include preparing a truck.

- An open mind, willingness to learn, desire to learn from experimentation. Admit that it all isn't in the book somewhere. To network and ask questions, to get out into the world, evaluate the good and what can be changed or adapted to their situation.

- None of the listed skills can be learned and polished in any education program alone. Hands-on experience is necessary in most of these areas in order to really know how to do anything.

Teacher other skills:

- Definitely telephone skills – messages.

- Employability skills. This is an important skill for today's market for job entry workers plus re-education for people who have forgotten how to dress, act and treat others – coworkers, themselves and the customer. It is better to look and act good than to worry about "I have a headache."
- Public relations.
- Marketing, business planning, retail displays.
- Legal knowledge of plant protection variety act. Export-import knowledge. State and federal health and safety regulations.
- Can work ethic be taught?
- Customer relations and sales.
- Understanding manipulation of genetics – atmosphere control.
- The ability to continue learning as trends change. The ability to communicate knowledge with others. Personal skills: hard work, honesty, flexibility, good communicator.
- All skills above are important. I feel many can be taught at the high school level. However, I don't feel many Agriscience programs meet this level of standards. Very few schools could have students perform well by this level.
- Knowledge of labor practices and laws and regulating agencies.
- Interpersonal skills.
- Interest in continuing education.
- Retailing skills, employee-customer relations.
- Tools and their uses. Equipment needs.

Appendix H

Comments

Industry comments:

- "I am presuming the "grower" is head grower of a plant farm."
- "Other employees need to understand that there's more to growing than *holding* a hose all day. Growers need to stop being the lowest paid and experienced."
- "I don't feel comfortable answering the third part of each skill. I don't think that you can be sure until the person has been hired for some time."
- "I learned by trial and error. I wish I had more formal training before getting into the business."
- "Good luck! I'd be interested in seeing the results of your survey."
- "Skilled workers are not paid on an hourly basis – only on a salaried basis."
- "A totally committed grower has to work long, hard hours to be successful. In today's economy, very few are willing."
- "Employees need most of all work-related experience. Best way of gaining usable knowledge."
- "My parents have owned and operated a wholesale perennial/annuals operation for 40 years and I have observed first hand all the answers to every question – Rhode Island."
- "It is almost impossible for me to find a grower in this market. We have only 100,000 people and none to draw from here. If you know of any good growers, send them up or e-mail.... Alaska."
- "This survey is flawed. What is the definition of a grower?"
- "Thank you, some questions were not easy to answer with one or two words, but I tried."
- "There are some great people who love working with plants. Just got to find them."
- "Worked for horticulture supplier and large greenhouse operation."
- "Salaries vary so much in this industry depending on location of business. It would be nice to have a standard."
- "Our best growers are those who have had on the job training."
- "*Enjoying plants* is a big part of growing and selling, the motivating factor. Self-*motivation to learn* and study."

- "There's nothing like experience gained in the work place. *The best college grad* many times fails in the real world."

- "Answers based on what we call a "section grower" – responsible for *watering,* pesticide applications, scouting, managing 1-2 people."

- "Assessment is most frequently "best" done via multiple methods, not *just one, e.g.* oral, degree, observation. To check one is not accurate."

Teacher comments:

- I would greatly appreciate receiving any agriculture skills requirement info. My "school is in the process of developing skills standard for agriculture. Please send any survey results."

- "Each skill could be broken down into levels of training. Many would only require high school or OJT. Some would require advanced degree work. Some areas are better left to suppliers and builders, although the growers need to be aware of what they receive."

- "It was very difficult to choose only one answer, especially in the best way to assess the skill or at what level – high school or college – is best to acquire the skill."

- "Rest of students continue education in other fields of interest."

- "Work ethic and habits are a definite necessity. However, multi-skills are also a big part of a successful business. There are quite a few skills (mechanical/physical) that should be left to a certified individual."

- "The section on how the skill can best be acquired has a different answer for different parts of each skill, therefore most of this survey is meaningless."

- "Most students attend college and pursue other majors while working. The nursery industry is located 30 miles south of the school."

- "I teach horticulture production for trainable ESE students. I answered the questions as they pertained to our program."

- "There are very little opportunities in the San Joaquin Valley to work for a greenhouse grower or begin a greenhouse operation."

