Department of Plant Science

Jordan College of Agriculture Sciences and Technology

California State University, Fresno

2020-21 AY Annual Report

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Executive Summary

The transition to a nearly virtual campus for the 2020-21 academic year notwithstanding, the department's staff and faculty continued efforts to address the goals outlined in our 2019 Program Review's Action Plan. As imagined, the considerable time and effort required to continue teaching in a nearly all-online format (exceedingly difficult for many of our hands-on courses in the major) resulted in the department prioritizing efforts to those goals most feasible to accomplish remotely - curriculum based efforts. These included; 1) development of sequenced planning checklists for both incoming freshmen and transfer students using the common Plant Science curriculum adopted in fall 2019, 2) assessing the effectiveness of regular course offerings in reducing time conflicts, and 3) addressing/updating content for many of historically offered courses. The latter proved to be an invaluable effort as faculty hires over the course of the past six (6) years have brought to the department a depth and breadth of experience in modern-day Plant Sciences. With the return to campus in fall 2021 our efforts to better understand the level of prerequisite knowledge and preparedness of our sophomore-junior students will resume, as well as continuing to engage our students more broadly in hands-on field-based experiential learning on our University Agricultural Laboratory (UAL) and regional industry partner agricultural operations. Noteworthy for this latter goal has been Ranjit Riar's team of undergraduate students ongoing crop production in the SW corner of the Horticulture Unit. Efforts to ensure industry-standard best management practices are a cornerstone of our entire Horticulture Unit facility are ongoing, thanks to the efforts of Mark Salwasser and his team on the UAL. The department continues to partner with our Ag One Development team and industry partners to secure funding for a faculty to support the proposed minor in Organic Crop Production. Dave Goorahoo and Ranjit Riar have been instrumental in this effort. Lastly, our final action plan item was to ensure our department retained a faculty member with expertise in Weed Science. We hope to accomplish this through either the return of Anil Shrestha to the department full-time, or a new T/TT hire following completion of the 2021-22 AY. Undergraduate enrollment remained strong (-1) compared to previous years, this despite projections for significant decreases due to the continued mostly virtual mode of instruction. Fall 2020 enrollment in the department's graduate program was identical to fall 2019. We anecdotally attribute this stable enrollment to the availability of rewarding entry-level careers in the Plant Sciences in California and nationwide per the 2020 Occupational Outlook Handbook/Bureau of Labor Statistics data (compiled courtesy of Mary Willis in our campus' Career Development Center. Four-year freshman graduation rates are at 27.8%, and 61.5%, the latter continuing its upward trend over the past decade. Transfer student 2-year graduation rates dropped slightly to 28.6%. Three-year transfer student graduation rates also dropped slightly to 78.% but remained above that observed in 2016. Graduate program graduation rates remained similar to previous years as expected for our largely full-time employed graduate student cohort. Our faculty have continued our department's tradition of student-involved research, with over

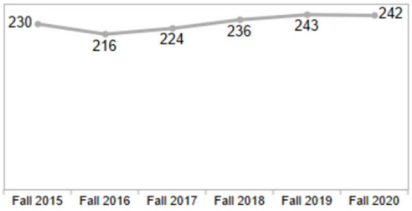
$567k in federal, state, and private funds this past AY alone, and thirty-two (32) research presentations accepted for local, national, and international professional conferences in collaboration with an extensive list of industry, university, and government research partners; all while actively participating in a wide-array of committees, advisory boards, and discipline-related organizations.

Enrollment and Curriculum

Undergraduate

One of the key goals outlined in the department's 2008 Program Review's Action Plan was to "*...design and implement a comprehensive student recruiting plan*". The trend over the past several years suggests enrollment has become relatively stabilized in the mid-200s for undergraduates (Figure 1). However, faculty, staff, classroom/laboratory space, and the department budget allocations have remained at pre-2008 levels. The 2019 program review team agreed that our graduate program has now reached stable enrollment, whereas, undergraduate enrollment will, or in many areas has already, exceed(ed) available space and personnel resources. Since this most recent program review, the department has increased efforts to maximize use of limited, and in some cases dwindling resources. Scheduling of courses to allow the most flexibility for students, while maintaining a sustainable workload for faculty has been a priority. Dual-semester offering of several of our historically over-enrolled major required courses (*PLANT 99 - Biometrics, PLANT 100 - Aspects of Crop Productivity, PLANT 107 - Plant Propagation, Plant 150 - Crop Improvement,* etc) has ameliorated many scheduling conflict issues for our students, and we are now focusing on doing the same for additional courses (*PLANT 160 - Weed Science, PLANT 161- Plant Pathology, PLANT 162- Economic Entomology and PLANT 163 - Integrated Pest Management*). These latter courses are regularly taken by students across several department in the Jordan College (AgBs, VE, and AgEd, etc.) interested in expanding career opportunities not available following completion of their major, many completing coursework required for the CA DPR - Pest Control Licensing program. The department also placed forty-nine (49) undergraduates in external career-focused/ paid *PLANT 194I - Agricultural Internships* in the 2020-21 AY with the assistance of the Jordan College Coordinator for Internships and Professional Experiences - Imelda Dudley.

Headcount or FTES
Count of Students



Enrollment broken down in: Count

Breakdown 1
Race / Ethnicity

	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
African American	1					
American Indian	2	1	2	3	1	1
Asian	12	11	10	7	6	5
Hispanic	98	93	110	131	141	144
Non-Resident Alien	9	9	13	16	14	18
Pacific Islander						1
Two or More	6	4	5	5	5	4
Unknown	12	17	18	15	15	11
White	90	81	66	59	61	58

Breakdown 2
Full-Time

	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
Full-Time	203	186	198	217	222	213
Part-Time	27	30	26	19	21	29

Breakdown 3
Enrollment Status

	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
Continuing	183	157	167	163	170	177
First-Time	12	21	14	27	23	30
Returning	8	6	6	1	6	2
Transfer	27	32	37	45	44	33

Breakdown 4 (Numeric)
Cum GPA BOT (only for continuing students)

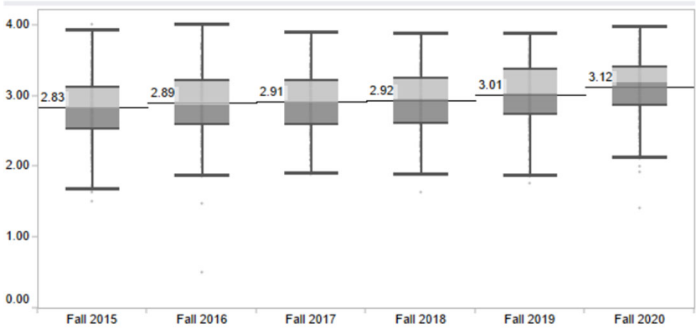


Figure 1. 2015-20 Undergraduate enrollment for the Department of Plant Science

- Data source: Office of Institutional Effectiveness

COVID-19 related travel restrictions again prohibited our department's efforts to meet with individual feeder community college faculty and advisers to ensure pre-transfers are being advised properly if considering the Plant Science Major at Fresno State. However, we have taken this as an opportunity to redraft/disseminate our curriculum planning sheet with recommendations for course sequencing that also outlines course prerequisites etc. (Figure 2). We will be resuming our visits over the 2021-22 AY with focus on more northern feeder community colleges (Modesto, Merced, San Joaquin Delta, etc.). Once complete we will expand this effort to include those community colleges that are increasingly sending students to Fresno State (Bakersfield, Cuesta, Porterville, Santa Rosa, Allan Hancock, etc.).

2021-22 Plant Science B.Sc. Course Checklist

California State University, Fresno

[For planning purposes only - Consult the official University Catalog for all degree requirements advising notes, prerequisites, etc.]

http://fresnostate.edu/catalog/subjects/plant-science/plant-sci.html

Student Name: Email Address: @mail.fresnostate.edu

Transfer Student? Catalog Year: 20____ Projected Graduation Semester/Year:

Planned Semester	Course	Semester Offered*	Semester Completed	Units
1st	GE A1 - Oral Communication	Fall/Spring		3
1st	GE A2 - Written Communication	Fall/Spring		3
1st	GE B4 - MATH 11 Elementary Statistics	Fall/Spring		3
1st	GE A3 - CSM 10 The Scientific Method	Fall/Spring		3
1st	Lower Division Elective_____	Fall/Spring		3
2nd	GE B2 - BIOL 11 Plant Biology†	Fall/Spring		3
2nd	GE B3 - Laboratory Component	Fall/Spring		-
2nd	GE C1 - Arts	Fall/Spring		3
2nd	GE C2 - Humanities	Fall/Spring		3
2nd	GE E - CSM 15 Evidence Based Decision Making	Fall/Spring		3
2nd	MEAG XX or XXX (based on field of study)	Fall/Spring		3
3rd	GE B1 - CHEM 3A Introductory General Chemistry (GE B4 - MATH 11)‡	Fall/Spring		3
3rd	GE C1 or C2 - Arts or Humanities	Fall/Spring		3
3rd	GE D1 - American History	Fall/Spring		3
3rd	PLSI 2 American Government and Institutions	Fall/Spring		3
3rd	Lower Division Elective_____	Fall/Spring		3
4th	GE D2 - AGBS 1 Agricultural Business	Fall/Spring		3
4th	GE F - Ethnic Studies	Fall/Spring		3
4th	CHEM 8 Intro Org Chem or CHEM 3B Elem Org/Biochem (CHEM 3A)	Fall/Spring		4
4th	PLANT 99 Intro to Biometrics (MATH 11 or any Intro/Elem Statistics course)§	Fall/Spring		3
4th	Lower/Upper Division Elective_____	Fall/Spring		3
5th	PLANT 71 Agricultural Water	Fall		3
5th	PLANT 100 Aspects of Crop Productivity (BIOL 11)	Fall/Spring		3
5th	PLANT 162 Economic Entomology (BIOL 11)	Fall		3
5th	PLANT 172 Soils (CHEM 3A)	Fall		3
5th	PLANT 172L Soils Lab (PLANT 172 (may be concurrent))	Fall		1
5th	Upper Division Elective_____	Fall/Spring		3
6th	CHEM 150 General Biochemistry (CHEM 3A and 3B or 8)	Fall/Spring/Summer		3
6th	PLANT 101 Crop Nutrition (PLANT 172)	Spring		3
6th	PLANT 160 Weeds (BIOL 11 & CHEM 3A) or PLANT 163 IPM (PLANT 162)	Spring		3
6th	GE IB - PLANT 105 Food Soc and Envir or GE ID AGBS 155 Envir Nat Res Policy¶	Fall/Spring		3
6th	UD Writing Skills Requirement - PLANT 110W Dimensions in Agriculture	Fall/Spring/Summer		-
6th	Upper Division Elective_____	Fall/Spring		3
7th	PLANT 161 Plant Pathology (BIOL 11)	Fall		3
7th	GE IC - Arts and Humanities	Fall/Spring		3
7th	PLANT 107 Plant Propagation or PLANT 108 Microprop. (BIOL 11, CHEM 3A)	Fall/Spring		3
7th	PLANT 150 Crop Improvement (BIOL 11)	Fall/Spring		3
7th	Upper Division Elective_____	Fall/Spring		3
8th	PLANT 160 Weeds (BIOL 11 & CHEM 3A) or PLANT 163 IPM (PLANT 162)	Spring		3
8th	GE IB - PLANT 105 Food, Soc and Envir or GE ID AGBS 155 Envir Nat Res Policy	Fall/Spring		3
8th	PLANT 180, 190, 194I, 196 Senior Experience	Fall/Spring		1
8th	Upper Division Elective_____	Fall/Spring		3
8th	Upper Division Elective_____	Fall/Spring		3
			Total	120

