CRITICAL ISSUES IN ALFALFA FERTILITY

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Fertility management of alfalfa has changed over the last few years. The economic environment has changed in terms of value of the crop and cost of the inputs.

Fertilizer can improve the production and quality in many cases, but not always. How can we manage this crop input to get the best results? The best economic return has always been the starting point. Does it pay to fertilize? What products give the most benefit? Often fertilizer was applied as a form of "insurance" to prevent nutrient deficiencies.

Today insurance fertilizer application can lead to problems. Applying unneeded fertilizer can impair quality, cause pollution and incur unnecessary costs. Today the goals include the 4 "R"s: right place, time, source and amount.

The tools to develop a sound fertility program are there to help us. The first is the wealth of data on plant usage and nutrient removal by the crop. We can know quite accurately what is being removed in the crop. Older data should be interpreted carefully because today's yields are often much higher. Information that relates nutrient use to yield is most helpful.

Secondly, we can test the soil to estimate its availability to supply nutrients for the crop. We need to understand the limitations and advantages of soil testing. Good sampling is the basis for accuracy. Most labs do a good job on the actual analysis, but may give different recommendations from the same results. Combining soil, plant and water tests can provide more accurate guidance.

Thirdly, we can manage fertility inputs directly as fertilizer and indirectly as nutrients may come from other sources such as irrigation water, manures, airborne sources or crop residues.

And finally, we can measure the fertilizer elements directly in the crop. This gives us the most accurate picture of what is actually happening in the field.

Fertilizer use has been an area where producers have traditionally had a free hand to decide on sources, timing, rates and methods. They have been assisted by Extension personnel, industry consultants and private labs. This collaboration has generally produced good results, reflected in the steady increase in average yields that occurred for many years. Fertilizer was a partner with improved seed genetics, crop protection chemicals, better farm equipment, better irrigation and other factors that produced this abundance.

Today outside interests in the form of regulators and various advocacy groups are watching and raising concerns about the environmental effects of fertilizer use. Fertilizer is changing from a simple crop input to a potential environmental danger to some people. A public that is increasingly poorly educated and virtually non-educated about agriculture is demanding more accountability and sensitivity to these concerns.

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Recent publications and research are raising serious questions about what we have done in the past with fertilizer, especially nitrogen, in parts of California. Undoubtedly, this will lead to new restrictions and regulations on fertilizer use. Manure management is a major concern for the animal industries. Hopefully, agriculture's side of this story will be told and a way forward can be found based on good science.

Nitrogen use on alfalfa has been an issue that keeps coming up.

In my opinion it shouldn't. The evidence is overwhelming that it is not needed, not beneficial and inhibits nitrogen-fixing bacteria. In the past it was recommended by many states to apply a small amount pre-plant on mineral soils. Today over half the states recommend no pre-plant nitrogen. In the field, usually the only response we see is when there is poor inoculation, usually due to soil acidity. And yet, there are still people applying it to alfalfa. When asked why the answer given was "the alfalfa looked better".

For the record, Alfalfa science and technology, ASA Monograph #15, 1972, states on page 443: "Visual observation of alfalfa fertilized with nitrogen may be somewhat misleading, since alfalfa plants fertilized with nitrogen frequently appear slightly taller with a darker green color and possibly slightly higher moisture content." That was written 40 years ago. It is still valid today.

Alfalfa needs many nutrients to grow and prosper, like all plants.

In reality, only some of these are truly important as possible limiting factors to full yield of alfalfa in California. Phosphate is clearly the most important nutrient for alfalfa on a statewide basis. Potassium is a problem in some parts of California. Sulfur can be deficient in areas with high rainfall and pure mountain waters. Micronutrients, molybdenum and boron, are needed in some very specific areas of California. Most areas show no response to other nutrients, even when other crops routinely need applications when grown on the same soils.

Foliar fertilization has become popular with some crops. It can produce results on alfalfa, but usually only when the plants are highly deficient. The amount of nutrients is limited because of large amounts can cause leaf burn. This usually requires multiple applications. Trying to predict exactly when and how much to apply is difficult and shortages will result in stunted plants. "Spoon feeding" is the technique of applying small doses over an extended time. This is very useful for nitrogen but questionable for other nutrients. It is important to apply enough in total to meet crop requirements. Intensive, ultra-high production programs may show benefits from foliar applications. But these will only work when the basic agronomy is sound.

The role of testing is crucial. Soil testing for pre-plant P, K,pH,salt,sodium and boron is mandatory. Irrigation water should be tested for nutrients such as nitrogen and sulfur. Waste waters can contain many other nutrients. Plant tissue can be tested for N, P, K, S, and B. If micronutrients are a concern, a plant test of the top 6" at cutting can give guidance.