- "Good luck *with* your dissertation."

- "*High school students* are simply not interested in the industry down here. People can *be hired off the* street for a minimum wage and many are immigrants, so they're *happy to get a job* and do well. (Florida)"

- "*Most of the skills* one can get out of a quality high school program. Some skills can

only be acquired from advanced education and on the job training."

- "Our school is set up for teaching students who are emotionally disabled. Students are enrolled here for learning to cope with their disability, but many go into business for themselves in computer technology, business, landscaping and greenhouse production if they complete their course of study. However, we hope they can return to a regular education setting."

- "Certification of skill acquisition at various levels – i.e. high school-technical, associate certificate. What skills should be taught at each level of instruction should be determined."

- "This survey is not designed to be answered with just one of the choices offered. If you answer with just one of the choices, the conclusions would be way off from what is actually true."

- "Most of these skills could be introduced with good success at high school level. Working competencies obtained at certificate degree programs. Understanding at Bachelor-plus programs. Research at graduate level."

- "My opinions are based on high school experience only. My own background is not in plant science, therefore I am no expert in plants myself. I concentrate on purely hands-on classroom adaptation of the basics of plant/horticulture sciences: methods of propagation, fertilizing and very basic greenhouse management."

- "This is not an area of the state where horticulture is valued as a vocational choice. There are a few small nurseries in the area but large farming operations and cattle and the local phosphate mine are the major employers. (Florida)"

- "There are a lot of different skill levels needed. From very basic to very complex and even different levels in the skills listed. The most important skill is good work habits. All the other skills can be taught if they have good work habits."

- "We have had many past graduates work in technical greenhouses but it varies heavily from year to year."

- "I work with special education students."

- "Many recent graduates pursue horticulture careers, which is a change from the previous years."

- "No more surveys, please!"

- *"It is difficult to* choose only one way to assess each skill area. In many areas more *than one way in* a combination works more accurately and best."

- *"Good survey."*

- "Our emphasis is floriculture/floral design, not pure horticulture. Most get entry-level jobs in floral shops."

- "Due to not having a greenhouse, students do not have the knowledge about what a greenhouse could offer them. This was a difficult survey to write out. Hope that this helps. With proper funding we would implement a horticulture program if we had a greenhouse."

- "Very thorough survey – nice job."

- "You did a pretty thorough job, Nancy."

Appendix I

Regional Frequencies

Table 20

Regional Frequencies

Skill	Very Important		Important		No Opinion		Not Very Important		Not Important At All	
	N	%	N	%	N	%	N	%	N	%
1. How important is the plant propagation skill?										
Industry										
West of Mississippi	17	48.6	16	45.7	0	0.0	0	0.0	2	5.7
South	8	44.4	10	55.6	0	0.0	0	0.0	0	0.0
North	51	62.2	28	34.1	0	0.0	0	0.0	3	3.7
Teacher										
West of Mississippi	20	74.1	7	25.9	0	0.0	0	0.0	0	0.0
South	34	81.0	8	19.0	0	0.0	0	0.0	0	0.0
North	30	62.5	18	37.5	0	0.0	0	0.0	0	0.0
2. How important is monitor, managing and analyzing the financial performance of the greenhouse as a skill?										
Industry										
West of Mississippi	15	42.9	3	44.4	3	8.6	1	2.9	0	0.0
South	3	16.7	2	55.6	2	11.1	3	16.7	0	0.0
North	30	37.5	7	41.5	7	8.8	8	10.0	1	1.3
Teacher										
West of Mississippi	7	25.0	3	64.3	3	10.7	0	0.0	0	0.0
South	18	45.0	2	44.2	2	5.0	1	2.5	0	0.0
North	15	32.6	7	47.9	7	15.2	1	2.2	0	0.0
3. How important is the work relationship skill?										
Industry										
West of Mississippi	30	85.7	4	11.4	0	0.0	1	2.9	0	0.0
South	14	77.8	4	22.2	0	0.0	0	0.0	0	0.0
North	58	70.7	24	29.3	0	0.0	0	0.0	0	0.0
Teacher										
West of Mississippi	23	85.2	4	14.8	0	0.0	0	0.0	0	0.0
South	33	80.5	8	19.5	0	0.0	0	0.0	0	0.0
North	40	85.1	7	14.9	0	0.0	0	0.0	0	0.0
4. How important is the receivings, unpacking and placing incoming plants and materials skill?										
Industry										
West of Mississippi	15	42.9	15	42.9	0	0.0	5	14.3	0	0.0
South	6	37.5	9	56.3	0	0.0	1	6.3	0	0.0
North	26	34.2	43	56.6	3	3.9	4	5.3	0	0.0
Teacher										
West of Mississippi	6	22.2	18	66.7	2	7.4	1	3.7	0	0.0
South	19	45.2	21	50.0	0	0.0	2	4.8	0	0.0
North	16	33.3	25	52.1	5	10.4	2	4.2	0	0.0
5. How important is selecting, grading, harvesting and preparing plants for delivery skill?										
Industry										
West of Mississippi	22	62.9	11	31.4	10	2.9	1	2.9	0	0.0
South	9	56.3	6	37.5	0	0.0	1	6.3	0	0.0
North	30	39.0	40	51.9	5	6.5	1	1.3	1	1.3
Teacher										
West of Mississippi	15	55.6	11	40.7	1	3.7	1	0.0	0	0.0
South	27	69.2	9	23.1	3	7.7	3	0.0	0	0.0
North	18	39.1	24	52.2	4	8.7	1	2.8	0	0.0