Notes:

** Semester offered is subject to change, summer courses are not always offered. Consider completing as early in schedule as possible*

† An "Introductory/Elementary/Fundamental Biology" combined with an "Introduction to Plant Science" course may be substituted for BIOL 11 - Plant Biology (Requires department approval and a permission number for any courses requiring BIOL 11)

‡ Prerequisite or co-requisite: G.E. Foundation B4 (MATH 11). No credit for CHEM 3A after CHEM 1A.

§ Prerequisites in parentheses/Must obtain a "C" or higher in all major course prerequisites

¶ PLANT 105/AGBS 155 can double count as GE IB/ID and an UD Elective provided a minimum of 120 total units will be completed

6-10-2021

Figure 2. 2021-2022 Plant Science B.Sc. Sequenced Planning Checklist

Department faculty continue to work closely with Jordan College Advisors and

Community College Advisors and Faculty to ensure incoming freshmen and transfer students are as best prepared as possible. Although on AY appointments, many department faculty continue to participate in intersession and summer Dog Days advising sessions, during which the major in Plant Science is detailed (Figure 3) along with the assistance of our department's JCACDC academic advisor Nyxy Morgan. Our department staff also assist with course schedules, seating availability with live updates during, and just following these advising sessions, permitting students to quickly determine, and secure seats in desired classes where available. Major changes to the General Education requirements, including the addition of an Ethnic Studies component (now designated as Area F) created some issues within the curriculum, including exceeding the maximum allowed 120 units for the undergraduate degree. The department has since been approved to waive the Multicultural/International university-wide requirement so the major now remains at 120 units. In addition, in an effort to address head-on the department's 2019 action plan item to "*Ensure prerequisite knowledge in biological sciences and chemistry exists within 1) sophomore and 2) transfer students majoring in Plant Sciences"* all incoming freshmen are now block-scheduled for enrollment in the College of Science and Mathematics' *CSM 10 - The Scientific Method* in their first semester, and *CSM 15 - Evidence Based Decision Making* in their second. These two lower-division courses also satisfy the General Education Area A3 and E requirements respectively. Incoming Freshmen (or Transfers if necessary) are also required to complete *MATH 11 - Elementary Statistics, BIOL 11 - Plant Biology, and CHEM 3A - Introductory General Chemistry* within their first year (or prior to transferring). Despite university-wide concerns about decline in enrollment due in large part to the COVID-19 pandemic, the department unanimously agreed to maintain pre-COVID-19 admission GPA requirements to best ensure the success of students attempting to complete the B.Sc. in Plant Science. We also held students requesting change-of-majors (to Plant Science) to the same admission standards, closing a loophole that historically permitted students to first declare a major with lower GPA admission requirements, and then switch majors after one semester, even without meeting the department's requirement. With the assistance of the Jordan College Ag One development team the department's undergraduate program committee (Dave Goorahoo, Margaret Ellis, Florence Cassel Sharma, Ranjit Riar, and Chris McKenna) forty-one (41) students were selected for distribution of $38,196.66 in scholarship funds in the 2020-21 AY, and again for thirty-six (36) students for distribution of $35,597 in scholarship funds for the upcoming 2021-22 AY. Five (5) undergraduate students were also awarded Rodger and Margaret Jensen Scholarships. The nationally competitive Collegiate Soils Judging team under the guidance of Jacob Hurst continues to practice: team membership now also requires enrollment in 1-unit *PLANT 190 - Independent Studies* to maintain the existing structured and rigorous program.

Figure 3. 2021-2022 Plant Science common advising slides-personalized by faculty volunteers for individual intersession/summer Dog Days sessions

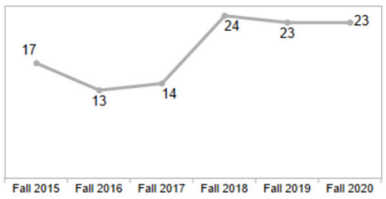
We will be administering a modified/updated version of our 2010 online Qualtrics student survey to directly measure the level of prerequisite knowledge and preparedness of our sophomore-junior students. Our intent is to obtain a more in-depth understanding of any barriers to student success within the major, specifically identifying gaps in prerequisite knowledge in biological sciences, chemistry, and mathematics, and now to include focus on a more broader ability to understand the scientific method, and apply such via evidence based decision making to address common problems found in the applied Plant Sciences (yield loss, disease pest pressure, water and nutrient use efficiency, etc.).

Graduate

The 2019 Program Review Committee report indicated that the graduate program in Plant Science "*...is perfectly aligned"with the University's goal to "produce transformative scholarly research and creative works that target regional issues with global significance*". The Plant Science Graduate Program under the guidance of the department's graduate

program committee (Sharon Benes, Gurreet Brar, and Jacob Wenger) has graduated on average 4.6 M.Sc. candidates per year over the past five years; however, this graduation rate is trending upward, and has nearly doubled over the past ten (10) years. In the 2020-21 academic year alone, nine (9) M.Sc. candidates applied for graduation following completion of all coursework and final thesis preparation, bringing the five-year graduation rate average up to 5.2. The growth in graduate program enrollment over the past several years (Figure 4) will likely increase graduation rates, as will the addition (replacement) of four new research-active tenure/tenure track faculty over the past six (6) years. It is evident by the number of program graduates employed in various sectors that there is considerable regional, national and international demand for our program: 97% are employed in the field of Plant Sciences, 60% are employed within California's Central Valley, fifteen (15) are employed within the University of California Cooperative Extension System, thirteen (13) have earned, or are pursuing, a doctorate in Plant Science, four (4) are university faculty (2 tenure track- Oregon State and CSU Monterey Bay and two (2) permanent lecturers, one at Fresno State). M.Sc. candidates in the Department of Plant Science Graduate program are also an essential component of faculty and research center/institute staff research programs. Plant Science faculty alone have secured nearly $3.3M in external grants over the past five (5) years, resulting in thirty-two (32) student-involved research presentations accepted at regional, national and international scientific conferences just in the 2020-21 AY, even with virtual attendance requirements due to COVID-19. Over the past year department faculty have authored/co-authored fourteen (14) peer-reviewed papers, most of which would not have been possible without graduate student researchers. Several global AgriBusinesses (e.g. Bayer CropSciences, Valent USA, Davren Global, etc.) have recognized the value of our program, and as such have continued to support via full-tuition fellowships, research grants etc. to aid in our program's preparation of their future employees. The Plant Science Graduate Program has been, and remains essential for recruiting and retaining research-active faculty from some of the leading land-grant institutions. Their ability to subsequently publish peer-reviewed publications relies heavily on an active M.Sc. candidate cohort; this is especially true given the broad array of disciplines within the department. These research programs (and concomitant use of Jordan Agricultural Research Center, Horticulture Unit, University Agricultural Laboratory, Center for Irrigation Technology, etc.) directly address many of the issues facing our regional, national and international agricultural industry (e.g. water, soil fertility, pest management, crop performance, etc.). Two (2) department graduate students received an ARI-HSI Science Fellowship, one (1) was awarded a Bayer Crop Science Fellowship, three (3) were awarded Jordan-Harvey Fellowships, and one (1) was selected for a NSF CSU-LSAMP Bridges to Doctorate Fellowship.

