

Professional Leave Report Cover Sheet

Name: Gurreet Brar

Department: Plant Science

College: Jordan College of Ag Sciences & Technology

Leave taken: ☒ Sabbatical ☐ Difference in Pay ☐ Professional Leave without Pay

Time Period: ☒ Fall 2022

☐ Spring

☐ Academic Year

☐ Other

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Sabbatical Leave Report: Dr. Gurreet Brar

Sabbatical period: Fall 2022

Section 1: Reporting on the success of the leave.

Proposal objective 1: Spend time at two research institutes in the Mediterranean region, which have major research programs focusing on almonds and pistachios:

The sabbatical leave was a great experience and exposure for me as I spent significant amount of time in two internationally recognized institutes working on tree nuts and fruit crops. My first visit was to IRTA, Lleida, Spain in the lab of Dr. Xavier Miarnau. Dr. Miarnau's research program focuses on super high-density almonds. I had a chance to visit all almonds SHD trial sites in the vicinity of IRTA Fruitcentre. Over the course of my stay in Lleida, here is the list of activities and accomplishments:

- Visited SHD trial sites with Dr. Miarnau
- Visited SHD trial sites with Dr. Ignasi Iglesias of Agromillora Spain.
- Attended an extension event for peach growers where new varieties and cultural practices were discussed.
- Presented to the faculty and students of IRTA Fruitcentre about my research program.
- Visited apple and pear training system trials with Dr. Jaume Lordan (IRTA Specialist)
- Helped Miarnau Lab staff in data taking on an almond trial near Lleida.
- Meeting and discussion with Dr. Luis Asín (Head of Fruit Production Program)

My second visit was to spend two weeks in Palermo, Sicily in the lab of Dr. Tiziano Caruso. Over the course of my stay in Dr. Caruso's lab here is a list of my activities and accomplishments:

- Learned about pistachio cultivation in the Mediterranean region from interactions with Dr. Tiziano Caruso.
- Visited pistachio orchards in Catania region of Sicily.
- Visited Olive germplasm/variety trial and olive tree training trial in Agrigento region of Sicily with Dr. Roberto Mussanti.
- Visited olive processing facility in Trapani Region of Sicily with Dr. Nicola Francesca.
- Presented to the faculty and students of UNIPA, Palermo about my research program.

Proposal objective 2: Attending International Horticultural Congress (IHC) in Angers, France, August 14-20, 2022:

I attended IHC in Angers from Aug 14-20, 2022. I did an oral presentation at this international conference. The title of my presentation was Spatio-temporal metabolomics of Imazalil postharvest treatment in Fukumoto Navel and Clementine Mandarins. This conference is held every 4 years and is a great place for networking. On the last day, I visited many vineyards, orchards and wineries in the Loire Valley region.

Proposal objective 3: Complete the manuscripts from our research work and work on a review paper on salt tolerance mechanisms in Pistachios:

During the latter part of my sabbatical leave, I worked on writing two manuscripts based on our lab team work. One manuscript was submitted to The Journal of Applied Horticulture and is currently under review. Second manuscript is in final stages of preparation and will be routed for internal review before submission. We started compiling the review paper on Salinity responses in pistachios but that manuscript is not complete yet.

Proposal objective 3: Develop joint research proposals on mitigating effects of climate change on pistachios, almonds and citrus with collaborating researchers in California and abroad.

While there was no immediate outcome regarding this objective, however, while abroad I discussed potential for collaboration with different scientists. I am currently working on a few different ideas related to work on pistachios and almonds and hopefully an international collaborative proposal will be developed soon.

Section: Benefits to the faculty member:

By spending a few weeks at both labs mentioned above (IRTA-Fruitcentre and UNIPA) I had an opportunity to learn about new orchard design elements like Super high density, different pruning and training methods in almonds, olives, pears and apples, germplasm of important Mediterranean region crops like almonds and olives. The notes I took on all these aspects are enriching my teaching lectures. I have added many materials to my current course and more research-based information will be added to my course 'Principles of Pomology' for Fall semester.

In California we have a lot of evidence of research work on almonds, pistachios, cherry, walnuts and peaches. However, we do not have significant research-based information on crops like pears, apples, olives etc. Studying these crops and their pruning and training systems are going to improve my focus of all fruit crops and thus expand my course content.

Attending the IHC conference was a great exposure for me. I am already working on a few research ideas I discussed/received at the conference. Also, based on my interactions with various student researchers, I now plan to send my graduate students to such conferences more frequently.

By spending some time on data analysis and manuscript writing I could prepare and submit two manuscripts. This has added to my academic progress.

