Plant Science Department
Undergraduate Program
Jordan College of Agricultural Science and Technology

Student Outcomes Assessment Plan (SOAP)

I. Mission Statement

To develop plant science professionals with the theoretical knowledge and practical skills necessary to meet the current and future needs of agriculture.

II. Goals and Student Learning Outcomes

Goal 1: *Plant Science students will understand scientific principles of crop production and be able to apply these principles to specific cropping systems.*

Outcome 1.1 Students will have the ability to describe and synthesize the methods to manage plants for optimal agricultural productivity with minimal negative environmental impact.

Outcome 1.2: Students will have the ability to define and assess the physical, chemical and biological environments for optimal agricultural productivity.

Outcome 1.3: Students will have skills to perform common agricultural field operations.

Outcome 1.4 a: Students in the Plant Health option will have the ability to describe, synthesize and apply methods to manage plant health considering environmental and economic constraints.

Outcome 1.4 b: Students in the Crop Production management option will have the ability to evaluate and apply management options to optimize farm profitability**.**

Goal 2*: Plant Science students will have the ethics, professionalism, quantitative, oral and written communication skills to work effectively in agricultural careers.*

Outcome 2.1: Students will be able to make management decisions incorporating ethical and professional standards.

Outcome 2.2: Students will have the quantitative skills to perform calculations related to agronomic, pest management and cultural practices necessary for optimizing crop production.

Outcome 2.3: Students will have the ability to communicate in written and oral formats appropriate to agricultural professionals and the general public.

Goal 3*: Plant Science students will be able to critically evaluate issues impacting agriculture and interpret and integrate new information into specific cropping systems.*

Outcome 3.1: Students will interpret and evaluate technical reports, such as field trial data, soil and tissue test reports, and be able to make recommendations based on the data and reports.

Outcome 3.2: Students will evaluate the interrelationships between agricultural, societal, and environmental issues incorporating critical thinking and problem solving skills.

III. *Plant Science Undergraduate Curriculum Map* **(Matrix of Courses X Learning Outcomes)**

Course No.	Out 1.1	Out 1.2	Out 1.3	Out 1.4a	Out 1.4b	Out 2.1	Out 2.2	Out 2.3	Out 3.1	Out 3.2
CORE COURSES FOR BOTH OPTIONS										
CHEM 3A										
BIOL 11										
PLANT 99	I				R	I			A	
PLANT 100	R	R					R	R		
SW 2	I	R	I				R	R	R	R
SW 100	I	I		R	R	R	I	R	R	R
SW100L	R	R		R	R	R	R	R	A	A
MEAG 20		I	I	I	I	I	R	I	I	
PLT H 103			A	I	R	I	R	I	I	I
PLT H 105	R	R	R	A	A	I	A	R	R	R
PLTH 106	R	R		A		R	R		R	
PLANT 110W								A		A
ELECTIVES FOR EITHER OPTION										
CR SC 1	I	I	I	I	I	I	I	I	I	I
CR SC 101	R	R	R	R	R	R	R	R	R	A
CR SC 102	R	R	R	R	R	R	R	R	R	A
CR SC 105	I	I	I	R	R	R	R	A	R	A
CR SC 111	R	I	A		A	R	I	A	R	A
CR SC 115	R	I	A		A	R	I	A	R	A
HORT 1	I	I	R	R	R	R	R	R	I	I
HORT 110	A	A	R	R	R	R	R	R	R	R
HORT 112	A	A	R	R	R	R	R	R	R	R
HORT 112	A	A	R	R	R	R	R	R	R	R
HORT 113	A	A	R	R	R	R	R	R	R	R
MEAG 3			IR		IR	I	R	I	I	
MEAG 103					R		A	R	A	
MEAG 112					A		A	R	A	
MEAG 113					R		A	R	A	
MEAG 120		A	A		A	A	A	R	A	
OH 1	I	I	I		A				A	
OH 104	I	I	I	R	I	R	R	R		
OH 108	R	R				R	R	R		R
OH 109	R	R				R	R	R		R
OH 110	I	I	I	R		R	R	R		R
PLANT 107	R	R		R	R	R	R	R	R	