Table 20 (cont'd).

Skill	Very Important		Important		No Opinion		Not Very Important		Not Important At All	
	N	%	N	%	N	%	N	%	N	%
6. How important is the knowledge of plant physiology and growth?										
Industry										
West of Mississippi	23	63.9	10	27.8	1	2.8	1	2.8	1	2.8
South	5	31.3	10	62.5	1	6.3	0	0.0	0	0.0
North	39	50.6	32	41.6	4	5.2	2	2.6	0	0.0
Teacher										
West of Mississippi	20	74.1	7	25.9	0	0.0	0	0.0	0	0.0
South	19	47.5	19	47.5	1	2.5	1	2.5	0	0.0
North	31	64.6	17	35.4	0	0.0	0	0.0	0	0.0
7. How important is the height control/cultural manipulation skill?										
Industry										
West of Mississippi	25	69.4	11	30.6	0	0.0	0	0.0	0	0.0
South	8	50.0	8	50.0	0	0.0	0	0.0	0	0.0
North	50	65.8	24	31.6	2	2.6	0	0.0	0	0.0
Teacher										
West of Mississippi	8	29.6	19	70.4	0	0.0	0	0.0	0	0.0
South	12	30.8	22	56.4	5	12.8	0	0.0	0	0.0
North	13	27.7	28	59.6	5	10.6	1	2.1	0	0.0
8. How important is the preparing of soil and growing media skill?										
Industry										
West of Mississippi	23	63.9	9	25.0	2	5.6	1	2.8	1	2.8
South	4	25.0	10	62.5	0	0.0	2	12.5	0	0.0
North	33	44.0	33	44.0	3	4.0	5	6.7	1	1.3
Teacher										
West of Mississippi	16	57.1	12	42.9	0	0.0	0	0.0	0	0.0
South	24	60.0	14	35.0	1	2.5	1	2.5	0	0.0
North	31	64.6	15	31.3	0	0.0	2	4.2	0	0.0
9. How important is the crop irrigation skill?										
Industry										
West of Mississippi	33	91.7	3	8.3	0	0.0	0	0.0	0	0.0
South	16	88.9	2	11.1	0	0.0	0	0.0	0	0.0
North	70	87.5	10	12.5	0	0.0	0	0.0	0	0.0
Teacher										
West of Mississippi	18	66.7	8	29.6	1	3.7	0	0.0	0	0.0
South	22	56.4	16	41.0	1	2.6	0	0.0	0	0.0
North	22	47.8	22	47.8	2	4.3	0	0.0	0	0.0
10. How important is the maintaining, repairing and safely operating equipment skill?										
Industry										
West of Mississippi	11	30.6	22	61.1	2	5.6	0	0.0	1	2.8
South	6	33.3	10	55.6	0	0.0	2	11.1	0	0.0
North	28	35.9	45	57.7	1	1.3	3	3.8	1	1.3
Teacher										
West of Mississippi	14	53.8	10	38.5	1	3.8	1	3.8	0	0.0
South	23	56.1	16	39.0	1	2.4	1	2.4	0	0.0
North	14	29.8	26	55.3	5	10.6	2	4.3	0	0.0
11. How important is the monitoring and operating environmental controls skill?										