Headcount or FTES
Count of Students



Enrollment broken down in: **Count**

Breakdown 1
Race / Ethnicity

	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
American Indian	1	1		1	1	1
Asian	1	1		2	2	1
Hispanic	7	4	4	5	5	7
Non-Resident Alien	4	3	3	6	4	1
Two or More	1	1	1	1	1	2
Unknown	2	2	2	2	1	1
White	1	1	4	7	9	10

Breakdown 2
Full-Time

	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
Full-Time	4	5	6	12	6	7
Part-Time	13	8	8	12	17	16

Breakdown 3
Enrollment Status

	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
Continuing	14	8	8	15	19	17
First-Time	3	4	4	9	3	5
Returning					1	1
Transfer		1	2			

Breakdown 4 (Numeric)
Cum GPA BOT (only for continuing students)

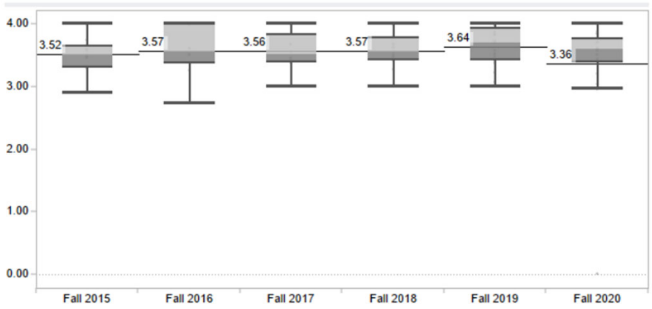


Figure 4. 2015-20 Graduate student enrollment for the Department of Plant Science

- Data source: Office of Institutional Effectiveness

Graduation Initiative (GI) - 2025

Graduation Rates

The Office of Institutional Effectiveness (OIE) has provided a GI 2025 Projections dashboard that provides snapshots of graduation rates etc. However, we also noted the initially provided (and exceeded) goals :

http://www.fresnostate.edu/academics/studentsuccess/documents/Fresno-State-Goals.pdf

were not aligned with actual goals:

http://www.fresnostate.edu/academics/studentsuccess/documents/OIE%20-%20Fresno%20State%20GI%202025.pdf

Nevertheless, the department's curriculum changes, course sequencing etc. discussed above were in large part an effort to increase graduation rates, thus we will continue to monitor effectiveness of such over the 2021-22 AY, and adjust accordingly if needed. Currently Fall 2016 four-year freshman graduation rates are at 27.8%, down slightly from fall 2015 (33%); however, the Office of Institutional Effectiveness estimates a continued upward trend, reaching 50.7% in 2023, well above the 35% goal (Figure 5a). The fall 2014 6-year graduation rate for freshmen continues its upward trend from 2012, currently at 61.5%, slightly below the 69% goal (Figure 5b). Transfer student 2-year graduation rates were above the 34% goal for fall 2017 students, but dipped slightly to 28.6% for fall 2018 students (Figure 5c). The Office of Institutional Effectiveness estimates a continued upward trend, reaching 61.5% by 2025. Transfer student 3-year graduation rates also dipped slightly from 84.6% for fall 2016 students to 78.6% for fall 2017 students (Figure 5d). The department will continue to closely monitor these data to determine if these slight decreases are representative of a future trend, or simply a short term effect of this past and unprecedented academic year. The Office of Institutional Effectiveness projections suggest the latter may be a significant contributing factor. It is worthy of note that our recent program review confirmed that lack of space and personnel resources to adequately accommodate all students remains a significant challenge; "*The existing instructional laboratories are over-subscribed* ", and " *The faculty are literally one-deep in many of the courses that need to be taught*". This most recent review team also highlighted that "*Admission to the program seems to outstrip department, college, and university resources and should be tied more closely to faculty numbers"*. From such, it becomes apparent that additional personnel and resources would significantly and positively impact graduation rates for both incoming freshman and transfer students.

