Updating Our Knowledge and Planning for Future Research, Education and Outreach Activities to Optimize the Management of Nutrition in Almond and Pistachio Production

Project No.: **06-HORT9-Brown**

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Objectives:

1. To conduct a focus group interview (FGI's) among selected stakeholders to identify current practices, concerns and needs in Almond and Pistachio nutrition management.
2. To design and conduct a statistically sound and informative survey instrument to identify current practices, concerns and needs in Almond and Pistachio nutrition management.
3. To design and conduct two regional nutrition workshops and simultaneous focus group interviews to update knowledge in nutrition management and further define concerns and needs in Almond and Pistachio nutrition management.
4. To collate and analyze existing information, survey and workshop findings and use this data to design an extension initiative to increase the efficiency of fertilizer usage and guide the development of new nutrition research and education programs.

Interpretive Summary:

There is a growing consensus among UC Faculty and Farm Advisors, consultants and growers that the UC established critical values for determination of Almond and Pistachio nutrient status and the methods used to manage fertilization in these crops may be outdated or underutilized. In the absence of viable and well-regarded standards and guidelines for nutrient management, growers do not have the resources needed to use fertilizers wisely. Our goal is to survey current practices, concerns and needs in Almond and Pistachio nutrition, collate existing information and best management practices and design a new research and extension initiative. To meet this goal, we conducted small focus groups with industry stakeholders and used the information we gathered to inform the content of surveys we distributed to approximately 1800 randomly-selected Almond growers and 300 Pistachio growers throughout California.

Preliminary Focus Group Results Participants in all focus groups identified universities and other farmers and important sources of information, but most stakeholders expressed that private consultants are many growers' first line of information. When asked their opinions about the effectiveness of the University of California's established critical values, participants in all focus groups expressed that the values are better than nothing and may provide a general guideline for nutrition management program. The focus groups comprised primarily of growers and chemical consultants talked at length about concerns with the accuracy of values and whether they are outdated. Stakeholders confirmed our belief that the industry is concerned with the suitability of the established critical values to inform modern nutrition management practices, questioning whether the values have kept up with changes in production related to yields and planting densities. The primary concerns participants expressed about critical values related to problems with timing, sampling method, yield maximization, and nutrient interactions.

Stakeholders repeatedly cited timing as a limitation to using critical values to inform nutrient management decisions on orchards. Participants were concerned that critical values relate to nutrient levels in plant tissue during only a ten-day period in July.

Participants prioritized future research projects that would allow growers to measure nutrient levels during the critical time of the year between dormancy and leaf production. Another major topic of discussion of critical values related to the difficulties of accurately sampling plant tissue to measure nutrient levels. In addition to problems with the timing of tissue collection, participants were also concerned with sampling inaccuracies due to spatial variation across orchards or even within trees, creating the possibility that "you could pick one [leaf] with your left hand and one with your right hand and get two different numbers." Participants stressed that the small sample sizes relative to the size of the orchard mask variability, and growers or consultants may be unaware of the large margin of error associated with the lab results.

Many participants were unclear about how a grower could practically apply the information provided by critical values to an orchards' nutrition management program. Participants questioned the best remedy for an orchard slightly deficient in a particular nutrient and highlighted this as an important field for future research. The relationship between critical values and yield maximization was also discussed. Some participants believed that fertilizer use efficiency is closely related to the irrigation system, and water mobilizes the nutrients, but they would like to see more research on the topic. Questions about irrigation particularly focused in the cases of micro and drip irrigation, in which roots grow closer to the surface than with other irrigation methods, causing one consultant to ask, "If our technology has changed how the tree grows, should we be changing our application technique to go along with it?" Participants expressed that when laboratories provide growers with average nutrient levels for trees in their region, growers may respond by trying to push their trees' levels higher in an effort to be better than average. The results of over-fertilization could be felt economically by growers, whose improved yields may not meet the costs of increased fertilization inputs.

Participants in all focus groups expressed concern about impending regulations on the almond industry, worrying that environmental pressures will be extreme. As one grower asked, "Environmentally, what are those critical levels? Are we putting on excess nitrogen? Are we contaminating the groundwater? What are the optimum levels that we should be applying? We don't have the relationship between those and what yield is returned. All we have is 30- or 40-year-old data, and that's not adequate." Participants feared that regulations based on the outdated values, which do not relate to modern cultivars, will "handcuff the growers" and prevent them from being able to grow high-yielding crops. Currently, there are few sources of information related to almond nutrition management to help the industry address this problem.