Table 20 (cont'd).

Skill	Very Important		Important		No Opinion		Not Very Important		Not Important At All	
	N	%	N	%	N	%	N	%	N	%
Industry										
West of Mississippi	19	57.6	12	36.4	1	3.0	0	0.0	1	3.0
South	5	27.8	13	72.2	0	0.0	0	0.0	0	0.0
North	33	43.4	37	48.7	3	3.9	2	2.6	1	1.3
Teacher										
West of Mississippi	6	26.1	16	69.6	1	4.3	0	0.0	0	0.0
South	16	38.1	20	47.6	5	11.9	1	2.4	0	0.0
North	14	29.2	27	56.3	5	10.4	2	4.2	0	0.0
12. How important is the growing of plants skill?										
Industry										
West of Mississippi	31	88.6	3	8.6	0	0.0	0	0.0	1	2.9
South	16	88.9	16	11.1	0	0.0	0	0.0	0	0.0
North	69	86.3	9	11.3	1	1.3	1	1.3	0	0.0
Teacher										
West of Mississippi	16	64.0	9	36.0	0	0.0	0	0.0	0	0.0
South	30	71.4	5	11.9	6	14.3	1	2.4	0	0.0
North	33	68.8	13	27.1	2	4.2	0	0.0	0	0.0
13. How important is the fertilizing of plants skill?										
Industry										
West of Mississippi	30	83.3	5	13.9	0	0.0	0	0.0	1	2.8
South	11	73.3	4	26.7	0	0.0	0	0.0	0	0.0
North	60	80.0	15	20.0	0	0.0	0	0.0	0	0.0
Teacher										
West of Mississippi	20	76.9	6	23.1	0	0.0	0	0.0	0	0.0
South	32	78.0	7	17.1	2	4.9	0	0.0	0	0.0
North	31	67.4	15	32.6	0	0.0	0	0.0	0	0.0
14. How important if the diagnosing of insect, cultural and disease problems skill?										
Industry										
West of Mississippi	31	88.6	3	8.6	0	0.0	1	2.9	0	0.0
South	13	81.3	3	18.8	0	0.0	0	0.0	0	0.0
North	59	76.6	18	23.4	0	0.0	0	0.0	0	0.0
Teacher										
West of Mississippi	17	63.0	10	37.0	0	0.0	0	0.0	0	0.0
South	31	75.6	9	22.0	1	2.4	0	0.0	0	0.0
North	27	60.0	17	37.8	0	0.0	1	2.2	0	0.0
15. How important is the correcting of insects, cultural and disease problems skill?										
Industry										
West of Mississippi	30	83.3	6	16.7	0	0.0	0	0.0	0	0.0
South	12	80.0	3	20.0	0	0.0	0	0.0	0	0.0
North	58	76.3	18	23.7	0	0.0	0	0.0	0	0.0
Teacher										
West of Mississippi	16	59.3	11	40.7	0	0.0	0	0.0	0	0.0
South	30	71.4	11	26.2	1	2.4	0	0.0	0	0.0
North	27	60.0	15	33.3	2	4.4	1	2.2	0	0.0
16. How important is the identification of plant material?										

Table 20 (cont'd).