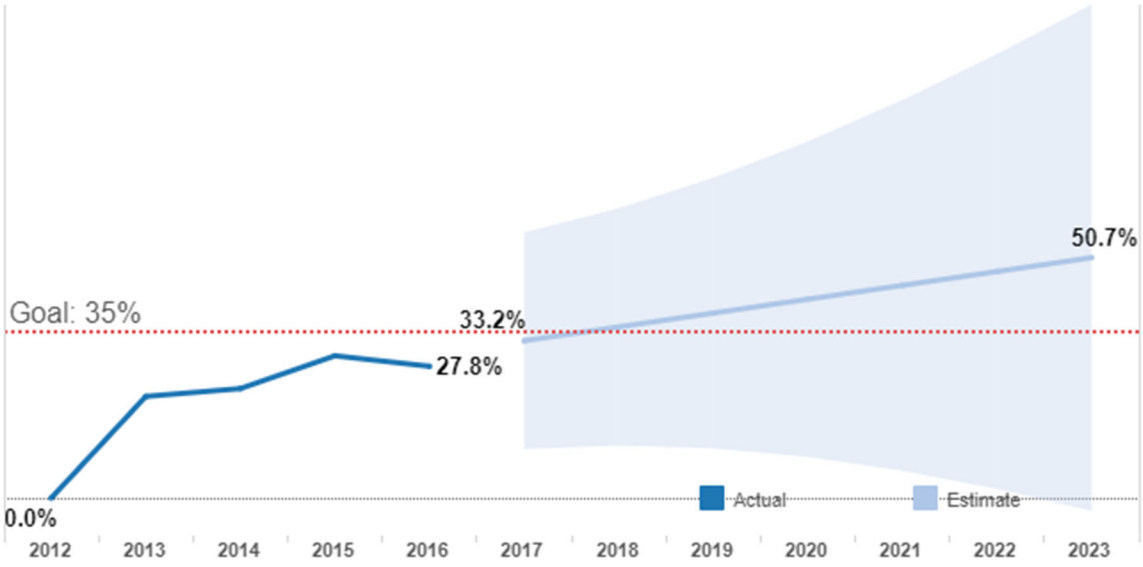


Figure 5a. 4-Year Graduation of Full-Time, First-Time Freshman Cohorts

Entry Cohorts from Fall 2012 to Fall 2016

- Data source: Office of Institutional Effectiveness

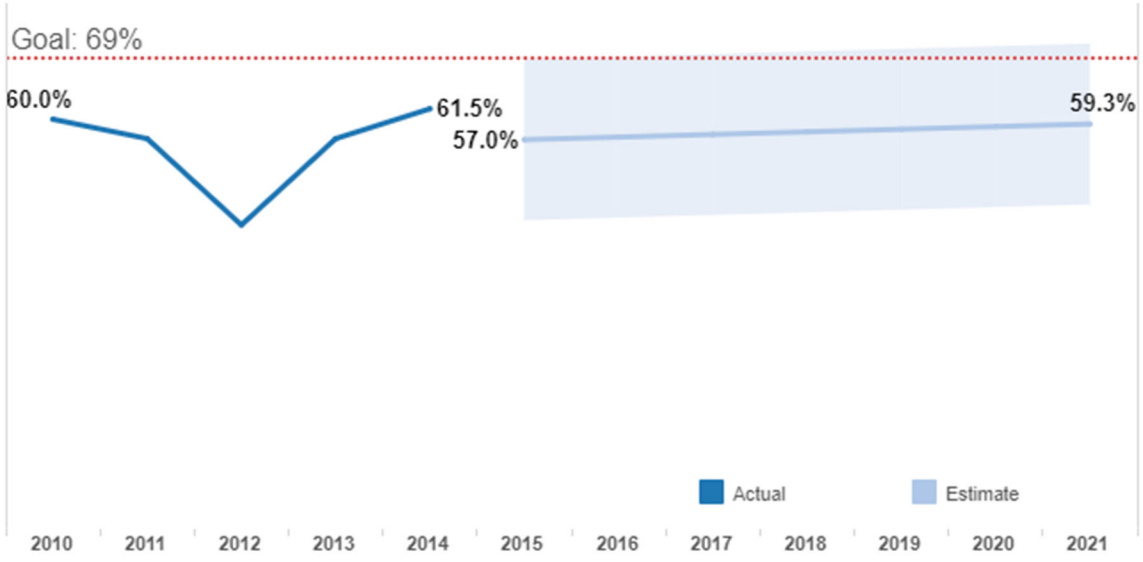


Figure 5b. 6-Year Graduation of Full-Time, First-Time Freshman Cohorts

Entry Cohorts from Fall 2010 to Fall 2014

- Data source: Office of Institutional Effectiveness

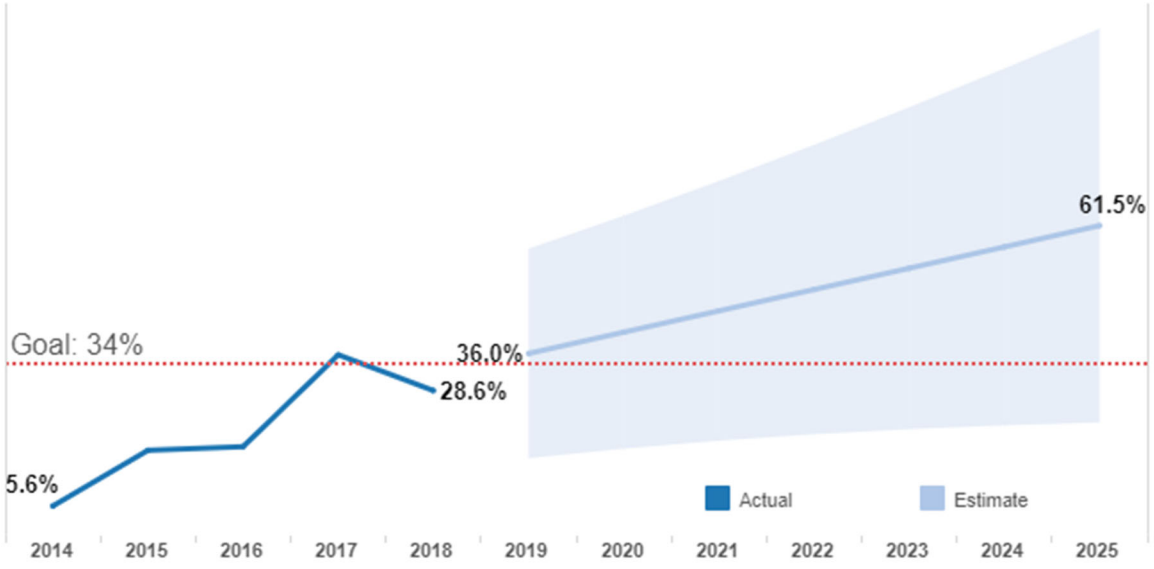


Figure 5c. 2-Year Graduation of Full-Time & Part-Time, New UGRD Transfer Cohorts

Entry Cohorts from Fall 2014 to Fall 2018

- Data source: Office of Institutional Effectiveness

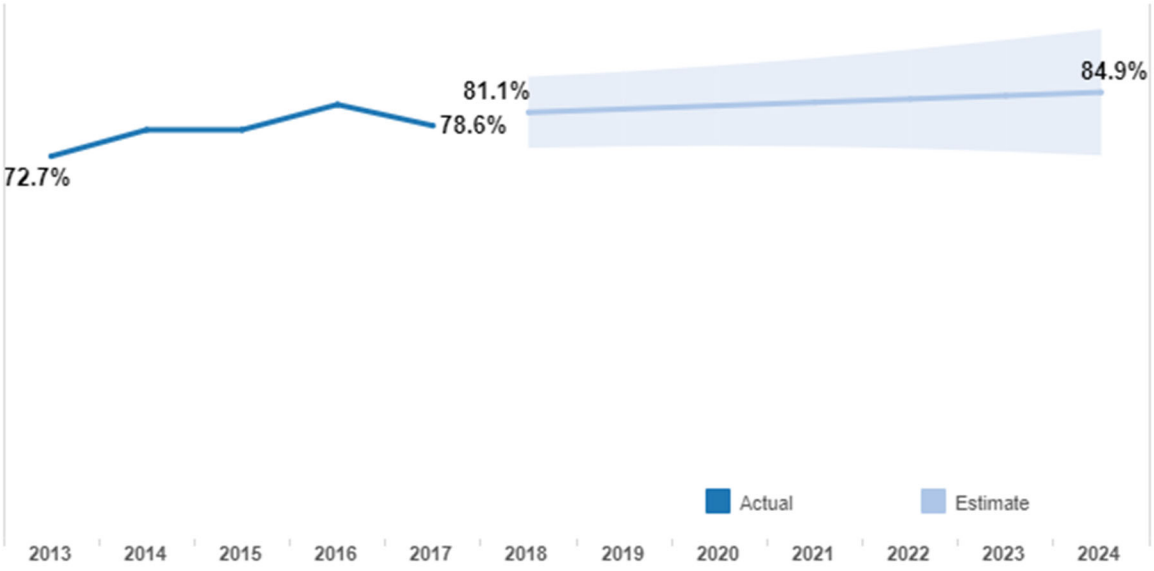


Figure 5d. 3-Year Graduation of Full-Time & Part-Time, New UGRD Transfer Cohorts

Entry Cohorts from Fall 2013 to Fall 2017

- Data source: Office of Institutional Effectiveness

The average graduation rate is 2 to 2.5 years for full-time graduate students and 3 to 4 years for working students (Figure 6). Given the long growing season in California (~ 8 months), it can be difficult for students to complete the graduate program in two years, particularly as a minimum of a second season of field data is required for publication in peer-review journals.

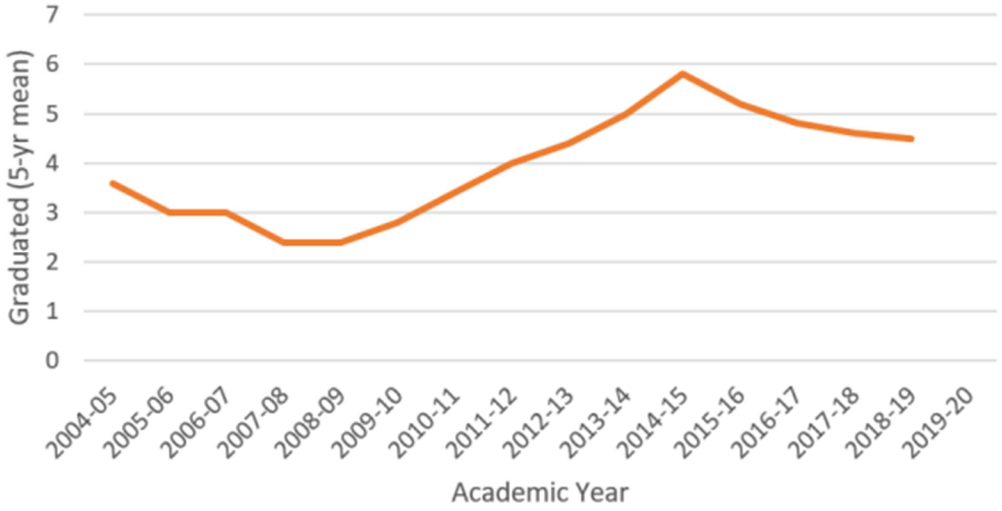


Figure 6. Department of Plant Science Graduate program graduation rate per academic year (5 year rolling average).

- Data source: Department of Plant Science Graduate Program Committee

Retention

Retention rates for the department's First-time Full-time Freshman has remained relatively consistent over the past decade with retention after 1-year ranging from 73-100%. Interestingly, the retention rate for fall 2020 students was on par with that observed in fall 2012 and 2014 (~93%) suggesting that the transition to mostly virtual instruction in spring 2020 due to COVID-19 did not significantly impact First-time Full-time Freshman (Figure 7). Although the retention rate for transfer students dropped slightly, it remained above 90% after 1-semester, and was slightly higher (at 90.7%) than observed for fall 2008, 2012, 2014, 2016 and 2017 (Figure 8). These similarities across multiple years suggest the retention rates for the department are stable, and were likely not negatively impacted by the COVID-19 pandemic. Retention rates for graduate students in the department have steadily increased since fall 2015, and reached 100% in fall 2019 (Figure 9). Anecdotal data from current M.Sc. candidate faculty advisors suggest that all of the fall 2020 graduate student cohort will continue to make good progress towards degree completion.

First-time Full-time Freshmen Cohorts

Entry Cohort	Cohort Size	Avg Entry GPA*	Avg. 1st Term GPA	Retention after 1 st Term	Retention after 1 Year
Fall 2008	12	3.34	2.88	100.0%	100.0%
Fall 2009	3	3.10	2.80	100.0%	100.0%
Fall 2010	8	3.42	3.18	100.0%	75.0%
Fall 2011	11	3.32	2.40	100.0%	81.8%
Fall 2012	15	3.03	2.44	93.3%	73.3%
Fall 2013	18	3.40	2.72	100.0%	88.9%
Fall 2014	16	3.17	2.35	93.8%	87.5%
Fall 2015	12	3.22	2.42	100.0%	75.0%
Fall 2016	21	3.45	3.15	100.0%	90.5%
Fall 2017	14	3.62	3.10	100.0%	92.9%
Fall 2018	25	3.59	2.81	100.0%	88.0%
Fall 2019	23	3.41	2.39	95.7%	78.3%
Fall 2020	29	3.56	3.04	93.1%	
Grand Total	207	3.40	2.75	97.6%	85.4%

Figure 7. Fall 2008-2020 Cohort Retention for the Department of Plant Science First-time Full-time Freshman

- *Data source: Office of Institutional Effectiveness*

First Time CCC Transfer Cohorts

Entry Cohort	Cohort Size	Avg Entry GPA*	Avg. 1st Term GPA	Retention after 1 st Term	Retention after 1 Year
Fall 2008	6	2.75	2.57	100.0%	83.3%
Fall 2009	20	3.10	2.62	95.0%	90.0%
Fall 2010	28	3.02	2.90	100.0%	92.9%
Fall 2011	23	2.94	2.73	100.0%	95.7%
Fall 2012	17	3.12	2.37	94.1%	82.4%
Fall 2013	50	2.93	2.59	94.0%	94.0%
Fall 2014	23	3.11	2.47	91.3%	73.9%
Fall 2015	21	3.25	2.99	100.0%	95.2%
Fall 2016	29	3.00	2.70	96.6%	89.7%
Fall 2017	35	3.04	2.98	91.4%	88.6%
Fall 2018	45	3.14	2.87	95.6%	91.1%
Fall 2019	43	3.30	3.20	95.3%	90.7%
Fall 2020	31	3.24	3.01	90.3%	
Grand Total	371	3.09	2.81	95.1%	90.0%

Figure 8. Fall 2008-2020 Cohort Retention for the Department of Plant Science Transfer Students

- *Data source: Office of Institutional Effectiveness*

Entry Cohort	Cohort Size	Retention after 1 Year	Retention after 2 Yrs
Fall 2010	6	66.7%	33.3%
Fall 2011	7	85.7%	42.9%
Fall 2012	6	100.0%	33.3%
Fall 2013	5	80.0%	40.0%
Fall 2014	7	85.7%	28.6%
Fall 2015	3	100.0%	33.3%
Fall 2016	5	80.0%	40.0%
Fall 2017	7	85.7%	14.3%
Fall 2018	10	90.0%	50.0%
Fall 2019	3	100.0%	
Fall 2020	5		
Grand Total	64	86.4%	35.7%

Figure 9. Fall 2010-2020 Cohort Retention for the Department of Plant Science Graduate Students

- *Data source: Office of Institutional Effectiveness*

Horticulture Unit

The department continues its efforts to achieve the 2019 action plan item "*... to upgrade our controlled environment facilities (Horticulture Unit) that are essential for the success of both the teaching and research mission of the department".* In this past year's uncertain budget climate it was readily apparent that any and all available resources were required to facilitate safe in-person instruction where possible, as well as facilitate virtual instruction. The department also recognized the absence of student use of the facility was an opportune time to reevaluate former and current maintenance and production practices. Working directly with the Jordan College and UAL administration some progress has been made, albeit limited due to mandated COVID-19 restrictions on personnel etc. As schedules and student use slowly returns to pre-COVID-19 levels the department along with Jordan College and UAL administration will continue its focus on the following ten (10) items specific to ensuring industry-standard best management/operation practices are the norm at the Horticulture Unit: 1) Assess historical, and current use of facilities, 2) Re-evaluate, or identify existing key facility components, 3) Develop a clear plan for maximizing use of facilities, 4) Develop a plan for facility sustainability, 5) Production costs/returns, 6) Inclusion in research funding requests, 7) Use of returned indirect for research, 8) Assess historical, and current staffing of facilities, 9) Re-evaluate, or identify existing staffing needs, and 10) Develop a clear plan for maximizing the use of existing resources (personnel, facilities, etc.). Our Jordan College Budget Committee (and our Ag One development team) has been provided a detailed list of items etc. required (est. costs = $750,000.00 to $1,000,000.00) to renovate all environmental controls for the four existing glass, and one polycarbonate greenhouse(s), and installation of two new larger polycarbonate (3300 sq ft each) greenhouse.