In addition to that, the experience to travel and see agriculture and geography in a distant environment is always enriching. For example, I am particularly interested in how the world rivers are changing. I had a chance to physically see and document/picturize these rivers in Europe while they are drying up: Seine River and Loire River in France, Rio Segre in Spain and Tibre River in Italy. I talked to locals and video-graphed a few to describe how recent climatic changes are taking place. The summer of 2022 was exceptionally hot for many southern European countries.

Section 3: Benefits to the university:

The experiences from this leave will certainly enrich my course work for undergraduate and graduate courses I teach at Fresno State. This may increase course rigor and competence of our Plant Science academic program in a very small but meaningful way. The international collaboration that may result from this visit are likely to bring external funding to my research program. My sabbatical stay at

the research institutions abroad will also open the doors for those researchers to spend their sabbatical/short term training time here at Fresno State, bringing international expertise to our campus.

Section 4: Original proposal: The original proposal is being pasted below verbatim:

Sabbatical Leave Proposal

Fall semester, 2022

Studying horticultural physiology and high-density orchard systems in almonds and pistachios in the Mediterranean Region

Submitted by: Dr. Gurreet Brar, Plant Science Department

Section 1: The Proposal:

A sabbatical leave is being requested for the Fall semester of 2022, with the objectives listed below in detail. The main idea of this sabbatical proposal is to spend time at two lab internationally while also working on completing pending work on data analysis, manuscript writing and review paper writing.

1. **Spend time at two research institutes in the Mediterranean region, which have major research programs focusing on almonds and pistachios.** My research focus is on pistachios and almonds. These two crops are well suited to Mediterranean-type climate, therefore much of the pistachio and almond germplasm is originally found in the Mediterranean basin. Mediterranean basin is the region of the lands around the Mediterranean Sea which have mostly the Mediterranean climate, characterized by hot dry summers and cool rainy winters. The first of the two labs I will be working with is: Dr. Xavier Miarnau at Institute of Agrifood Research and Technology (IRTA), Lleida, Spain. IRTA Spain has a history of working on improved almond orchard systems. In California we are faced with issues like water shortage and dust during harvest, therefore there is a lot of interest in changing the almond orchard system to high density designs with shake & catch harvest. Newer production system also means we can introduce newer varieties. There is an interest about Spanish and other European almond cultivars to see if they can be a successful addition to California almond industry. Dr. Miarnau's work in NE Spain is a great place to learn about these cultivars and orchard systems. I have been in touch with Dr. Miarnau and I am working on the details for spending 6-8 weeks on their research station to gain new knowledge.

The second lab of interest is Dr. Tiziano Caruso's lab in UNIPA, Palermo, Italy. Dr. Caruso is a senior professor of Agriculture at UNIPA and runs an incredible research program on pistachios, peaches, olives and other fruit and nut crops. His lab has recently conducted research work on in season photosynthesis and carbohydrate dynamics in pistachios, which is also very similar to the work conducted by my lab at Fresno State. My goal will be to visit Dr. Caruso's lab for 2 weeks with an aim to gain knowledge on studying effect of in season cultural practices on pistachio metabolite concentrations and post-harvest quality. I will also have the opportunity to learn more about pistachio germplasm in the Mediterranean basin, which is potentially more salt tolerant.

2. **Attending International Horticultural Congress (IHC) in Angers, France, August 14-20, 2022:** IHC is held every 4 years and is organized by the International Society for Horticultural Science (ISHS). It is a conference that brings hundreds of researchers, specialists and students involved in horticultural research and academics from all over the world. Since my sabbatical proposal is to spend time in NE Spain (which is just 500 miles from the IHC conference site in France) during Fall of 2022, IHC conference will be a perfect opportunity to gain greater exposure without adding much expense to my trip. My research team is submitting abstracts for several talks and posters to the IHC Conference.
3. **Complete the manuscripts from our research work and work on a review paper on salt tolerance mechanisms in Pistachios:** Target journal for the review paper: *Trees: Structure & Function*; target journal for the original manuscripts: *Journal of Plant Growth Regulation and HortScience*. Our lab team at Fresno State has been focusing on Pistachio tree response to soil and irrigation water salinity in collaboration with researchers from UC and USDA. Salinity is a major problem that California's nut crops industry faces and this problem is becoming even more challenging in commercial almond and pistachio growing areas of the central valley. We recently published a review article on Alternate Bearing in Pistachios in the journal "*Trees: Structure & Function*" and have recently started working on the review manuscript on Responses of pistachio trees to soil and irrigation water salinity. The goal during the sabbatical period is to utilize my time in conducting extensive literature review and complete the draft review manuscript.
4. **Develop joint research proposals on mitigating effects of climate change on pistachios, almonds and citrus with collaborating researchers in California and abroad.** While completing the writing work and data analysis from previous research projects will make way for developing newer ideas, my international visits and exposure will certainly bring in new ideas for writing collaborative grants for projects on dormancy and chill accumulation management in pistachios, orchard systems in almonds, and improved nursery management techniques in citrus among others. I plan to spend latter portion of my sabbatical period working on developing such ideas into research proposals.