In all focus groups, participants felt future university research provides the primary opportunity to ensure that environmental regulations on the almond industry will be based upon viable nutrition management practices that will not seriously detriment the industry economically. As one consultant stated, "Having strong data about what the nutrient needs of the trees are, under what conditions, ultimately can help us take a stronger stand, should the push-back come." Participants cited the University of California's obligation to look out for impacts to growers and feel the university should communicate the results of its future research projects with the Environmental Protection Agency. New research to bring "scientific proof back into the picture" has the

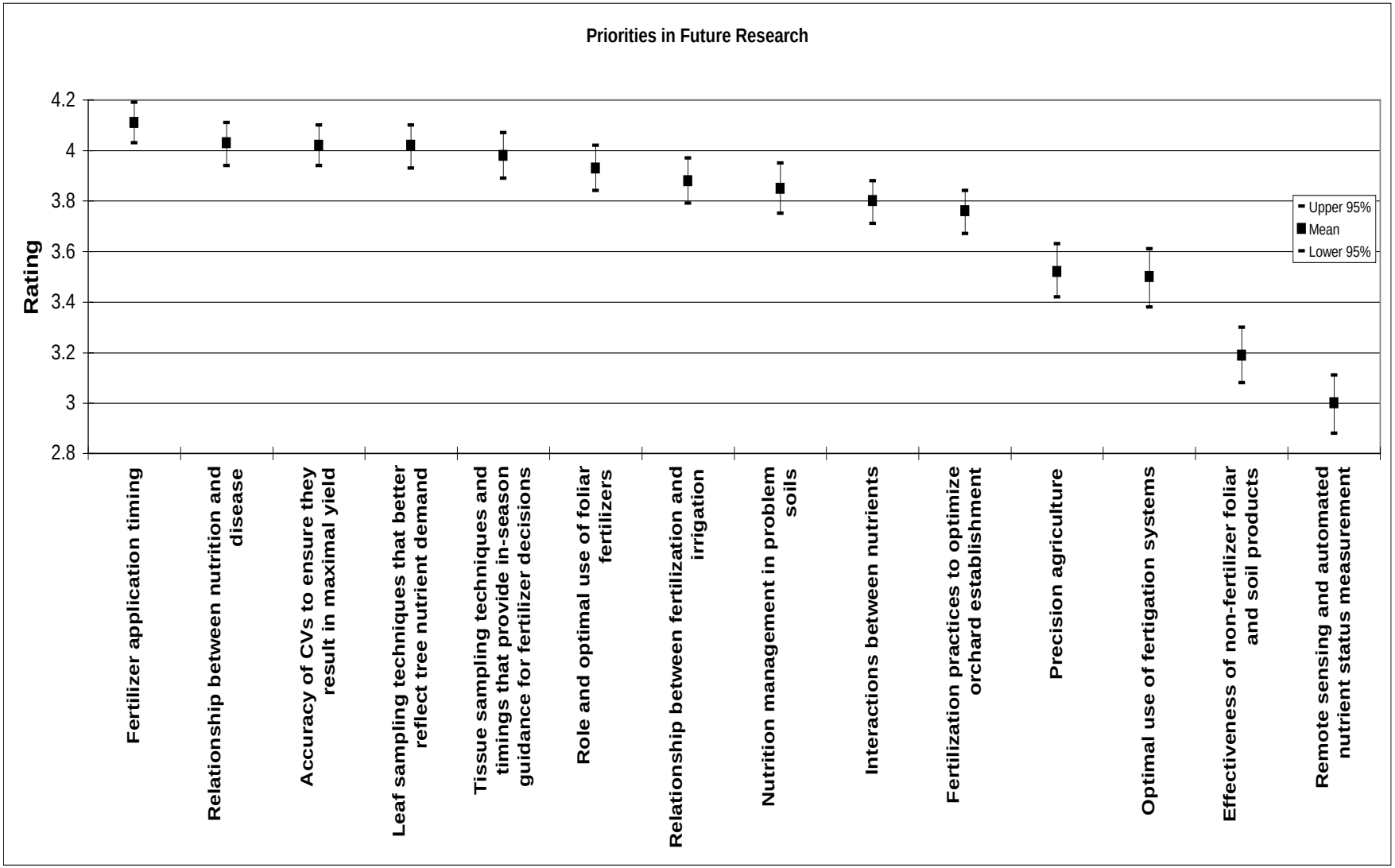
potential to inform growers of best management practices and to justify those practices, should environmental regulation occur.

Focus group participants prioritized a number of considerations for future research in almond nutrition management. While research for established critical values was based upon single nutrients evaluated on a tree-wide scale, participants in the focus groups called for a systems-based approach to research in which interactions between nutrients and external factors are investigated on an orchard-wide scale. The established critical values are reductionistic by nature, but farmers manage their orchards systematically and require a solution that allows laboratory results to clearly inform management practices.

An integrated approach to nutrition management research, in which investigators consider multiple elements and factors simultaneously on a large scale, will serve stakeholders in California's almond industry economically and environmentally. By identifying best management practices relating to modern cultivars and technology, researchers will provide growers with the opportunity to optimize yields without wasting money on excess fertilizer that does not provide adequate economic returns. The research will also serve to protect the industry when environmental regulations are created, giving stakeholders hard data with which to justify their fertilization practices. This focus group study demonstrated a clear and immediate need for a new approach to nutrition management research in almonds, so growers will have adequate information to make decisions that will optimize their yields without causing environmental degradation to surrounding communities.

Surveys

The input from the focus groups was used to design and industry wide survey. Complete analysis of survey data has not been completed. The following is a summary of most important nutrition research goals for the Almond industry based on responses of 750 almond growers representing 35% of the industry.



The University of California is designing a research project to improve the management of fertilizers in almond production. How useful would research about each of the following topics be to you?
1= Not Useful; 2= Somewhat Useful; 3= Useful; 4=Very Useful; 5= Extremely Useful