Skill	Very Important		Important		No Opinion		Not Very Important		Not Important At All	
	N	%	N	%	N	%	N	%	N	%
Industry										
West of Mississippi	13	36.1	21	58.3	0	0.0	2	5.6	0	0.0
South	6	37.5	10	62.5	0	0.0	0	0.0	0	0.0
North	27	36.5	44	59.5	1	1.4	2	2.7	0	0.0
Teacher										
West of Mississippi	15	60.0	9	36.0	0	0.0	1	4.0	0	0.0
South	25	61.0	15	36.6	1	2.4	0	0.0	0	0.0
North	31	66.0	16	34.0	0	0.0	0	0.0	0	0.0
17. How important is the assisting in erecting greenhouses, film houses and similar facilities skill?										
Industry										
West of Mississippi	3	8.3	20	55.6	3	8.3	9	25.0	1	2.8
South	1	6.7	6	40.0	1	6.7	6	40.0	1	6.7
North	8	10.4	33	42.9	10	13.0	23	29.9	3	3.9
Teacher										
West of Mississippi	1	3.6	19	67.9	5	17.9	2	7.1	1	3.6
South	7	17.1	24	58.5	5	12.2	5	12.2	0	0.0
North	8	17.0	21	44.7	7	14.9	10	21.3	1	2.1
18. How important is the scheduling of crops skill?										
Industry										
West of Mississippi	30	83.3	6	16.7	0	0.0	0	0.0	0	0.0
South	11	64.7	6	35.3	0	0.0	0	0.0	0	0.0
North	62	75.6	20	24.4	0	0.0	0	0.0	0	0.0
Teacher										
West of Mississippi	14	51.9	13	48.1	0	0.0	0	0.0	0	0.0
South	20	48.8	18	43.9	3	7.3	0	0.0	0	0.0
North	25	53.0	20	42.6	1	2.1	1	2.1	0	0.0
19. How important is the maintaining a safe work environment skill?										
Industry										
West of Mississippi	23	65.7	12	34.3	0	0.0	0	0.0	0	0.0
South	11	64.7	6	35.3	0	0.0	0	0.0	0	0.0
North	47	58.0	34	42.0	0	0.0	0	0.0	0	0.0
Teacher										
West of Mississippi	23	85.2	4	14.8	0	0.0	0	0.0	0	0.0
South	33	80.5	8	19.5	0	0.0	0	0.0	0	0.0
North	39	83.0	8	17.0	0	0.0	0	0.0	0	0.0

Appendix J

Early and Late Returns Data

Table 21

Early and Late Returns Data

Skill Area	Early Returns			Late Returns			t-Value	Sig of t
	N	Mean	SD	N	Mean	SD		
1. How important is the plant propagation skill?	165	1.30	.46	87	1.61	.77	-4.04	<.001
2. How important is it to monitor, manage, and analyze the financial performance of the green house as a skill?	164	1.85	.84	83	1.90	.84	-.50	.620
3. How important is the work relationship skill?	163	1.25	.48	87	1.15	.36	1.75	.081
4. How important is the receving, unpacking and placing incoming plants and materials skill?	158	1.77	.73	86	1.87	.86	-1.01	.311
5. How important is selecting, grading, harvesting and preparing plants for delivery skill?	154	1.56	.67	86	1.65	.75	-.99	.324
6. How important is the knowledge of plant physiology and growth?	158	1.42	.59	86	1.69	.79	-3.01	.003
7. How important is the height control/cultural manipulation skill?	153	1.54	.61	88	1.64	.61	-1.15	.250
8. How important is the preparing of soil and growing media skill?	155	1.59	.83	88	1.61	.79	-.19	.854
9. How important is the crop irrigation skill?	160	1.26	.48	86	1.33	.50	-1.07	.286
10. How important is the maintaining, repairing and safely operating equipment skill?	161	1.74	.81	85	1.76	.68	-.25	.804
11. How important is the monitoring and operating environmental controls skill?	155	1.68	.74	85	1.86	.73	-1.83	.068
12. How important is the growing of plants skill?	161	1.29	.65	87	1.26	.54	.26	.793
13. How important is the fertilizing of plants skill?	152	1.22	.51	87	1.31	.49	-1.37	.171
14. How important is the diagnosing of insect, cultural and disease problems skill?	154	1.27	.52	87	1.31	.49	-.64	.521
15. How important is the correcting of insects, cultural and disease problems skill?	156	1.28	.50	85	1.35	.53	-1.12	.264

Table 21 *(cont'd).*

Skill Area	Early Returns			Late Returns			*t-Value*	Sig of t
	N	Mean	SD	N	Mean	SD		
16. How important is the identification of plant material?	152	1.51	.58	87	1.64	.70	-1.56	.120
17. How important is the assisting in erecting greenhouses, film houses and similar facilities skill?	157	2.57	1.06	87	2.52	1.04	.35	.725
18. How important is the scheduling of crops skill?	162	1.35	.54	88	1.43	.54	-1.21	.229
19. How important is the maintaining a safe work environment skill?	159	1.31	.46	89	1.26	.44	.83	.410

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