

A Description of Current National Horticulture Curriculum for Greenhouse Food Crop Production

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Abstract

In order to determine whether horticulture programs within higher education are mirroring industry trends for greenhouse food crop production (GFCP) within their curricula, we set out to describe the presence of courses and topics within existing undergraduate horticulture programs devoted to GFCP currently offered at land-grant institutions within the United States. Our objectives were to describe: 1) the number of greenhouse food crop production courses offered by land-grant institutions; 2) the number of courses offered within land-grant institutions with objectives related to GFCP; 3) the number of objectives related to GFCP in courses offered by land-grant institutions; and 4) the amount of course time allocated to topics related to GFCP in courses offered by land-grant institutions. Forty-one institutions had a total of 84 courses with potential for GFCP while 69 institutions had no courses with potential for GFCP. From the 27 syllabi received, three courses were focused solely on GFCP, six courses contained a total of 8 GFCP-related objectives, and four courses contained a total of 59 GFCP-related topics in their timelines, which was calculated to total 51.5 hours devoted to GFCP. The authors recommend that land-grant institutions provide more courses and integrated course content in GFCP to better align curricula with industry needs and employment opportunities.

Introduction

The U.S. greenhouse food crop production (GFCP) industry has experienced significant growth during the past decade (U.S. Department of Agriculture, 2014). The vast majority of GFCP in the U.S. is comprised of the production of tomatoes, peppers, cucumbers, fresh

leafy greens and herbs in greenhouse structures of varying designs with a small amount of production being conducted in other types of controlled environments such as lighted warehouses and chambers. For the purposes of this study, we referred to production of food crops in any type of controlled environment as being in greenhouses.

Although less dependent on greenhouse food crop production than many other advanced countries, production of food crops in greenhouses has been growing rapidly in the U.S. Between 2007 and 2012, the number of farms producing greenhouse food crops more than doubled, increasing the square footage of GFCP from 61,765,935 to 97,999,731 (U.S. Department of Agriculture, 2014). In 2013, Rabobank reported the greenhouse food production industry had sales exceeding \$3 billion and projected the industry to grow to more than \$4 billion by 2020 (Rabobank, 2013). Inside Grower (2015) reported on findings from "Research and Markets" that the global hydroponics food crops production industry was expected to grow from \$18.8 billion in 2014 to \$27.29 billion by 2020. The U.S. production of greenhouse-grown food crops was expected to grow by 9.1% each year during the same period.

Numerous factors have contributed to the expansion of the greenhouse food crop production industry, including evolving consumer expectations (National Restaurant Association, 2013), advances in new technologies (Hottenstein, 2011), the need to feed a growing population with limited land and water resources (National Research Council, 2009), an increased interest having locally-grown food year-round, and unpredictable and

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often detrimental weather patterns (U.S. Global Change Research Program, 2009).

The Association of Public and Land-grant Universities (2009) reported a need for agriculture, food and natural resources curricula to adapt to meet the needs of the changing agriculture industry. They reported rapid growth in demand for graduates with “advanced academic preparation closely tied to advances in knowledge and technologies” within most agricultural, food, and natural resources industries (Association of Public and Land-grant Universities, 2009). The growing controlled environment and greenhouse food production industry also requires employees with the appropriate training and skills to support the industry, and students need to be properly trained in order to be able successfully pursue careers in this expanding area of agriculture.

As of 2005, the nation’s land-grant institutions offered more than 84 courses related to general greenhouse production and management (Tignor et al., 2005). While greenhouse-related courses have the potential to prepare students to enter the GFCEP industry, their inclusion of food production topics has not been assessed. In order to adequately adjust the content of greenhouse courses in a manner that will effectively prepare graduates to lead further innovation in GFCEP, baseline data regarding the current inclusion of GFCEP concepts in greenhouse-related courses was needed.

The overall purpose of this study was to evaluate the inclusion of general greenhouse management courses and specifically greenhouse food crop production courses in horticulture curricula within land-grant institutions. In order to achieve this purpose, the following specific objectives were developed: 1) to describe the number of GFCEP courses offered by land-grant institutions; 2) to determine the number of courses that included objectives related to GFCEP; 3) to describe the number of course objectives related to GFCEP within greenhouse-related courses offered by land-grant institutions; and 4) to describe the amount of course time allocated to topics related to GFCEP in greenhouse-related courses offered by land-grant institutions.

Materials and Methods

This descriptive study used content analysis methods (Krippendorff, 1989) to identify the presence of courses, course objectives, course topics, and course time devoted to GFCEP within land-grant institutions’ course catalogues and related course syllabi. As content analysis does not involve human subjects but rather the analysis of written data, the study was deemed exempt by the University of [State]’s Institutional Review Board. Objectives, topics, and course time are each recommended components of comprehensive syllabi (Nilson, 2010); therefore, these syllabus components can accurately reflect a course’s content.

Researchers attempted to collect a census of syllabi for greenhouse-related courses available to students between 2003 and 2013 from the 110

land-grant colleges and universities established in 1862, 1890, and 1994 (U.S. Department of Agriculture, 2014). A manual search of each institution’s website led to the acquisition of course catalogues for the academic years 2005, 2008, and 2013. Catalogues for the remaining years were not available.

A total of 84 greenhouse-related courses were identified from 41 land-grant institutions. Sixty-nine institutions did not offer any courses related to greenhouse production or management. Requests for syllabi were made following an adapted tailored design method (Dillman et al., 2009). An email requesting either the identified course syllabus or contact information for the course instructor was sent to heads of departments with identified greenhouse-related courses. Non-respondents were sent a reminder email request after one week and another after two weeks. Twenty-seven syllabi were received for a total response rate of 32.1%. Due to the response rate in this study, we caution against generalizing the findings of this study beyond the included syllabi.