Course No.	Out 1.1	Out 1.2	Out 1.3	Out 1.4a	Out 1.4b	Out 2.1	Out 2.2	Out 2.3	Out 3.1	Out 3.2
PLANT 108	R	R				R	R	R		R
PLANT 150	R	R	I	I	R	R	I	A	R	A
PLANT 180						R	R	R	R	R
PLANT 190						R	R	R	R	R
PLANT 194	R	R	R	R	R	R	R	R	R	R
PLTH 104	R			A		R	R		R	
PLT H 107			R	A		R	R	R	R	R
PLTH 109				R		R				
SW 101	A	A	R	A	A	A	A	A	A	A
SW 104	R	R	R					A	R	R
SW 111	R	R	R					A	R	R
ADDITIONAL REQUIREMENTS/ELECTIVES FOR CROP PRODUCTION MANAGEMENT OPTIOI										
AGBS 28										
AGBS 31										
AGBS 100										
AGBS 110										
AGBS 117										
AGBS 120										
AGBS 130										
AGBS 150										
AGBS 160										
AGBS 163										
AGBS 164										
CHEM 3B										
CHEM 8										
CHEM 150										
PHYSICS 2A										
ADDITIONAL REQUIREMENTS/ELECTIVES FOR PLANT HEALTH OPTION										
PLT H 102	R	R		R		I	A	A	R	R
PLT H 108			A	A	R	A	R	A	A	R
SERVICE COURSES										
MEAG 1S			A	I			I			
MEAG 5			IR							
MEAG 50			A	I			I			
MEAG 114			A	I			I			
SW 1	I	R	I				R	R	R	R
SW100N	I	I		R	R	R	I	R	R	R

I= Introduced; R= Reinforced; A = Advanced

IV. Assessment Methods

Rubrics to evaluate each outcome will be developed in the semester each assignment is to be evaluated. Rubrics will be designed on a 1-4 point scale for each variable in the outcome where a 3 on the scale represents meeting the stated outcome. A group of three faculty members will evaluate the student work with the rubric after a norming session to ensure uniformity of results. In an effort to make assessment results more broadly applicable, we have chosen to use artifacts from multiple courses to assess each outcome.

A. Direct Measures

Outcome 1.1 Students will have the ability to describe and synthesize the methods to manage plants for optimal agricultural productivity with minimal negative environmental impact.

Plant 100 Crop Reports: In Plant 100-Aspects of Crop Productivity, students write a crop report term paper. For the crop report papers, students select an important crop grown in the San Joaquin Valley and describe the phenological development of the crop (e.g. growing degree days, root structure, leaf and canopy development, floral initiation, flowering, and fruiting), describe the physiology of the crop (e.g. photosynthesis, water relations, fertility requirements, harvest index) and discuss important management (e.g. soil preparation, variety selection, plant and row spacing, irrigation and fertility management, pruning, thinning) interventions to improve the productivity of the crop. Papers will be evaluated and scored as advanced, competent, developing or elementary based on the ability to describe and synthesize the methods to manage plants for optimal agricultural productivity with minimal negative environmental impact.

Plant 107 Lab Reports: In Plant 107 –Plant Propagation; students select a plant species from a list of available woody and herbaceous plants on the campus to propagate via seed and vegetatively. They are required to conduct a comprehensive literature review to determine (describe) the most appropriate propagation methods for this selected species. These data are then directly used as they attempt to replicate and/or modify (synthesize), and evaluate the use of these methods in the greenhouse. Parameters such as propagule source tissue are evaluated to balance plant growth with minimal negative environmental impact (energy/water/fertilizer use etc.). Student success is evaluated primarily by direct outcomes: germination, callus and root development etc. Final data are recorded in laboratory notebooks and evaluated by Nursery faculty and staff. Literature review and data are evaluated for thoroughness (appropriate literature/databases accessed) and overall performance of propagules. Failure to germinate/root is not negatively considered in evaluation of these projects; however, if this occurs, students are expected to clearly outline possible explanations and provide recommendations for alternative methods.

CRSC Papers: In the crop production courses- in CRSC 101 (Row Crops), 102 Cereal and Forage Cops),111 (Vegetable Production), and 115 (Organic Crop Production), students write laboratory reports and research papers on topics such as, but not limited to: bed preparation for crop establishment, seeding rates, and irrigation and management practices throughout the growing season. In addition, students have the opportunity to observe and document the diverse agronomic and cultural practices implemented by growers in the Central Valley via field trips.

Students are generally required to compile a term paper and a PowerPoint presentation on an assigned crop, in which they review the underlying scientific concepts for the various management practices observed. The presentations are evaluated by the course instructor and one of his/her peers in accordance with a rubric to assess the student's ability to synthesize the material presented and recognize the interaction between crop production and environmental impact. Whenever possible, students will deliver either poster or oral presentations on the findings from their reports at either scientific meetings or to growers and other members of the public.

Outcome 1.2 Students will have the ability to define and assess the physical, chemical and biological environments for optimal agricultural productivity.