Student Engagement on the University Agricultural Laboratory

Although the COVID-19 restrictions significantly reduced, or in some cases cancelled all student engagement on the UAL, the department continued making progress towards its 2019 action plan item to: "*Embark on a dedicated initiative to engage students more actively in all aspects of the university agriculture laboratory, including creation and integration into the curriculum of a 2-semester series of "Field Applications in Agricultural Sciences" course"*. It is noteworthy that, department faculty and UAL staff were able to maintain some level of student engagement on the UAL during the 2020-21 AY, either through student employment at the various production enterprises, or through the Plant Science Club's management of the "Student Farm" on the southwest corner of the Horticulture Unit; success of such due was in large part to Ranjit Riar's mentorship of the students, as well as support provided by the unit's Instructional Support Technician Calliope Correia and the UAL Director Mark Salwasser. The department also resumed its historical practice of providing 1-2 units of academic credit for students completing directed and comprehensive *PLANT 180/190 Field Applications in Agricultural Sciences* Independent Studies/Undergraduate Research course. As PLANT 180/190 are only available for junior and above-level students the department has also requested reactivation of the PLANT 80 Independent Studies/Undergraduate Research course. This course was historically available for lower-division Plant Science Majors under the direct supervision of a faculty, or often the Department Chair. This course was last listed in the catalog in 2008, and has not been offered since, thus was automatically deactivated. Since that time the department has modified its curriculum to include additional approved lower division elective courses, including PLANT 80. Reactivation of PLANT 80 will restore the opportunity for entry-level students to begin exploring in greater depth possible careers in Plant Science. This course will also provide the necessary fundamental background for many PLANT 180 projects, as well as specific crop production-focused research and/or independent studies. The department continues to work with our Ag One development team and California Certified Organic Farmers industry partners to secure external support for a faculty line with expertise in Organic Production systems, and within this proposal includes a field-based 2-semester course. In the interim, the department has since included two new related field-based upper-division elective courses within the new curriculum (PLANT 169 - Bee Biology and Apiary Science and PLANT 171 - Soils in the Environment).

COVID-l9 Response

The COVID-19 pandemic continued to significantly disrupt the department's ability to deliver on its mission "*To ensure our students graduate with the skills and knowledge necessary to become leaders in modern, scientifically based, economically and environmentally sound agriculture*"; however, triage efforts to "*mitigate its impact*" that were required in late 2019-20 AY were not as comprehensive since department staff and faculty spent considerable time and resource over the summer of 2020 to deliver on our mission as best as possible. Over the course of the 2020-21 AY we were again reminded of our department's staff and faculty resiliency and dedication to the success of our

students. Lessons learned in the early days of the AY were quickly shared across the department, as expertise in specific areas, whether technology related or student advising and mentoring during this rather difficult year became evident, even unexpected in many cases. Several of our faculty (full and part-time) participated in the Center for Faculty Excellence's *Introduction to Teaching Online Using the QLT Instrument (QLT1), ACUE Effective Online Teaching Practices. Introduction to Teaching Online Using the QLT Instrument (QLT1), and Foundations of Virtual Instruction*. Seven of the department faculty have fully completed the requirements outlined in APM 206 *Policies and Procedures on Technology-mediated Courses and Programs* to teach in Blended I and II, or fully online formats. Several others are participating in the summer 2021 CFE training cohorts in preparation for the 2021-22 AY. In fall 2020 ninety-six (96) sections were approved/offered via virtual instruction, and six (6) sections were approved/offered via in-person. In spring 2021 seventy (70) sections were approved/offered via virtual instruction, and eighteen (18) sections were approved/offered via in-person. This latter (and welcome) decrease in virtual instruction is due in large part to efforts by department faculty and staff to modify instruction in adherence with COVID-19 safe capacity limits established under the guidance of Lisa Kao's Office of Environmental Health & Safety and Risk Management team and Grace Borbe - Associate Director of Planning and Design. In fall 2021 nineteen (19) sections have been approved for virtual instruction whereas eight-five (85) sections have been approved for in-person instruction. Faculty have also taken this unprecedented opportunity to refine their course content, strengthen core areas and remove potentially redundant material within individual courses, as well as across the curriculum. The value of hands-on experiential learning that our department is best known for became even more evident this past AY. Noteworthy was the critical role the college's Instructional Support Technicians (Stella Sommer and Geoff Dervishian) had in procurement, technolocial, and training support required to facilitate virtual and in-person teaching and research where feasible.

Faculty/Staff

The department maintains a diverse array of discipline-specific tenured/tenure track, and full time lecturer expertise (Table 1), and continues to enlist the considerable expertise of part time lecturers to ensure program delivery as needed (Table 2). Our Ag One development team is actively seeking external support for the hiring of a much needed full time faculty with expertise in Soil Microbiology or Agroecology to support the proposed minor in Organic Crop Production. Faculty and staff continue to participate in various Professional Development Opportunities offered by The Center for Faculty Excellence and The Office of Organizational Excellence, and despite transition to virtual meetings, attend annual meetings of related professional societies and organizations (Table 3). Noteworthy is John Williams' successful completion of the doctoral program in Educational Leadership. The Department's Administrative Support Coordinator Marlene Miyasaki continues to provide expertise for all department operations, as well as serving on multiple

task force and search committees campus-wide, and as the critical point of contact for a wide array of industry and community partners and department alumni.

Full Time Faculty	Expertise
Sharon Benes, Ph.D.	Soil Science
Gurreet Brar, Ph.D.	Pomology
John Bushoven, Ph.D.	Horticulture
Florence Cassel S., Ph.D.	Irrigation Science
Margaret Ellis, Ph.D.	Plant Pathology
Dave Goorahoo, Ph.D.	Olericulture
Jacob Hurst, M.Sc.	Plant Health
Christopher McKenna, M.A	Mechanized Agriculture
Ranjit Riar, Ph.D.	Agronomy
Vacant, Ph.D.*	Weed Science
Jacob Wenger, Ph.D.	Economic Entomology
John Williams, Ed.D.	Mechanized Agriculture

Table 1. Full-time faculty expertise in the Department of Plant Science

* *On temporary assignment in the Department of Viticulture and Enology*

Part Time Faculty	Course(s) Taught
Jill Hendrickson, M.F.A.	Plant 110W – Dimensions in Agriculture
Robert Roy, M.Sc.	Plant 105 – Food, Society and Environment
Richard Stoltz, M.Sc.	PLANT 30 – Introduction to Fruit Science, PLANT 165 - Pesticides
Ron Nishinaka, M.A.	PLANT 40 – Introduction to Ornamental Horticulture
Jennifer Tweedy, M.A.	PLANT 41 – Floral Design
Don Vasconcellos, M.Sc.	PLANT 105 – Food, Society and Environment
Maria Estrada, M.Sc.	PLANT 150 – Crop Improvement, PLANT 105 - Food, Society Environment, Plant 99 - Introduction to Biometrics, PLANT 20 - Introduction to Crop Science
Charles Krauter, Ph.D.*	PLANT 71 - Agricultural Water
Arthur Faria, M.A.	MEAG 114 - Small Gasoline and Compact Diesel Engines laboratory

Table 2. Department of Plant Science part-time faculty for the 2019-20 AY

** Emeritus faculty*

- ASA California Plant and Soil Conference Annual Meeting
- California Weed Science Society Annual Meeting
- International Root Research Society Meeting
- American Society of Agronomy, Crop and Soil Science International Meeting
- American Society for Horticultural Science Annual Meeting
- Farmer Veteran Coalition Annual National Meeting
- Entomological Society of America Annual Meeting
- California Women for Agriculture Annual Meeting
- Univ of Arizona Greenhouse Crop Production and Engineering Design Short Course
- The American Phytopathological Society Annual Meeting
- Univ of California C Pistachio Short Course
- CSU Agricultural Research Institute Annual Meeting
- FREP/WPH Nutrient Management Conference

Table 3. 2020-21 Professional Development/Conference Attendance (virtual) by the Department of Plant Science staff and faculty

Research Activity

The Department of Plant Science faculty remains very active in research with either internal (ARI, RSCA, etc.), or external (Commodity Boards, CDFA, USDA, Industry, etc.) funding (Table 4). In the 2020-21 AY alone faculty requested $1.45M, and received $567K in research funding (an impressive ~40% success rate). These data also do not include the substantial in-kind support faculty receive each year. The department faculty actively engage undergraduate and graduate students, exchange students, and visiting scholars in all research activities, supported by in large part by a combination of funding sources (e.g. Fresno State Undergraduate Research Awards, Harvey Jordan Fellowships, and externally funded Grants/Contracts, etc.). Research conducted by the department faculty continues to span a diverse array of disciplines relevant to California Agriculture (Table 5).

	2013-2014		2014-2015		2015-2016		2016-2017		2017-2018		2018-2019		2019-2020		2020-2021	
	Requested	Received	Requested	Received	Requested	Received	Requested	Received	Requested	Received	Requested	Received	Requested	Received	Requested	Received
Federal $	221,145	8,000	424,154	26,504	493,779	154,736	669,383	292,246	256,115	71,116	458,235	40,0000	376,580	64,920	341,577	88,505
State $	239,919	26,665	800,101	107,393	1,878,962	246,552	1,899,573	703,329	722,497	310,595	1,209,815	612,794	659,310	311,157	639,579	165,682
Private $	208,160	208,160	139,778	0	150,688	10,910	155,786	122,668	301,785	21,526	292,460	175,458	228,970	87,311	465,250	313,342
Total $	669,224	242,825	1,364,033	133,897	2,523,429	412,198	2,724,742	1,118,243	1,280,397	403,237	1,960,510	828,252	1,264,861	436,388	1,446,406	567,529

Table 4. Research funds requested-received by the Department of Plant Science faculty for the past eight (8) years. Funds requested/received do not include in-kind match or proposals under review at time of reporting

- *Data source: Division of Research and Graduate Studies*

Orchard Crop Production	Nitrogen Leaching
Salinity Tolerance	Plant Tissue Culture
Irrigation	Nitrogen Use Efficiency
Vegetable Production	Organic Production Systems
Weed Ecology and Management	Pesticides
Soil Quality	Entomology
Propagation	Conservation Tillage
Water Use Efficiency	Crop Yield Management
Plant Disease	Root Development
Dormancy	Plant Disease

Table 5. Example research topics addressed by department faculty and students in the 2020-21 AY.

