

May 14, 2014

Agricultural Expert Panel
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Re: Considerations for Agricultural Expert Panel Questions

The following is background considerations for areas under review by the Expert Panel provided by the Almond Board of California.

Application of Management Practices

Over the last few years the Almond Board of California has supported work directed by Dr. Patrick Brown (UC Davis, Plant Sciences) developing an annual nitrogen management plan, also known as a nitrogen budget approach, for almonds. Accordingly we are supportive of this management plan. An example of how this plan can be executed was reviewed by Parry Klassen in his presentation to the Expert Panel on May 3, 2014. Beyond this planning context, we do not believe practices should be mandated, as there are too many variables to consider (e.g., soil type, crop, irrigation system). In light of these variables, growers and their advisors need to be given flexibility to tailor irrigation and fertility programs to specific growing and field circumstances.

For example the use of soil nitrogen soil quick tests seem to be extremely useful in certain cropping situations and irrelevant in other cropping situations. It makes sense where substantial amounts of biomass are returned to the soil during harvest, a new crop will be quickly planted, and where only a limited soil volume is to be used by the next crop. In perennial crops soil nitrate quick testing is confounding. Most of the N in the leaves is actually harvested by the tree/vine at the end of the season and stored in the stem and roots for use the following growing season. This process is called senescence. Thus, typically there is not that much high nitrogen containing biomass being returned to the soil with harvest. Furthermore with microirrigation systems and the depth of the roots in perennial crops, it is nearly impossible to know where best to sample for the soil nitrogen quick tests.

Verification Measures (Monitoring)

As noted, in contrast to surface water, direct ground water monitoring is not a practical, nor a reliable measure of grower nitrogen management practices. Ground water monitoring is useful to assess trends over time. The 3 pronged-approach currently being suggested in the Central Valley Water Quality Coalitions seems to find a reasonable balance to verify that grower practices are reducing nitrogen loading over time.

- 1) For growers, verification should focus on education and monitoring of practices, in particular doing a nitrogen management plan that is site and crop specific. It is not reasonable to expect growers to implement specific practices beyond a crop specific nitrogen management plan as there are too many variables to determine which practices would help in all situations. Thus the mandate for N management plans allows for site specific combinations of practices to be utilized and tailored to specific circumstances. The use of CCAs helps with the verification, though it should be noted that growers would like to be able to get the specialized certifications themselves. That latter would be useful as it would expand the pool of growers specifically educated on N management practices.
- 2) Use research to assess which practices are protective of ground water while not making other environmental concerns worse. Again some of the research will be crop or type of crops specific. Currently there is little data on the relative reduction in leachable N of different practices, meaning N that goes below the rootzone and reaches groundwater. Some research like this is needed, especially to link what is going on at the surface with what is going on below the rootzone. The current FREP, almond, and pistachio-funded research comparing two different N application practices to measures N in the plant and harvest, N movement in the root zone, N movement below the root zone, and N in the ground water is a good example of the type of research needed (Smart, Brown, Hopmans, and Harter FREP project).

However, the experience of putting this research project together has shown that it is extremely difficult to find appropriate locations for such efforts (fields of large enough size, proximity of ground water, willing cooperators, etc.), as well as expensive – especially for well drilling and the monitoring equipment. Thus, it will be impossible to quickly assess practices if the regulators expect each and every practice to undergo such rigorous testing. Furthermore, there are not enough researchers to conduct the work in a timely fashion. Therefore, as Harter has pointed out, “Proxy Monitoring” is a tool using models to gain insights beyond these intensely monitored research sites.

Therefore, improvements of nitrogen use efficiency (NUE), meaning that more of the nitrogen being put on the crop is utilized by the crop, should suffice to provide evidence of which practices are more protective of ground water. However this biological concept is foreign to the engineers, so some research providing a sense of how NUE and N below the root zone are correlated is needed initially. Measures of NUE are relatively easy to obtain and thus more practices can more quickly be assessed for their relative merit for reducing the potential for N losses.

We note that care needs to be taken that the focus on preventing nitrate leaching doesn't make other environmental issues worse. The Almond Board is funding additional research with the existing FREP project to assess how the different grower practices affect nitrous oxide (N₂O) emissions which are a potent greenhouse gas. If putting N on in smaller amounts more

frequently reduces leaching but increases N₂O emissions, growers are put in a bind. The Air Resources Board has indicated in their most recent AB32 scoping plan that they expect agriculture to contribute to N₂O emissions reductions. Similarly, the San Joaquin Valley Air District has expressed concerns about ensuring that changes in grower practices don't increase ammonia emissions from soils that contribute to PM_{2.5}, a criteria air pollutant that the San Joaquin Valley is not in compliance with federal standards.

- 3) As Harter and others have noted, wells are most useful to verify long term trends in ground water quality. The complexity of water movement below ground makes it impossible to use wells to verify grower compliance per se. Also, as was noted in the 2012 UC Davis report on nitrates in ground water, the likely trend will be worsening nitrate levels in ground water initially, as nitrate from historic nitrogen use is still making its way downward before the implementation of N management plans will reduce the nitrogen loading in soils over time. The caveat is that an expectation of no nitrate leaching is biologically and physico-chemically not obtainable.

Reporting

The issue of the appropriate level of reporting is a balancing act. On one hand, field-by-field reporting is out of the question, as there is not enough time and money resources to collect, compile and analyze the massive amount of data generated. On the other hand, there needs to be enough information generated and reported to assure growers and advisors are executing appropriate management practices. The reporting template developed by the collaborative effort of the Central Valley Water Resources Control Board and the Central Valley Coalitions achieves this balance and should be given serious consideration as a model to implement for reporting.

Sincerely,



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