Plant 100 Crop Reports: In Plant 100-Aspects of Crop Productivity, students write a crop report term paper. For the crop report papers, students select an important crop grown in the San Joaquin Valley and describe the phenological development of the crop (e.g. growing degree days, root structure, leaf and canopy development, floral initiation, flowering, and fruiting), describe the physiology of the crop (e.g. photosynthesis, water relations, fertility requirements, harvest index) and discuss important management (e.g. soil preparation, variety selection, plant and row spacing, irrigation and fertility management, pruning, thinning) interventions to improve the productivity of the crop. Papers will be photocopied prior to grading. Three faculty will evaluate the papers and score each as advanced, competent, developing or elementary based on the ability to describe and synthesize the methods to manage and assess the physical, chemical, and biological requirements for optimal agricultural productivity with minimal negative environmental impact.

Plant 107 Lab Reports: In Plant 107 –Plant Propagation; students select a plant species from a list of available woody and herbaceous plants on the campus to propagate via seed and vegetatively. They are required to conduct a comprehensive literature review to determine (describe) the most appropriate propagation methods for this selected species. These data are then directly used as they attempt to replicate and/or modify (synthesize), and evaluate the use of these methods in the greenhouse. Parameters such as propagule source tissue are evaluated to balance plant growth with minimal negative environmental impact (energy/water/fertilizer use etc.). Student success is evaluated primarily by direct outcomes: germination, callus and root development etc. Final data are recorded in laboratory notebooks and evaluated by Nursery faculty and staff. Literature review and data are evaluated for thoroughness (appropriate literature/databases accessed) and overall performance of propagules. Failure to germinate/root is not negatively considered in evaluation of these projects; however, if this occurs, students are expected to clearly outline possible explanations and provide recommendations for alternative methods.

SW 104 Lab Reports: In SW 104, the students will complete a final project, due at the end of the semester as part of their final exam. This project requires them to construct a water management model for four different combinations of a crop and a soil. Two of the crops must be trees or vines and the other two must be annuals. The students select the crops they will work with. They are given four soils, chosen randomly, for their crops. They must select a specific area of California served by a Dept. of Water Resources weather station that has a multi-year history of evapotranspiration data. Each student will have a unique set of crops, soils and weather information. For the final project, the students will collect information from various

published and online sources to construct an irrigation management program for each crop grown in the soil that the student selected. The students must choose an appropriate irrigation system and must use each of the basic irrigation methods, surface, sprinkler and micro-irrigation, for one of their four crops. A spreadsheet model that each student develops earlier in the semester is used to construct an irrigation schedule for each crop that is appropriate for the crop, soil and weather station location. When this spreadsheet model has been completed the students will have created a tool that can be (and has been) used for irrigation planning and water management of California crops.

Fertilizer Experiment: In SW101-Crop Nutrition, students will conduct a small field scale experiment on Nitrogen (N) management of lettuce during the semester and compile a laboratory report. Major tasks include analyzing and presenting soil, tissue and yield data resulting from the experiment having different rates of applied N fertilizer (s). Outcomes of the experiment will be discussed considering both agricultural productivity and environmental protection. Students enrolled in CRSC 115-Organic Crop Production- will either conduct a similar experiment related to the use of organic fertilizers or analyze and critically discuss data obtained from previous experiments. Reports and presentations will be graded in accordance with a rubric and account for a portion of the final grades as outlined in the respective course syllabus.

Outcome 1.3 Students will have skills to perform common agricultural field operations.

MeAg 3/20 Skill Evaluations: In MeAg 3 – Agricultural Tractors and MeAg 20 – Agricultural Machinery and Equipment students operate machinery, perform mechanic tasks, and conduct common agronomic operations during the labs. The instructor will score each student's performance as advanced, competent, developing or elementary.

PltH 108 Field Monitoring and Degree Days: In PltH 108 - Integrated Pest Management, students complete a field monitoring and degree day report. Students will perform common field monitoring techniques using pheromone traps for common orchard pests in order to establish a biofix and determine relative populations. Summary papers which plot field populations over time and utilize the field data in degree day models to predict timing of field operations will be reviewed for successful deployment an observation of field traps.