2020-21 Faculty/Student Research and Scholarly Activity

Publications

(* student)

1. Hurst, J.A., Rayor, L.S. Effects on running speed of changes in sexual size dimorphism at maturity on the cursorial huntsman spider, Delena cancerides (Sparassidae). J Comp Physiol A 207, 269–277 (2021). https://doi.org/10.1007/s00359-021-01469-3

2. Khezri, M., Heerema, R., Brar, G. et al. Alternate bearing in pistachio (Pistacia

vera L.): a review. Trees 34, 855–868 (2020).

3. H. Singh, M. Khezri, S. Benes, J. Bushoven and G. Brar. 2020. Different photoperiod regimes with LED Lighting influence growth of container grown budded and non-budded citrus nursery trees. Accepted for publication in Acta Horticulturae.

4. Elgharably, A., Benes, S. Alfalfa Biomass Yield and Nitrogen Fixation in Response to Applied Mineral Nitrogen Under Saline Soil Conditions. J Soil Sci Plant Nutr 21, 744–755 (2021). https://doi.org/10.1007/s42729-020-00397-6

5. Singh, A.; Quinn, N.W.T.; Benes, S.E.; Cassel, F. Policy-Driven Sustainable Saline Drainage Disposal and Forage Production in the Western San Joaquin Valley of California. Sustainability 2020, 12, 6362. https://doi.org/10.3390/su12166362

6. Diaz*, J., Garcia*, J., Lara*, C., Hutmacher, R.B., Ulloa, M., Nichols, R.L., and Ellis, M.L. Characterization of current Fusarium oxysporum f. sp. vasinfectum isolates from cotton in the San Joaquin Valley of California and Lower Valley El Paso Texas. Plant Disease. 2020 Oct 6. doi.org/10.1094/PDIS-05-20-1038-RE.

7. Ulloa, M., Hutmacher, R. B., Schramm*, T., Ellis, M. L., Nichols, R., Roberts, P. A., Wright, S. D. 2020. Sources, selection and breeding of Fusarium wilt (Fusarium oxysporum f. sp. vasinfectum) race 4 (FOV4) resistance in Upland (Gossypium hirsutum L.) cotton. Euphytica. 216: 109.

8. Ellis, M.L., Diaz*, J., Garcia*, J., Lara*, C., Hutmacher, R.B., Ulloa, M., and Nichols, R.L. 2020. Genotypic evaluation of current field populations of Fusarium oxysporum f. sp. vasinfectum isolates from California. Proceedings of the Beltwide Cotton Conference. National Cotton Council of America, Austin, TX.

9. Reger*, J., Wenger, J. A., Burks, C., Wilson, S.H. (2021). Evaluating flight performance of mass-reared and irradiated navel orangeworm (Lepidoptera: Pyralidae) for sterile insect technique. Economic Entomology. Accepted, in press.

10. Wilson, H., Burks C.S., Reger*, J.E., Wenger, J.A. (2020). Biology and Management of Navel Orangeworm (Lepidoptera: Pyralidae) in California. Journal of Integrated Pest Management. 11(1): 25.

11. Reger*, J., Wenger, J.A., Brar G., Burks C., Wilson, S.H. (2020). Evaluating response of mass-reared and irradiated navel orangeworm, Amyelois transitella (Lepidoptera: Pyralidae) to crude female pheromone extract. Insects. 11(10): 703.

12. Vulchi*, R.; Daane, K.M.; Wenger, J.A. Development of DNA Melt Curve Analysis for the Identification of Lepidopteran Pests in Almonds and Pistachios. Insects 2021, 12, 553. https://doi.org/10.3390/insects12060553

13. Angeles* J., Hembree KJ., Goorahoo, D. and A. Shrestha (2020) Response of tomato transplants to varying soil residual levels of preplant herbicides, Journal of Crop Improvement, 34:5, 697-714, DOI: 10.1080/15427528.2020.1762273

14. Wang T., Melton FS., Pôças, I., Johnson, LF., Thao*. T., Post, K., and F. Cassel-Sharma, Evaluation of crop coefficient and evapotranspiration data for sugar beets from landsat surface reflectances using micrometeorological measurements and weighing lysimetry, Agricultural Water Management, Volume 244, 2021

Scholarly Presentations

(* student)

1. Garcia*, J., Lara*, C., Schramm*, T., Hutmacher, R.B., Ulloa, M., Nichols, R.L., and Ellis, M.L. 2020. Baiting Techniques used for the Direct Isolation of the Fusarium Wilt Pathogen Fusarium oxysporum f. sp. vasinfectum race 4 of Cotton from Field Soil. Plant Health Conference August 2020.

2. Maddox*, A. M., Hutmacher, R.B., Ulloa, M., Ellis, M.L. 2020. The Effects of pH and Temperature on Growth of Rhizoctonia solani Isolated from Symptomatic Cotton using in vitro Assays. Plant Health Conference.. August 2020.

3. To*, M., Westphal, A. Wenger, J., and Ellis, M. 2020. Identification and quantification of Pratylenchus vulnus from almond orchard soil using quantitative PCR. Plant Health Conference. August 2020.

4. Urner*, M. Hutmacher, R.B., Ulloa, M., Nichols, R.L., and Ellis, M.L. 2020. Detection of Potentially Pathogenic Effector Genes in Fusarium oxysporum f. sp. vasinfectum race 4 Isolates from California. Plant Health Conference. August 2020.

5. Garcia*, J., Lara*, C., Diaz*, J., Hutmacher, R.B., Ulloa, M., Nichols, R.L., and Ellis, M.L. 2020. Genotypic characterization of Fusarium oxysporum f. sp. vasinfectum isolates from current field populations in California. California Plant and Soil Conference. Fresno, CA, USA. February 4-5, 2020.

6. Evans*, D., Houston Wilson, H., and J. Wenger Gut-Content Analysis to Determine Previous Host Plants of Leaffooted Bug (*Leptoglossus zonatus*) Infesting California Orchards (Infographic) Entomological Society of America Pacific Branch Meeting 2021

7. Evans*, D., Houston Wilson, H., and J. Wenger Gut-Content Analysis to Determine Previous Host Plants of Leaffooted Bug (*Leptoglossus zonatus*) Infesting California Orchards (Infographic) Entomological Society of America National Meeting Meeting 2021

8. Herrera* J., and J. Wenger Assessing Synthetic Amorphous Silica (SAS) for the management of small hive beetle (*Aethina tumida*) Conference: Entomological Society of America National Meeting 2020

9. Herrera* J., and J. Wenger Assessing Synthetic Amorphous Silica (SAS) for the management of small hive beetle (*Aethina tumida*) ASA-CSSA-SSSA International Annual Meeting 2020

10. Martin*, T., Wenger, J., and K. Daane Improving vine mealybug controls through adjuvant addition in major grape growing regions of California Entomological Society of America National Meeting 2020

11. Reger*, JE., , Wenger, J., CS., and H.Wilson Relative impact of strain, irradiation, and handling on flight performance of navel orangeworm (Lepidoptera: Pyralidae Conference: Entomological Society of America National Meeting 2020

12. Metz*, RL., and J. Wenger Synthetic amorphous silica for post-harvest control of *Tribolium castaneum* and *Plodia interpunctella* in California tree nut commodities Conference: Entomological Society of America National Meeting 2020

13. Wenger, J., and J. Herrera* Sustainability: The Usage of Synthetic Amorphous Silica to manage Small Hive Beetles World Ag Expo, Tulare CA, 2021

14. Wenger, J., and J. Herrera* Sustainability: The Usage of Synthetic Amorphous Silica to manage Small Hive Beetles 39th Annual Agribusiness Management Conference, Fresno, CA, 2020

15. DYP Syverson*, H Singh*, JT Bushoven, M Khezri, L Ferguson, G Brar A Novel Tandem Method of Quantitating Nonstructural Hexoses and Non Hexose Sugars in Plant Tissue Reveals Ecodormancy Release in Pistachio 2020 ASHS Annual Conference 2020

16. Yeasmin, D., J. T. Bushoven., A. Mucciardi., D. Chellemi, A. Vizcarra*., and T. Xiong* (2020). A Novel Approach for Long-Term Non-Destructive Monitoring of Root Growth by Ground Penetrating Radar (GPR) in Agriculture. ASA, CSSA and SSSA Annual Meetings

17. Vizcarra*, A., Yeasmin, D., Bushoven J. T. and Krauter, C. (2020). The "Hidden Half" - Use of Ground Penetrating Radar in Assessing Tree Root Morphology.

