SOI AND WATER AMENDMENTS

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In my assigned few minutes, I have been asked to review again with you where we are in the use of soil and water amendments. Most of this was covered last conference by Les Stromberg and Herb Schulbach.

What Is An Amendmen

An amendment i ething added to soil or water that is intended to prevent uce, or correct em. So, we would use an amendment to solve blem- present o , imagined or real.

Why Do We Use It?

Amendments Cost Money!

Lost Hills gypsum used to be about $4.50 per ton or less- spread. Now the cost is more like $8.00. By-product gypsum at Helm used to be $8.00 or less per ton at the plant. Now it is $11.50. Sulfuric acid for soil application now is about $60.00 to $70.00 per ton. As prices go up, growers must be assured that the money spent for amendments will produce a profit- collectible today in improved yields and profit, or perhaps be collectible at some time in the future. Collecting profits on intangibles such as improved soil structure, tilth, water infiltration rate won't pay the bill. Results, in my opinion, must be in tangibles- yield, productivity, dollars. I recognize that sometimes a grower simply sleeps better believing he has done the right thing.

For What Sort of Problems Are Amendments Useful?

Herb Schulbach last year discussed the "Guidelines for Interpretation of Quality of Water For Irrigation", These haven't changed. These Guidelines cover the four main problem areas encountered in irrigation agriculture-salinity, permeability, toxicity and miscellaneous problems.

These same problem areas can be looked at from the standpoint of use of amendments and this I will attempt to do.

Salinity Problems (of either soil or water).

These have to do primarily with the effect of salinity on the availability to crop of stored soil water. The crop has been irrigated. The water is in the soil ready for use by crop. It is now soil water. As salinity in this soil water increases, availability of the water decreases and if salts accumulate to high enough concentrations, yields decline. The solution to the salinity problem lies in salt control. Leach out accumulated salts and then properly manage the irrigation water to keep salts under control.

In general, amendments will have little effect in controlling salinity or in reclamation if only excessive salinity is the problem. By high salinity we mean excessive soluble leachable salts measured by Electrical Conductivity (EC) or Total Dissolved Solids (TDS). True, in a few cases, organic matter- manure, rice hulls bulky organics- may improve water penetration and speed reclamation and leaching. The real problem though is the salts in the water supply; salts in the soil; poor water management; or high water tables and drainage problems. For these, amendments are a poor bet. It should not be expected that chemical amendments- gypsum, acids, or other additives- will pay their way for plain high salinity problems.

Soil Permeability Problems (soil takes water slower than normal or water does not percolate through the soil as readily as expected).

Such soil permeability problems make it difficult to get enough water into the soil to supply enough water for the crop between

irrigations. The causes can be many- compaction, soil texture, slope, or some chemical imbalance due to-
a) almost complete lack of soluble salts or soluble calcium- as with some soils irrigated with Friant-Kern or Kings river water, or
b) preponderance of sodium in soil or water (this adds up to a shortage of calcium), or
c) in some cases presence of relatively high concentration of bicarbonates in applied water can be a factor.

Soil and water amendments can be expected to appreciably improve water penetration for the chemical imbalance situation but not for compaction or texture related problems (unless these are related in some way to the soil chemistry). We can look at the soil analysis and water analysis and make a good estimate of the probability of an amendment (gypsum, acid, or other) improving water penetration.

There is only one sure way, however, of evaluating a soil or water amendment- try it in a small way first! Then, use it on a larger acreage. Be sure the continuing cost is off set by continuing profits.

There are sometimes other ways to get adequate water to the crops without costly chemical treatment-
1) Irrigate more often.
2) Hold water on the field longer to increase opportunity time for infiltration.
3) Cultivate to roughen furrows or field and slow the flow of water.
4) With sprinklers, reduce the rate of application by putting in smaller orifices and increasing numbers of nozzles so no run-off occurs and then extend period of sprinkling. Remember, the problem is to supply the crop with adequate water.

In some cases, as with potatoes, a quality factor is involved and gypsum has often helped improved quality (shape) and soil sulfur has reduced disease (scab). I'm sure there are other examples. Such quality factors may have little to do with water penetration.

So, to summarize to this point, for salinity problems- no real expectation of benefit due to amendments. For permeability problems- of the right kind- there are real benefits to be expected. The proof of benefit must, however, be on a case-by-case, demonstration basis.

3. How About Toxicity Problems?

Toxicity problems result from crop up-take of certain constituents from soil or water and their accumulation in the plant to toxic concentrations which reduce yield. Usual constituents of concern are sodium, chloride, and boron.

Sodium can come from "plain" salinity (high salt soils or water) or from chemical imbalances in soil or water (high sodium relative to calcium, evaluated by SAR or ESP). Chloride is included as an important part of salinity of soil or water. Boron usually comes from water, less commonly from the soil itself.

Sodium toxicities can sometimes be helped by increasing the available calcium. This means by use of amendments.

Chloride and boron are not usually affected by additions of amendments except if amendments allow added leaching of chloride or boro to take place which might then effectively reduce toxicity.

So, for toxicities, amendments may reduce effects of sodium. Probably will not affect chloride or boron.

4. Miscellaneous Problems (all others not considered above).

Problems are sometimes due to bicarbonate and pH.

Bicarbonate in waters applied by overhead sprinkling may result in white deposits on foliage or fruit. If this is a problem, a change to night irrigation during problem periods (high winds, low humidity) or to flood or other method of irrigation may solve the problem. Another possible solution for bicarbonate in waters might be to carefully add an acid to knock-out the bicarbonate. A reduction to pH= 4.2 would be needed to get rid of all the bicarbonate. A reduction to pH 6.5, sometimes said to be a safe pH for sprinkler pipes and pipelines, will

reduce the bicarbonate, but will not remove all of it. Whether this addition of acid is worth the cost would, again, have to be proven on a trial basis. Do the results justify the cost?

pH problems are usually related to pH 8.4 or greater and is symptomatic of other problems- water penetration, sodium toxicity. The attack on the basic problems (permeability and toxicity) will usually be effective to correct the pH. Gypsum adds calcium and reduces the sodium problem which usually is accompanied by a high pH (pH over 8.4). An acid added to soil or water, ultimately may put more calcium into solution and in turn will affect pH of a high pH soil (an acid directly reduces pH of water by adding acid hydrogen to the water). For high soil pH (pH above 8.4), gypsum, or soil sulfur and sulfuric acid (if lime is present) are effective. For low soil pH (pH less than 5.5 to 6.5) ground limestone is about the only material used and is very effective.

We have now covered the four usual problem areas of irrigation agriculture- Salinity, Permeability, Toxicity and Miscellaneous problems. There are others but they are special cases and not discussed here.

In Summary

Soil and Water amendments as usually used in California agriculture include gypsum or acid forming amendments (soil sulfur, or sulfuric acid).

Each can be effective and if used properly can be expected to correct specific types of soil permeability and toxicity problems related to excessive sodium or too little calcium (bicarbonate is believed to be related to too little calcium).

Acid materials added to irrigation water may be effective to control or reduce the miscellaneous problems related to bicarbonate and pH.

Amendments and soil or water treatment cost money. They should first be used on a trial basis to firmly establish that benefits are in line with costs. There sometimes are other cheaper and perhaps more effective ways of solving the problem (irrigate more frequently, etc.).

Amendments are not very effective in correcting problems of salinity, or toxicity problems related to chloride or boron. As supplement and support for this discussion, I would again refer you to last year's proceedings and the discussions of Fresno Farm Advisor Les Stromberg and Area Specialist Herb Schulbach.