PltH Collections: In PltH 103 –Economic Entomology, students complete an insect collection. Students will be required to properly collect, preserve, mount and identify a diverse collection of insects from the field. Collections will be evaluated for ability to preserve, mount and identify. In PltH 106 - Plant Pathology, lab exam questions test student's ability to identify common diseases based on symptoms. Disease identification questions will be separated from the other portions of the lab exam to obtain the percentage of correct identifications. In PltH 105 – Weeds, students complete a weed collection. Students will be required to properly collect, identify, and prepare a herbarium style folder of 4o common weeds of California. Collections will be evaluated for correct identification on common and scientific names and quality of the samples. In the lab, the students will be required to identify live weed samples at various growth stages and weed seeds. They will be evaluated on their ability to correctly identify the specimens.

Outcome 1.4a Students in the Plant Health option will have the ability to describe, synthesize and apply methods to manage plant health considering environmental and economic constraints.

PltH Exam questions: In Plth 108, PltH 106 and PltH 105, short essay style exam questions which ask students to describe, synthesize and apply methods to manage plant health considering environmental and economic constraints will be inserted into midterm and final exams. These questions will be evaluated separately from the exams to measure student performance.

Outcome 1.4 b: Students in the Crop Production management option will have the ability to evaluate and apply management options to optimize farm profitability.

CRSC Exam Questions: Assessment of this outcome will be conducted in collaboration with faculty members teaching the AGEC courses (i.e. AGEC 28, 31, 100, 110, 117, 120, 130, 150, 160, 163, and 164). Plant Science faculty members teaching the crop production course will request appropriate input from the AGEC instructors in order to assess the performance of the crop production management students in the economics related courses. In addition, in CRSC 101 (Row Crops), 102 Cereal and Forage Cops),111 (Vegetable Production), and 115 (Organic Crop Production), short essay type questions in the 2nd mid-term and finals exams will test the student's ability to relate the costs associated with various farm inputs and yield data to determine the net profit associated with growing a specific crop.

Outcome 2.1: Students will be able to make management decisions incorporating ethical and professional standards.

PltH Exam questions: In PltH 108 - Integrated Pest Management, and PltH 102 - Pesticides, short essay questions will be embedded in the midterms or final exam which provide students a scenario and ask them to discuss their management decisions and provide explanations for their reasoning. Students will be prompted to incorporate ethical and professional standards in their response.

Outcome 2.2: Students will have the quantitative skills to perform calculations related to agronomic, pest management and cultural practices necessary for optimizing crop production.

SW 104 Lab Reports: In SW 104, the students will complete a final project, due at the end of the semester as part of their final exam. This project requires them to construct a water management model for four different combinations of a crop and a soil. Two of the crops must be trees or vines and the other two must be annuals. The students select the crops they will work with. They are given four soils, chosen randomly, for their crops. They must select a specific area of California served by a Dept. of Water Resources weather station that has a multi-year history of evapotranspiration data. Each student will have a unique set of crops, soils and weather information. For the final project, the students will collect information from various published and online sources to construct an irrigation management program for each crop grown in the soil that the student selected. The students must choose an appropriate irrigation system and must use each of the basic irrigation methods, surface, sprinkler and micro-irrigation, for one of their four crops. A spreadsheet model that each student develops earlier in the semester is used to construct an irrigation schedule for each crop that is appropriate for the crop,

soil and weather station location. When this spreadsheet model has been completed the students will have created a tool that can be (and has been) used for irrigation planning and water management of California crops.

Calculations on Exams: In the crop production courses- CRSC 111, CRSC 115, MeAg 20, MeAg 120, OH 104 and PLTH 105, students will perform calculations related to agronomic and field practices such as fertilizer application rates, crop yields and basic production and equipment costs analysis, seeding rates, germination percentages, pesticide formulations and sprayer calibration. These calculations may be based on available data sets or graphical depictions and charts from research and extension publications. The calculations will be part of the midterm and final exams in the respective courses.

Outcome 2.3: Students will have the ability to communicate in written and oral formats appropriate to agricultural professionals and the general public.

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Fertilizer Experiment: In SW101-Crop Nutrition, students will conduct a small field scale

experiment on Nitrogen (N) management of lettuce during the semester and compile a laboratory report. Major tasks include analyzing and presenting soil, tissue and yield data resulting from the experiment having different rates of applied N fertilizer (s). Outcomes of the experiment will be discussed considering both agricultural productivity and environmental protection. Students enrolled in CRSC 115-Organic Crop Production- will either conduct a similar experiment related to the use of organic fertilizers or analyze and critically discuss data obtained from previous experiments. Reports and presentations will be graded in accordance with a rubric and account for a portion of the final grades as outlined in the respective course syllabus.

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Outcome 3.2: Students will evaluate the interrelationships between agricultural, societal, and environmental issues incorporating critical thinking and problem solving skills.