2020 California Plant and Soil Conference. American Society of Agronomy California Chapter.

18. Brar, G. 2021. Overview of Springtime, Summertime and Canker Diseases in Almonds. Almond Field Day USDA-NRCS and Punjabi American Growers' Group (PAGG)

19. Brar G. 2020. Pre-harvest, harvesting, processing and grading of Pistachios. UC Pistachio Short Course

20. Steinhauer*, KMC., Shrestha, A., Bushoven, JT., and K. Waselkov Environmental Conditions On Postemergence Herbicides Control Of Glyphosate-resistant Junglerice (Echinochloa Colona) CA Weed Science Society 2021

21. Galvan*, K., Shrestha, A., and K. Waselkov - Effects of Salinity and pH on Common Waterhemp (Amaranthus tuberculatus) Germination CA Weed Science Society 2021

22. Gabrielle Celaya-Finke*, G., Waselkov, K., Sosnoskie, L., and A. Shrestha Effects of Moisture and Salt Stress on Germination of Common Waterhemp (Amaranthus tuberculatus) CA Weed Science Society 2021

23. Goorahoo D., F. Cassel S., C.L Muraka*, A. Unc, and G. Seepersad. 2021. Optimizing Water and Nitrogen Use Efficiency (WUE & NUE) with Airjection® Irrigation. Accepted for oral presentation at the 2020 International Nitrogen Initiative (INI2020)

24. Cassel S. F., J. Samano-Monroy and D. Goorahoo. 2021. Nitrate Leaching Potential for Drip Irrigated Cauliflower (Brassica oleracea var. Botrytis) Grown on a Sandy Loam Soil. Accepted for poster presentation at the 2020 International Nitrogen Initiative (INI2020)

25. Brar R K.*, T. Frnzyan*, L. Reyes-Solorio*, F. Cassel S., T. Jacobson, C. L. Muraka*, K. Steinhauer*, J. Robles, A. Venegas, D. Goorahoo, A. Mele, and A. Garcia*. 2021. Comparing yield, nutritional quality, water and nitrogen use efficiencies of deficit drip and flood irrigated sorghum (Sorghum bicolor) and corn (Zea mays) subjected to different nitrogen rates. Accepted for oral presentation at the 2020 International Nitrogen Initiative (INI2020) Conference scheduled for May 4th -7th 2020 in Berlin, Germany.

26. Brar, R. K.*, T. Frnzyan*, L. Reyes-Solorio*, F. Cassel S., T. Jacobson, C. Muraka*, K. Steinhauer*, J. Robles, A. Venegas, D. Goorahoo, A. Mele, and A.

Garcia**. 2021. Evaluation of sorghum (Sorghum bicolor) yield and nutritional quality to varying irrigation and nitrogen fertilization regimes, in comparison with corn (Zea mays). Proceedings, California Chapter of the American Society of Agronomy. *3rd place student poster award*.

27. Muraka, C.*, L. Dejean, D. Goorahoo, and F. Cassel S. 2021. Impact of Airjection® Irrigation on Glutathione Levels in Tomatoes. Proceedings, California Chapter of the American Society of Agronomy.

28. Brar R. K.*, T. Frnzyan*, L. Reyes-Solorio*, T. Jacobsen, C. Muraka**, K. Steinhauer*, J. Robles, D. Goorahoo, A. Garcia, and F. Cassel S. 2020. Evaluation of different nitrogen rates on the performance of flood-, drip-, and deficit drip-irrigated sorghum and corn. American Society of Agronomy, Crop Science, Soil Science Annual Meetings.

29. Brar, R. K.*, F. Cassel, T. Jacobson, C. Muraka*, K. Steinhauer*, J. Robles, A. Garcia*, D. Goorahoo, L. Reyes Solorio*, and T. Frnzyan*. 2020. Evaluation of sorghum (Sorghum bicolor) performance to varying irrigation and nitrogen fertilization regimes, in comparison with corn (Zea mays). 4th Agricultural Research Institute Annual Meeting

30. Cassel S., F., S. Ashkan, T. Thao, R. K. Brar*, A. Garcia*, D. Goorahoo, F. Melton, T. Wang, and L. Johnson. 2020. Lysimetric determination of crop water requirements for onions. 4th Agricultural Research Institute Annual Meeting

31. Muraka, C.*, L. Dejean , F. Cassel S., and D. Goorahoo. 2020. Quantifying Antioxidant Glutathione Levels in Tomato Leaves and Fruits. 4th Agricultural Research Institute Annual Meeting

32. Goorahoo, D., F. Cassel S., L. Dejean, and C. Muraka*. 2020. Effect of AirJection Irrigation on Soil Nitrogen Cycle Gene Communities. 4th Agricultural Research Institute Annual Meeting.

M.Sc. Theses

1. Effects of strain, irradiation, and shipping on the comparative fitness of navel orangeworm Amyelois transitella, and implications for the use of sterile insect technique in California tree nut crops - Reger, Joshua Eugene

2. Yield and nitrogen use efficiency for lettuce (Lactuca sativa) grown with AirJection® and Non-Aerated Irrigation - Gutiérrez, Daniel A.

3. Commercial viability of in-container budding and grafting of English walnut (Juglans regia) -De Almeida, Mauricio

4. Airjection® irrigation potential in regulation of oxidative stress in tomatoes grown in a clay soil - Muraka, Chaitanya Lakshmi

5. Effect of different photoperiod and led lighting regimes on the growth and physiology of containerized citrus nursery trees - Hardeep, Singh

6. Foliar Nutrient Dynamics And Soil Nitrate Distribution Under Three Nitrogen Fertilizer Management Strategies In Pistachios - Parra, Francisco

7. Characterization Of Spatial And Temporal Variability Of Soil Salinity In Relationship To Alfalfa Productivity - Singh, Simarjeet

8. Yield And Nutritional Quality Of Forage Sorghum (Sorghum Bicolor) And Corn (Zea Mays) Grown Under Different Irrigation And Nitrogen Fertilizer Regimes - Brar, Ramandeep

9. Improving Vine Mealybug Planococcus Ficus Controls Through Adjuvant Addition In Major Grape Growing Regions Of California - Martin, Thomas Rodger

Financial Management

The department manages several foundation/stateside accounts used to directly support its teaching, research and outreach missions (Table 6).

Account #	Account Name	7-1-16	5-30-17	5-30-18	5-30-19	5-30-207	6-16-21	Primary Use(s)
30175	Annual Fund-Plant Science	3,922	3,982	3,198	1,388	356	1,331	General department support

32435	Plant Science & Mech Agric	22,233	16,868	15,543	24,853	27,437	26,512	FFA, supplies, travel, CAPCA, com.rel., recruitment, etc.
300052	Gar Tootelian Fdn-Plant Health	11,477	7,947	1,470	504	504	5,504	Travel, com. rel., year-end banquet, awards, misc.
300340	Plant Science Soil Team	3,077	4,986	1,419	2,455	922	0	Travel, lodging, registration, supplies
32266	Plant Science - Indirect Return	7,147	8,122	8,259	8,137	8,137	8,137	General support for research
(Note: Final balances for accounts below are pending fund transfer prior to close of fiscal year)								
46724	OH & CRSC	-	7,209	4,059	4,262	6,025	2,490	Misc. course fees for PLANT 41 and 123
46746	MeAg	-	140	3,794	6,001	828	3,455	Misc. course fees for MeAg 1 and MeAg 50

Table 6. Accounts managed by the Department of Plant Science (rounded to nearest dollar)

- Data Source Foundation Financial Services

Department staff and faculty are closely monitoring use of collected course fees within each semester, and have made significant improvements to use of such for required expendable laboratory supplies and equipment. New fee proposals for undergraduate laboratories were submitted, and in the queue for university-level approval and potential implementation in the latter part of the 2020-21 AY; however, with the transition to nearly all virtual instruction this was put on hold until return to all in-person instruction, and likely will be implemented in the 2022-23 AY.

Department of Plant Science Advisory Board

Efforts to re-envision the department's existing advisory board in cooperation with the Ag One Development team (Table 7) was put on hold for the 2020-21 AY due to the COVID-19 - related safety issues. The current advisory board has not met as a full group in many years; however, the membership (in addition to de facto advisory experts listed below) have individually, or in smaller groups been instrumental in providing insight to the department on curricular, research, and development efforts. The Mechanized Agriculture sub-committee was instrumental in demonstrating a state-wide need for a robust

Mechanized Agriculture Program in the Jordan College, with specific emphasis that such should not be an Agricultural Engineering, or an Industrial Technology orientated program. The Plant Health sub-committee membership is being re-evaluated as faculty within the discipline are continuing to establish new and significant partnerships with members of the Department of Pesticide Regulation, CA Association of Pest Control Advisers, Bayer Crop Science, Syngenta, Commodity Boards, etc. The Horticulture sub-committee restructuring remains in process as Gurreet Brar further establishes his teaching and research program. Members of this latter group will be essential for the department's efforts to garner internal and external support to update the much outdated controlled environment facilities (Hort Unit). With the hiring of Ranjit Riar, and the appointment of Sharon Benes as the J.G. Boswell Endowed Chair in Plant Science, the Agronomy/Soils/Irrigation sub-committee will also likely undergo some membership changes to better reflect the current industry needs.

AGRONOMY/SOILS/IRRIGATION

1. **Washoua "Sam" Vang**
   Soil Conservationist
   NRCS
2. **Bill Pucheu**
   Partner
   Pucheu Brothers
3. **Tom Willey**
   Owner and Grower
   T & D Willey Farms
4. **George Garcia**
   Senior PCA
   Growers Farm Management
5. **Steve Wright**
   Farm Advisor
   UCCE Tulare & Kings
6. **Jim Gregory**
   Agronomist/Sales Manager
   Verdegaal Brothers, Inc.
7. **Brock Taylor**
   Private Consultant
   Brock Taylor Consulting
8. **Nat Dellavalle**
   Owner
   Dellavalle Laboratory, Inc.
9. **Rob Mikkelsen**
   Western U.S. Director
   IPNI
10. **Rob Roy**
    Resource Conservationist
    USDA-NRCS
11. **Carl Carlsen**
    Owner
    Western Ag & Turf

MECHANIZED AGRICULTURE

12. **Larry Dinis**
    Instructor
    Reedley College
13. **Dennis Magulas**
    Manager
    Stamoules Produce Co.
14. **Mark Woods**
    Designer
    Hydraulic Controls Inc.
15. **Steve Americano**
    Division Service Representative
    Kubota Tractor
16. **Darol Fishman**
    Faculty
    Merced Comm. College
17. **Don Nelson**
    Owner/Manager
    Midland Tractor

PLANT HEALTH

18. **Jerry Prieto**
    Ag Commissioner (Ret)
19. **Don Wolf**
    Specialist
    Grover Soil Solutions
20. **Walter Bentley**
    U.C. IPM Entomologist (Ret)
21. **Doug Reese**
    Summit Agronomics
22. **David West**
    Technical Service Rep
    Syngenta Crop Protection, Inc.