Bale sampling allows samples to be taken at anytime and with ease. This tool can be very useful, especially when looking for problems. There are differences in which cutting is used and length of the cutting cycle is important.

Carefully consider previous management of the field. Many fields have had heavy manure applications. These can have plenty of carryover nutrients and not need applications until these

nutrients are used. Some vegetable crops leave substantial amounts of fertilizer in the soil that can be used by following alfalfa crops. Pre-plant soil sampling should show if this is the case.

With the high costs of fertilizer, some growers have chosen to skip applications. Is this a good idea? Testing is a better idea. Many growers have gotten by for a while, but yields will drop to the level of the limiting growth factor. Usually this will be phosphate. Remember that phosphate deficiency develops gradually. The plants don't change color until it is severe.

In the long run, we need to find a safe level that gives good production and apply maintenance amounts to stay at that level.

We need to use testing to confirm that we are accomplishing that goal. Having good nutrient levels may allow some producers to skip years when fertilizer costs are excessively high. This topic can be complicated and is worthy of careful study. Get good advice and do your own yield tests. Good records are very useful in making good decisions.

Previous symposia have covered soil, plant and water testing. Plant nutrient removal and fertilizer use have been well covered.

These are the best starting point. Recent work on bale sampling is very good and useful.

To demonstrate a systematic approach, we can look at some case studies.

Problem #1: A large ranch in midsummer. The north half of the ranch has alfalfa that is chlorotic and stunted. The South half looks fine. What should we do??

Plant, soil and water test!! results:

Soil shows no difference. Plant test shows low sulfur on north half. Water test shows extremely low sulfur in run-off water used to irrigate north half of ranch. South half irrigated with well water.

Run-off water is only applying 15 lbs. S per year in 4 feet. Well water is applying 80 lbs.S. Crop requirement is 50 lbs. per acre per year.

Recommendation: Apply 250 lbs. Elemental S per acre. Good results. Rapid response. Should fix problem for 4 or 5 years.

Problem #2: Grower reports low production. New account, no history. First determine what good production should be at this ranch. Based on soil, water and local production. Second, get production records and history. Grower does great job on this and issues challenge: In ten years of production, guess which two years had fertilizer application? Data shows no difference between applications and yields. Next, review any testing information and past fertilizer applications. Testing shows incomplete work. P wasn't tested. No plant tests. Fertilizer applied was K+Humic acid+micronutient blend. Suggest soil sampling fields. Hay from previous year still in barns. Suggest bale sampling. Results of testing: low soil P (average 6-8ppm Olsen).

Bale samples have P of .15%. Should be in range of .22-.24%

Conclusion: Major P deficiency. Other nutrients were good.

Recommendations: Apply P as 11-52-0 in winter. Suggest 200 to 300 lbs. acre. High cost of P this year, most of ranch gets 200 lbs.

Follow up bale testing shows improvement but P still in .19-.20 range. Suggest increased amount next year. Following year P test show .23-.24%P. Suggest maintained applications from this point on. Grower reports major production improvement.

Problem #3 Reclaimed water facility. Excellent alfalfa, 11 tons per acre. Good quality, good stand. No fertilizer has been applied.

Suggest plant tests to check nutrient levels. All levels good. Not excessive K. No toxic levels. Water is supplying all requirements for this crop. Nitrogen removal is major concern at this site. Estimate of applied N in water is 360 lbs. per year. Estimate of N removal by alfalfa is 660 lbs. per year. The difference is fixed N from rhizobia. The alfalfa is protecting the ground water from N pollution. Studies at this site show virtually no N gets past root zone.

Problem#4 Good average field. Long crop history. Good stand. Good production(over 10 tons). good quality. What fertilizer program should we use??

Soil: Olsen P- 14 ppm pH- 7.7 EC- .4 mmhos/cm

K- 181 ppm B- .5ppm No3-N - 6ppm

Plant tests: average P: .24%, average K: 2.50% S-.26%

This field was fertilized last year with 300 lbs. per acre of 11-52-0

K is high in plant, adequate in soil so no K

S is above .20% in plant so no S

P is adequate in plant, 14 ppm in soil is adequate to low for this soil at this site. Colder climate and higher pH mean higher P needed.

Recommend maintained application of P: 200 to 250 lbs. 11-52-0

N03-N level in soil is very low. This is common in alfalfa. This low level helps create an unfavorable environment for weeds and grass. Alfalfa will add nitrogen to soil when it is plowed under or killed at end of crop cycle.

In summary, with today's' high value alfalfa crop and high costs of production, using all of the tools and management skill we can bring can help us maintain or improve production and avoid problems from unneeded application of Plant nutrients.