Two analytical constructs were chosen for this study (Krippendorff, 1989). The first construct was “greenhouse-related,” which was used to identify courses with the potential to include GFCEP content from course catalogues. Identification was performed using course titles and where needed, course descriptions. Courses initially identified as being related to greenhouse production and management were confirmed by a panel of experts in greenhouse production and management education in order to ensure reliability (Krippendorff, 1989). The second construct was “food crop”, which was used to identify objectives and topics related to GFCEP within the greenhouse-related courses. This stage of data analysis was confirmed by a panel of experts in syllabus evaluation, content analysis methods, and greenhouse crop production and management education. All data are reported using descriptive statistics, including frequencies and percentages.

Results

The first objective was to describe the number of GFCEP courses offered by land-grant institutions. Forty-one of the 110 institutions offered a total of 84 greenhouse-related courses. A majority (71.43%) of the courses contained a combination of the terms “greenhouse,” “management,” and/or “production”. Most courses (35%) specifically contained “greenhouse man-

Table 1. Number and percent of courses offered by land-grant universities associated with general greenhouse management and the production of food crops in greenhouses.

Identified construct in course title	Number of courses containing construct	Percent of courses containing construct ^z
Greenhouse management or operation	29	35
Greenhouse production	19	23
Greenhouse production and management	12	14
Food or greenhouse related miscellaneous	21	25
Food crops	3	4
Total courses	84	100

^z Percent of total of 84 courses.

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agement or operations” in their titles. A total of three (4%) courses contained the term “food crops” in their titles (Table 1).

In objective two, the number of courses that included objectives related to greenhouse food crop production was determined. Six of the courses (7%) contained objectives related to food production. Seventy-three courses (87%) did not contain food-related objectives, while five courses (6%) did not state objectives within their syllabi.

In objective three, we sought to determine the number of course objectives related to GFPC within the 84 greenhouse-related courses identified in objective one. Eighty-three objectives were identified from the 79 course syllabi containing objectives. Eight of the objectives (10%) related to food crop production while 75 (90%) were not related to food.

In objective four, we sought to determine the amount of time allocated to topics related to GFPC in greenhouse-related courses. Thirty-one of the 84 courses (37%) listed topics on which course content focused. Of these 31 courses, four courses (13%) contained topics related to food production, while 27 courses (87%) did not contain food-related topics. Collectively, the 31 courses listed a total of 466 topics. Fifty-nine (13%) of the topics were related to food production, while 407 (87%) of the listed topics were not food-related.

Four of the syllabi included indications of the amount of time spent on each course topic during the course (Table 2). Percent time spent on a course topic was calculated according to the number of credit hours allocated to the course and the number of times the class met. The course with the highest food-related focus spent 69.5% of course time devoted to food-related topics. The courses with the lowest food-related focus spent 7.1% of course time devoted to food-related topics, although the two courses devoted different amounts of time to GFPC.

Discussion

While the availability of greenhouse-related courses appeared to be stable since 2005 (Tignor et al., 2005), these courses may not be adapting content to reflect current industry trends. Within every area of description, focus on GFPC within greenhouse classes was in the minority. Ninety-six percent of identified courses focused primarily on greenhouse production, operations, or management and omitted food-related terms in their titles. Ninety-three percent of the courses omitted food-related learning objectives, and of those courses

containing food-related objectives, only 13% of the listed objectives focused on food. Eighty-eight percent of the courses listing topics covered omitted food-related content. Finally, almost 90% of all topics listed were not related to food.

These findings imply that while the GFPC industry is growing, current higher-education offerings may not align with industry trends. This lack of alignment between industry and education suggests the call made by the Association of Public and Land-grant Universities to transform academics in agriculture to meet innovative industry technologies has not yet been fully answered by horticulture programs (Association of Public and Land-grant Universities, 2009). Leaders in horticulture education have an opportunity to address this gap by reviewing technologies and best practices within industry, examining existing courses and potential areas for course development, and evolving course content to accurately reflect industry trends.

Additional findings from this study imply that many greenhouse courses offer syllabi that do not contain “generally recommended components related to pedagogy and student learning” (Teaching and Faculty Support Center, n.d., para. 2). Learning objectives, topics to be covered, and time allocated to each topic are recommended components of a quality syllabus because they reduce misunderstandings about the scope and nature of the course and communicate expectations to students (Nilson, 2010). Many land-grant institutions provide opportunities for faculty to receive support in developing quality syllabi; the researchers recommend the use of syllabus development services and support, especially for faculty with degrees outside of the education field. Utilizing syllabus development services can assist faculty in accurately examining the content of their courses when aligning with industry trends, as well as enable students to access meaningful information regarding courses.

Summary

The greenhouse food crops production industry has greatly increased over the past decade. Projections are that this area of agriculture will continue to expand. This industry will need highly trained graduates with special training in the production of food crops in greenhouses and other controlled environments. Likewise, the expansion of this industry will offer significant job opportunities for horticulture graduates. Programs within higher education should acknowledge this trend and adjust curricula to recognize these changing industry needs and employment opportunities.

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Table 2. Hours and percent of class time in greenhouse courses including food production topics devoted to teaching greenhouse food crop production.

Course syllabus	Hours of class time devoted to food-related topics	Percent of class time spent on food related topics ²
1	4.0	7.1
2	41.0	69.5
3	4.5	9.4
4	2.0	7.1

² Percent of total class time as defined in course syllabus.

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