Section 2: Benefits to me as a faculty member:

This one semester of sabbatical leave will increase my productivity at Fresno State by several means. A part of this is explained in the Section 1 above alongside each objective. However, to summarize, here are a few ways this will benefit my career at Fresno State:

1. *Creative activity and gaining new knowledge and skills:* Attending research work at these two international institutes will help me bring in knowledge and expertise into my research work as well as teaching at Fresno State. I have been working on analysis of metabolites in pistachio and almond tissues in my lab in the Jordan Agricultural Research Center. The above-mentioned labs in the Mediterranean basin have extensive experience in laboratory analytical work. By working directly in these labs, I aim to enhance the analytical capabilities of our lab here at Fresno State. Recently we started working on a super high-density orchard system project established in Kern County. There is a lot to learn about evaluation techniques and orchard systems parameters from CITA in Spain.
2. *Student-faculty exchange:* Delivering seminars and having interactions with graduate students and their faculty will provide mutual opportunities for collaborative work. It could also possibly help me get some good MS student candidates to study at Fresno State in my research program.
3. *International exposure:* Attending IHC Conference will enhance my portfolio in terms of presenting my research work internationally and provide opportunities to interact with global horticultural community.
4. Developing long-term collaborations to explore opportunities like short-term faculty led study abroad trips, and writing research grants etc.

Section 3:

Benefits to the university:

1. New research funding: My experiences and exposure to the fruit and nut crops industries abroad will certainly broaden my expertise and enable me to bring in extramural funding to Fresno State. New collaborations with scientists of international repute will also open new avenues of submitting grant proposals to new funding agencies.
2. International recognition: My stay abroad will help bring international recognition to Fresno State. Especially when there will be interaction with graduate students and the seminar presentations during the visit period, the presence of a Fresno state faculty member will open

up avenues for their students and faculty to visit, study or travel to Fresno State for long-term mutual benefit.

3. Exposure at the International Horticultural Congress: IHC is held every 4 years in different locations in the world and it is a rare opportunity for a faculty member to attend this conference conveniently. Because the timing and location of the 2022 IHC conference coincides with my sabbatical plans, this will provide me with an opportunity to interact with international community of horticultural researchers as well as to present my research work internationally.
4. Enhancing my teaching capabilities at Fresno State: Every academic experience we gain abroad certainly feeds into our teaching programs. From the sabbatical trips, I will bring in a wealth of knowledge and experience in pistachios, almonds, citrus and other fruit and nut crops of interest. Also, since Mediterranean basin climate is very similar to California's, the new knowledge on salinity effects, chill accumulation, heat tolerance, tree architecture, water use efficiency, rain fed horticulture, planting density etc. will open a treasure trove for my undergrad and grad students at Fresno state.

Project time frame:

- August 2022: Attend IHC Conference in Angers, France, August 14-20, 2022.
- September-October 2022: Stay at CITA, Spain and a short visit to Palermo, Italy.
- November, 2022: Back to Fresno: Work on finishing the review paper and grant proposals the rest of the semester.

Proposed course scheduling to accommodate the sabbatical leave:

In the spring semester, I teach an intense graduate course along with my undergraduate teaching responsibility. Therefore, this sabbatical leave is being proposed for Fall semester when my teaching load primarily is an undergraduate course.

PLANT 132: I will propose that Rob Roy, USDA can be approached to teach the Principles of Pomology course during Fall 2022 in my absence as he has previously taught this course. I can provide a number of guest speakers during that speaker from the industry to supplement the effort.

Other responsibilities needing coverage:

University Academic senate: We can substitute my seat on that committee with any faculty member from the department as a department representative.

Plant science graduate program committee: Before my leave, I will make sure to nominate another faculty member to serve on the committee in my absence.

Amount of time requested:

This proposal is for one semester (at full pay), during the Fall of 2022.

CSU Resources required:

For these visits, I can support my stay at the respective locations while my air travel can be supported using miscellaneous research funds in my foundation research accounts. Various research project are budgeted for conference travel which can be used to attend IHC Conference.
