NITROGEN MANAGEMENT PLANS
AND COVER CROPS FOR ALMOND GROWERS

California agriculture is extremely diverse. Over 400 commodities are produced in a wide variety of growing conditions. Irrigation and fertilization are critical to an efficient and productive crop yield. Water discharges from agricultural operations in California include runoff which can affect water quality by transporting pollutants, including pesticides, sediment, nutrients, salts, pathogens, and heavy metals, from cultivated fields into surface waters. While groundwater quality can be impaired by nitrogen and salts when they leach below the rootzone. Cover crops can play a role in protecting surface water quality by slowing down run off during rain events and by supplementing nitrogen without the use of fertilizers.

All the land used to grow almonds in California is regulated by The Central Valley Regional Water Quality Control Board (CVWB). It is one of nine Regional Water Boards in California. Stretching from the Oregon border to Los Angeles County, the Central Valley is about 60,000 square miles or nearly 40 percent of the state. It includes about 75 percent of the state’s irrigated agricultural land. In 2003, the CVWB created a specific program designed to address water quality activities associated with irrigated lands. This program is referred to as the Irrigated Lands Regulatory Program. Growers must join and pay into regional water quality coalitions which do the monitoring and outreach necessary to ensure water quality standards are met. Please refer to the Irrigated Lands Regulatory Program for more details.

As part of the Irrigated Regulatory Program, starting in 2015, all growers are required to have a nitrogen management plan. This plan will indicate how much nitrogen is needed and identify the sources where it is coming from. Accurately determining the amount of nitrogen being applied to an agricultural system can be challenging. Fertilizers, manures, composts, cover crops, and sometimes irrigation water all add nitrogen to soil, and figuring out how much is needed can be complicated. Fortunately, the Almond Board of California and SureHarvest have created an online assessment tool to make this process easier and more streamlined. The online assessment tools needed to create a nitrogen management plan are available at the California Almond Sustainability Program (CASP) website. Here almond growers can create a private account, and information entered is kept confidential.

One very useful tool provided is a Nitrogen Calculator. Based on the nitrogen budget model developed by Dr. Patrick Brown of UC Davis, this calculator simplifies the process of budgeting nitrogen for almond growers. The calculator takes into consideration yield estimates, leaf sampling results and nitrogen that comes from other sources, like bee forage cover crops. It stores data by orchard block, making updates easy as information changes. Budget components can be cloned and applied to other orchards or used in subsequent years. All almond growers can use the online model to create budgets but must be participants in CASP for the data storage aspect, which eliminates the need
Almond growers who plant cover crops are helping bees while simultaneously amending their soil with a free source of nitrogen. However, without knowing how much nitrogen is being fixed into the soil by legume cover crops like PAm Clover Mix, growers won’t know how much to reduce their fertilizer application rate. Using the Nitrogen Calculator will give growers clarity about how to manage their operation. Depending on the strength of the stand (poor, good, or great) and the incorporation method (mow only or discing in), almond growers are getting 15-84 lbs. N/acre from the cover crop alone. Once the nitrogen from the cover crop is factored in, the calculator will then give detailed recommendations about how much additional fertilizer is needed and when to apply it.

Almond trees need nitrogen every year for two reasons: 1) to assist perennial growth, and 2) to replace the nitrogen lost by the annual harvesting of almonds. The nitrogen in the roots, trunk and branches increases annually by 25-30 lbs./acre. The hulls, shells, leaves, debris, and kernels collected each year during harvest are responsible for depleting nitrogen from the tree. The average amount of nitrogen lost each year from harvested crop pruning, and leaf fall is 68 lbs./acre of nitrogen for every 1000 kernel lbs./acre harvested. Higher kernel yields are positively correlated with higher nitrogen demand. Growers can use a previous year’s yield data to estimate how much nitrogen will be needed during the current growing year, but ideally update during the season the calculation as the grower gets a better idea of what the yield is likely to be.

<table>
<thead>
<tr>
<th>Kernel Yield (lbs./acre)</th>
<th>N demand (lbs./acre)</th>
<th>Fertilizer N required (lbs. N/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>68</td>
<td>95</td>
</tr>
<tr>
<td>1500</td>
<td>102</td>
<td>143</td>
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<tr>
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<tr>
<td>3500</td>
<td>238</td>
<td>333</td>
</tr>
<tr>
<td>4000</td>
<td>272</td>
<td>380</td>
</tr>
</tbody>
</table>

After the amount of required nitrogen is determined, growers can make a choice about what source(s) the nitrogen will come from. For example, if an orchard yielded 1000 lbs./acre of kernels the nitrogen required for a successful crop the next year will be 95 lbs. nitrogen/acre. Take note that the required nitrogen is greater than the nitrogen demand because nitrogen use is not 100% efficient. Applying only 68 pounds of nitrogen for every 1000 kernel pounds will not meet the tree’s need, because the application efficiency of nitrogen is not 100%. If a cover crops is providing 84 lbs. nitrogen/acre, then the amount of additional nitrogen that needs to be applied with fertilizer is only 11 lbs./acre. If this orchard didn’t have a cover crop, the grower would have to apply all the recommended 95 lbs. nitrogen/acre with fertilizer alone.

In summary, cover crops can add a significant amount of nitrogen to orchards. Having accurate data about the necessary amount is the key to wise fertilizer use. Please refer to the following links for more information:

- California State Water Resources Control Board
Irrigated Lands Regulatory Program

- Almond Board of California / SureHarvest
  Nitrogen Calculator
- California Department of Food and Agriculture
  Almond Nitrogen Fertilizer Guidelines

References:


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