HORTICULTURE

23. **Jon Reelhorn**
    Owner
    Belmont Nursery
24. **Ron Nishinaka**
    Board President
    State Center Community
    College District
25. **Michael Cline**
    Sales Representative
    Wilbur Ellis Co.
26. **Mel Machado**
    Special Projects Coordinator
    Blue Diamond Growers
27. **Tim Gerdts**
    Sales Representative
    Burchell Nursery
28. **Mike Mehling**
    Owner
    Grape Harvester, Inc.
29. **Kevin Olsen**
    Vice President
    S & J Ranch
30. **Brent Smittcamp**
    President
    Wawona Packing

Table 7. Department of Plant Science Advisory Board Membership

The department also continues to enlist the expertise of the following external personnel as graduate thesis committee members and/or research collaborators (note: these also serve as the department's de facto advisory experts as needed):

- Andreas Westphal, Ph.D, UC ANR
- Anthony Mucciardi, Ph.D., TreeRadar Inc.
- Brian Duggan, Ph.D., Davren Global
- Charles Burks, Ph.D., USDA-ARS
- Chris Wallis, Ph.D., USDA-ARS

- Dan Putnam, Ph.D., UC ANR
- Dave Cheetham, M.Sc., Helena Agri-Enterprises
- David Grantz, Ph.D., UC ANR
- Elaine Backus, Ph.D., USDA-ARS
- Gary Banuelos, Ph.D., USDA-ARS
- Giulia Marino, Ph.D., UCCE
- Houston Wilson, Ph.D., UC ANR
- Jeffery A. Dahlberg, UC ANR
- Jeffrey Mitchell, Ph.D. UC ANR
- Jeremy Bahne, M.Sc., Burchell Nursery
- Joseph Smilanick, Ph.D., USDA-ARS
- Kent Danne, Ph.D, UC ANR
- Kurt Hembree, M.Sc. UCANR
- Kyle Brasier, Ph.D., CSU Chico
- Louis Holloway, M.Sc. , Bayer CropScience
- Louise Ferguson, Ph.D., UC ANR
- Masood Khezri, Ph.D., MR Research Institute
- Mauricio Ulloa Ph.D., USDA-ARS
- Rachel Naegele, Ph.D., USDA-ARS
- Robert Hutmacher, Ph.D., UCCE
- Sebastian Saa, Ph.D., Almond Board of California
- Steven Wright, M.Sc., UCCE
- Themis J Michailides Ph.D., UC ANR

2020-21 Committee-Organization Representatives

The department staff and faculty continued significant engagement, participation, and leadership in multiple committees, advisory boards, professional societies, etc. at the department, college, university and external level (Table 8).

Department	
Undergraduate Program Committee	Goorahoo, Ellis, and Cassel S.
Undergraduate Program Assessment Coordinator	Cassel S.

Graduate Program Committee	Benes, Brar, and Wenger
Graduate Program Coordinator/Assessment Coordinator	Benes
GE Coordination (Plant 105)	Goorahoo
RTP Peer Review Committee	Bushoven, Shrestha, Goorahoo
Soil Judging Team Faculty Adviser	Goorahoo
Plant Science Club Faculty Adviser	Wenger/Riar
Students of Agronomy, Soils, and Environmental Sciences Faculty Adviser	Riar
Irrigation Club Faculty Adviser	Cassel S.
MeAg Advisory Board Faculty Liaison	Williams/McKenna
Horticulture Advisory Board Faculty Liaison	Brar, Bushoven, Goorahoo
Soils, Agronomy, Irrigation Advisory Board Faculty Liaison	Benes, Cassel S., Riar
Plant Health Advisory Board Faculty Liaison	Ellis, Wenger, Hurst
Jordan College	
Budget and Resources	Goorahoo
Research, Scholarly and Creative Activities	Benes
Personnel	Benes
Academic Programs	Cassel S.
University Farm Laboratory	Brar
Faculty Executive Committee	Riar
Jordan Agricultural Research Center Committee	Wenger
Jordan Honors Council	Ellis
Jordan Honors Faculty Advisor	Goorahoo, Cassel S.
Jordan College International Programs Taskforce	Ellis
FFA Faculty Adviser - Agricultural Mechanics	McKenna
FFA Faculty Adviser - Nursery/Landscape	Bushoven/Nishinaka
FFA Faculty Adviser - Agronomy	Riar
FFA Faculty Adviser - Cotton	Ellis/Riar
FFA Faculty Adviser - Citrus	Brar
FFA Faculty Adviser - Farm Power and Machinery	Williams
FFA Faculty Adviser - Small Engines	Williams
FFA Faculty Adviser - Agricultural Pest Control	Wenger
FFA Faculty Adviser - Citrus Judging	Brar/Stoltz
FFA Faculty Adviser - Fruit Tree Judging	Brar/Stoltz
FFA Faculty Adviser - Floriculture	Tweedy
FFA Faculty Adviser - Vegetable Crop Judging	Goorahoo
FFA Faculty Adviser - Soil and Land Evaluation	Benes
University	
Central California Research Symposium Committee	Benes
Faculty Search Equal Employment Opportunity Designee	Benes
Staff Search Equal Employment Opportunity Designee	Miyasaki
Campus Planning Committee	Bushoven
Arboretum Committee	Bushoven
Veterans and Military Services Committee	Bushoven
Omega Delta Sigma Faculty Adviser	Bushoven
Academic Policy & Planning Committee	Goorahoo
University Budget Committee	Cassel S.
University Water Cohort	Cassel S.

CSM Biotechnology PSM Faculty	Bushoven, Goorahoo
Master of Science in Water Resource Management Faculty	Benes, Goorahoo, Cassel S.
Academic Senator	Brar
Radiation Safety Committee	Bushoven
University Library Subcommittee.	Cassel S.
California Water Institute Faculty Fellow/Campus Advisory Committee	Cassel S.
External	
California Chapter – American Society of Agronomy	Benes (Past President)
California Chapter – American Society of Agronomy	Cassel S. (President)
California Chapter – American Society of Agronomy	Wenger (Governing Board)
ASHS Nut Crops Workgroup	Brar (Chair)
Irrigation Association Technical Committee	Goorahoo (Vice Chair)
Westside Research and Extension Center, Research Advisory Committee	Cassel S., Benes
USDA National Institute of Food and Agriculture Review Panel	Bushoven
California Women for Agriculture State Parliamentarian	Miyasaki
Fresno County 4-H co-Community Club Leader	Miyasaki
CSUPERB Faculty Consensus Group	Wenger
CA Urban Forests Council	Bushoven
CA DPR APCAC	Ellis
CAPCA – Fresno State Liaison	Wenger
Clovis Community College - Environmental Science Program Advisory Board	Wenger
Central Valley Beekeepers Association - Fresno State Liaison	Wenger
Clovis Botanical Garden Advisory Board	Bushoven
Plant Disease Journal - Notes Assigning Editor	Ellis
CDFA SCBGP Technical Review Committee	Brar
Journal of Plant Growth Regulation- Editorial Board	Brar
Saratoga Horticultural Research Endowment Committee	Bushoven
California FFA Board of Directors	Williams
Madera South High School Ag Advisory Board Member	Williams
Minarets High School Ag Advisory Board Member	McKenna

Table 8. 2020-21 Committee-Organization Department of Plant Science Representatives

Note: largely unchanged since the 2019-20 AY due to the COVID-19 related extension of appointed terms, meeting cancellations or delays

Outreach and Community Engagement

(* student(s))

1. Honey Bee Biology & Management PBS, My Job Depends on Ag American Grown J. Wenger
2. Introduction to beekeeping USDA AgDiscovery Summer Camp J. Wenger
3. Honey bee pollen: Pollination biology & human health impacts National Agri-Marketing Association Club, Fresno State Chapter J. Wenger
4. Garden Bugs, the good & bad Farms-R-Us J. Wenger
5. Chaffee Zoo farm exhibition - Plant Science Club*

6. West Fresno School Sweet Potato Project - Plant Science Club*
7. Ag Booster BBQ _ Plant Science Club*
8. Ag Fest basketball game - Plant Science Club*
9. Preview Day - Plant Science Club*
10. FFA Field Day - Plant Science Club*
11. 4-H Judging Day - Plant Science Club*
12. Fresno State's Student Cupboard student grown produce donations - Plant Science Club*
13. Ag Business Conference -Tyler Armbrister*, Desiree Madrigal* and Alejandra Valdez*
14. Plant Propagation Workshop Fresno Autism Network GROW/Castanon Farms - Jacob Hurst
15. California Strawberry Commission - Bianey Medina*
16. Dolores Huerta Foundation - Produce harvest and donations - Plant Science Club*
17. USDA sponsored weekly Agricultural Talk show on KBIF 900 AM - Gurreet Brar
18. Vegetable Crop Production Workshop Farms-R-Us - Dave Goorahoo
19. Crop Production Workshop Fresno Autism Network GROW/Castanon Farms - Dave Goorahoo

Student Awards and Recognition

1. President's Prize - Infographics 2020 Entomological Society of America, National Branch - Danielle Evans
2. Greenfield Scholars - American Society of Agronomy - Mario Lemus
3. Golden Opportunity Scholar - American Society of Agronomy - Javier Herrera 2020
4. Cohort 7 Jordan College Honors Program - Mario Lemus
5. Cohort 7 Jordan College Honors Program - Gurbinder Kang
6. 1st place - Students of Agronomy, Soil & Environmental Sciences (SASES) 2020 Quiz Bowl - Plant Science Club
7. 2020 President's Trophy - Students of Agronomy, Soil & Environmental Sciences (SASES) - Plant Science Club
8. 23rd Assembly District's 2021 Ag Scholar Student Recognition Award - Ramandeep Kaur Brar
9. Division of Research and Graduate Studies Graduate Student Ambassador - Ranvir Tung
10. 2021 USDA Future Leaders in Agriculture Program - Tyler Armbrister
11. 2021 USDA Future Leaders in Agriculture Program - Diana Zegarra
12. Gerald O. Mott Meritorious Graduate Student Award in Crop Science Crop Science Society of America - Ramandeep Brar
13. National Student Recognition Award - American Society of Agronomy - Tyler Armbrister 2021