OH 108/109/110 Projects: In OH 109-Herbaceous Plant Materials and OH 110-Turfgrass Science: Students evaluate water-use requirements in existing landscapes on campus and surrounding areas. Students are required to develop a report/design that balances climate-appropriate plant selections (from those covered in the semester) and landscape use needs (municipal, residential, sports etc.). Successful completion of these projects requires that students evaluate the aesthetic value of landscapes and develop both short- and long-term solutions for good stewardship of our urban ecosystems. Projects are evaluated by faculty, and nursery staff for demonstration of effective use of existing plant material, novel introductions and management techniques.
In OH 108- Woody Plant Materials: Students conduct a "Tree Awareness Survey" throughout the Fresno-Clovis Metropolitan area that engages students directly in the community. This assignment prepares them to develop tree selection guidelines of our region using the software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools. This assignment require students to critically evaluate a community's ability to to strengthen their urban forest management and advocacy efforts by quantifying the structure of urban trees and the environmental services they may/may not provide. Survey data are collected and analyzed by students, and used to develop a plan for existing urban forests. Student success is directly measured by their ability to identify climate and use (shade, street, specimen, etc.) appropriate tree selections from those covered in the semester through weekly quizzes and three hour exams.

Fertilizer Experiment: In SW101-Crop Nutrition, students will conduct a small field scale experiment on Nitrogen (N) management of lettuce during the semester and compile a laboratory report. Major tasks include analyzing and presenting soil, tissue and yield data resulting from the experiment having different rates of applied N fertilizer (s). Outcomes of the experiment will be discussed considering both agricultural productivity and environmental protection. Students enrolled in CRSC 115-Organic Crop Production- will either conduct a similar experiment related to the use of organic fertilizers or analyze and critically discuss data obtained from previous experiments. Reports and presentations will be graded in accordance with a rubric and account for a portion of the final grades as outlined in the respective course syllabus.

B. Indirect Measures

1. Alumni Surveys: The involvement of Plant Science graduates in the Agricultural and other sectors will be assessed by analyzing alumni survey data.

V. Student Learning Outcomes X Assessment Methods Matrix

Direct Method	Out 1.1	Out 1.2	Out 1.3	Out 1.4a	Out 1.4b	Out 2.1	Out 2.2	Out 2.3	Out 3.1	Out 3.2
1. OH 108/109 survey handout/quizzes										X
2. PltH Exam questions				X		X				
3. Plant 100- crop reports	X	X						X		
4. Plant 107 lab reports	X	X								
5. SW 104 lab reports		X					X			
6. Calculations on exams (CrSc 111, 115, MeAg 20, 120, OH 104, and PltH 105							X			
7. PltH collections			X							
8. MeAg 3/20 skill evaluations			X							
9. PltH 108 – field monitoring and degree days			X						X	
10. Fertilizer experiment		X						X	X	X
11. CrSc 101/102/111/115 Exam questions					X					
12. CrSc 101/102/111/115 Papers	X							X		

"X" indicates the objectives the assessment activity will measure

VI. Timeline for Implementation of Assessment Methods and Summary Evaluations

Academic Year	Activities to be Assessed	Out 1.1	Out 1.2	Out 1.3	Out 1.4a	Out 1.4b	Out 2.1	Out 2.2	Out 2.3	Out 3.1	Out 3.2
1. Year 2011 to 2012	2 & 5		X		X		X	X			
2. Year 2012 to 2013	8 & 9			X						X	
3. Year 2013 to 2014	10 & 11 & alumni survey		X			X			X	X	X
4. Year 2013 to 2015	3, 4 & 12	X	X						X		
5. Year 2015 to 2016	1, 6 & 7			X				X			X

"X" indicates when the assessment activity will be conducted. Numbers under activities to be assessed represent activities as numbered in Table V.

VII. Closing the Loop - Summary Evaluation, Curriculum Adjustment, and Reporting

The Department of Plant Science faculty will meet for a department retreat prior to the start of classes in the Fall semester. At this meeting faculty will examine the data gathered from the assessment activities the previous academic year. The discussion will consist of two parts. The first part will address whether the data indicate that our majors are meeting our student learning outcome standards. If the answer is positive then no further action is required. If the answer is negative, then discussion will address the changes necessary to improve student performance. Potential changes could include at least one of the following: adjustments of student learning outcome standards; modifications of syllabi or assignments in one or more courses; substantial revisions of existing courses, proposal of new courses; minor modifications of major requirements; and, substantial modifications of major requirements. Depending on the courses involved and the actions necessary, specific faculty members will be tasked with completing the agreed changes.