Irrigation and Nutrient Management Reporting

• A brief introduction
  • Dr. Lowell Zelinski
  • PhD UC Davis 1995 Soil Science “Soil-Plant-Water Relations”

• Owner, Precision Ag Consulting
  • Help farmers throughout the central coast comply with Regional Board ILRP requirements

• Central coast member of Statewide Expert Panel on Nitrates

• Suggestions for INMP Reporting Requirements
Nitrogen Applied and Removed

- Applied is fairly straightforward – Use #’s from Total Nitrogen Applied (TNA) Reports

- Removed – much more of a challenge
  - Requires “accurate” estimates of **yield** and **concentration** of N in harvested portion of crop.
  - **Yield** is considered a closely guarded trade secret by most growers – major push back here
  - Methodology to estimate of **concentration** of N is not established and plant analysis labs are unwilling or reluctant to perform this task
Nitrogen Removed – an alternative approach

• Removed = Yield x Concentration
  • For many cool season vegetable (CSV), yields are similar from grower to grower
  • N Concentration is unknown for the dozens of crops grown

• The concentration problem
  • Need to sample and analyze EVERY harvest
  • There are 10,000’s of harvests
  • Sampling methodology is unknown
  • Should sample numerous times per harvest to get statistically valid results
  • Personnel and Labs are not available
The Standard Deduction

• I propose that the Regional Board develop a “standard deduction” of N removed

• Survey growers as to what is a good, average yield of the CSV that they grow

• Next slide has methodology of concentration estimation
Concentration estimation

• Most CSV are “food” crops
• Nutritional information exists for all CSV
• When determining “protein” content “protein” is not measured.
• Nitrogen is measured, and a conversion factor is applied
• If you know “protein” (from nutritional information) you can go backwards to get to nitrogen

• We can now estimate Removed: (Yield(survey) x Concentration(protein))

[Image of Nutrition Facts]
• East San Joaquin WDR indicates that A/R and A-R should be reported

• We now have a methodology for reporting these values, that only requires some minor arithmetic to report

• The reporting of these values is NOT the best indicator of the effectiveness of changes in nitrogen management

• Why Not?
The fate of N in CSV systems

- N applied – simple enough
- N removed – also if previous methodology is adopted – simple enough
- This does not capture the “effectiveness” of nitrogen management changes
- Nitrogen Use Efficiency (NUE) is proposed
Nitrogen Use Efficiency (NUE)

- NUE = N taken up / total N applied
- Not a new concept – been around in agronomic crops for decades
- N taken up = N removed + N taken up but not removed
- Total N applied – from TNA forms
Nitrogen Use Efficiency
NUE = (A+B)/(A+B+C)
## Example Table

<table>
<thead>
<tr>
<th>Applied</th>
<th>Applied but not taken up</th>
<th>Removed</th>
<th>Taken up but not removed</th>
<th>NUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
<td>250</td>
<td>25</td>
<td>75</td>
<td>28.6%</td>
</tr>
<tr>
<td>300</td>
<td>200</td>
<td>25</td>
<td>75</td>
<td>33.3%</td>
</tr>
<tr>
<td>250</td>
<td>150</td>
<td>25</td>
<td>75</td>
<td>40.0%</td>
</tr>
<tr>
<td>225</td>
<td>125</td>
<td>25</td>
<td>75</td>
<td>44.4%</td>
</tr>
<tr>
<td>200</td>
<td>100</td>
<td>25</td>
<td>75</td>
<td>50.0%</td>
</tr>
<tr>
<td>175</td>
<td>75</td>
<td>25</td>
<td>75</td>
<td>57.1%</td>
</tr>
<tr>
<td>150</td>
<td>50</td>
<td>25</td>
<td>75</td>
<td>66.7%</td>
</tr>
</tbody>
</table>

Note that increasing N Applied does not change removed or taken up but not removed
Increasing NUE is the Goal

But how is it done?
The Four R’s of Fertilizer Management

- Right Rate (100 lbs vs 200 lbs)
- Right Timing (Before Planting vs During Growth)
- Right Placement (Broadcast vs Fertigation)
- Right Form (Ammonium vs Nitrate vs Compost)

Farmers can control these things – They can not control N removed or N required
Summary

- A/R and A-R are good but not as sensitive as NUE
- Farmers can not control A/R or A-R – but can NUE
- Don’t forget Standard Deduction concept
- No additional data collection is required with these proposals
- Works for Irrigation Management also – Irrigation Use Efficiency (IUE)