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Nitrogen Efficiency in Almond Production

Nitrogen is the most important element we can apply to our tree fruit crops. Almond growth and productivity depend on the availability and uptake of nitrogen. Most fertilizer recommendations are based on making nitrogen available to our trees so that a nitrogen shortage does not limit tree growth or productivity. Unfortunately, a recent report commissioned by the State Water Control Board, conducted by a team of UC Davis researchers, has shown that many of our wells are contaminated with excess nitrogen, and that agricultural fertilizers and dairy waste are the most likely source (http://groundwaternitrate.ucdavis.edu/). Efficient nitrogen management will become increasing important in the future as we collectively try to reduce groundwater contamination while keeping our orchards productive. Nitrogen usage should be based on an individual orchard's cropping history (previous yields) and leaf and irrigation water analysis to determine nitrogen availability and potential sources. See chapter 27 on nitrogen usage in our UC Almond Production Manual #3364 (Figure 27.1) and the interactive model "Nitrogen Fertilization Recommendation for Almond" by Dr. Patrick Brown, UC Davis, at http://fruitsandnuts.ucdavis.edu/index.cfm. This model can be used to calculate both the timing and rate of fertilizer applications required to maintain optimum yield. Site-specific information is required in order to accurately project the nitrogen requirement for orchards.

A removal and replacement rate of 60 lbs N per 1000 lb nut meat yield is suggested by Dr. Brown when estimating annual N demand from a crop load. Dr. Brown is currently leading a research effort, near Belridge in Kern County, to determine more accurately efficient nitrogen use in productive almond orchards (http://ucanr.org/sites/scri/). In this study, applications of 275 lbs fertilizer N produced 3500-4500 lbs of Nonpareil nut meats/acre in 2009-2011. A higher rate of 350 lbs N/acre/year did not produce more nuts than the 275 lb N rate. Lower fertilization rates of 125 and 200 lbs N/acre/year produced good yields but significantly less than the 275 lb N/acre/year rate. Dr. Brown carefully points out that you can't expect to increase yields by increasing nitrogen application rates; that nitrogen applications should replace the N removed in last season's crop.

Some groundwater has elevated nitrogen levels, and you should take into consideration any nitrogen found in well water in developing your fertilization program. Several years ago the well water at my family's farm tested at 50 ppm nitrate (NO_3-). If I applied three acre-feet of water per season with this water I would apply approximately 92 lbs N per acre. This figure can be determined by multiplying mg/l or ppm of nitrate by 0.61 to get

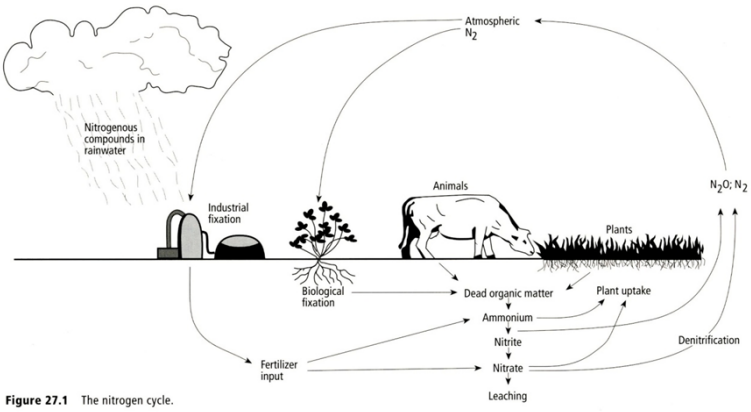

Figure 27.1 The nitrogen cycle.

pounds of actual nitrogen per acre-foot of water (Figure 27.2 UC pub #3364). If the lab analysis reports nitrogen levels in nitrate-nitrogen (NO_3-N), then multiply the nitrate-nitrogen value by 2.72 to get pounds of actual nitrogen per acre-foot of water. For example, if your orchard produced 3,500 pounds of kernel meats last year, you would determine that 210 pounds of nitrogen was removed with the crop and needs to be replaced. But if your irrigation water has 50 ppm nitrate then you may only need to apply 118 pounds of nitrogen per acre to your orchard (210 lbs nitrogen needed minus 92 pounds found in the water).

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Table 27.2 Amount of nitrogen (N) applied in irrigation water as a function of concentration.

Concentration		Amount of N applied (lb/acre)			
ppm NO_3-N	ppm NO_3^-	2.5 acre-ft	3.0 acre-ft	3.5 acre-ft	4.0 acre-ft
2.26	10	15.4	18.4	21.5	24.6
4.52	20	30.8	36.8	43.0	49.2
6.78	30	46.1	55.2	64.5	73.8
9.04	40	61.5	73.6	86.0	98.4
11.30	50	76.9	92.0	107.5	123.0
13.56	60	92.2	110.4	129.0	147.6
15.82	70	107.6	128.8	150.5	172.2

*Agricultural laboratories may report their results of water analyses as either NO_3-N (ppm N) or ppm NO_3^-. The following conversion factors may be used to calculate the amount of N applied annually in the irrigation water for N concentrations or levels of applied irrigation water other than those listed above.

1 ppm NO_3-N in water = 2.72 lb N/acre-foot of water applied.

1 ppm NO_3^- = 0.614 lb N/acre-foot of water applied.

Since the atomic weight of the N atom is 22.59% of the atomic weight of NO_3, ppm $NO_3^- \times 0.2258$ = ppm N.

Mature trees need more nitrogen in early spring during periods of active shoot growth, leaf activity, and photosynthesis when temperatures are between 70 and 80°F. Shoot growth is vital for canopy development and for the creation of fruiting positions (buds). Almond nuts and shoots use 80% of the season's nitrogen during the period between bloom and mid-June. Dr. Brown's group recommends delivering N fertilizer at four different timings and amounts through the season – February or March (20% of total annual N input), April (30%), June (30%) and September - October (20%). Nitrogen use efficiency is increased dramatically when nitrogen is applied at the time of peak tree demand and uptake. I would prefer to see you add a little bit of nitrogen with each irrigation from March to July, rather than applying large doses periodically through the season. Fertigation delivers fertilizer to active roots. It is important that irrigation deliver only needed water, for excess water could dilute or leach the nitrogen applied past the root zone. In orchards with flood or solid set sprinkler irrigation systems the nitrogen should be applied down the tree rows and not broadcast down the row middles. Dormant winter applications of nitrogen should be avoided as well as applications during hull split (July), which can aggravate hull rot and delay harvest. Deciduous almond trees take up no nitrogen between leaf drop and leaf out.

I have seen many young trees burned by too much nitrogen, especially if liquid fertilizers like UN-32 (urea ammonium nitrate 32 %) or CAN 17 (a clear solution of calcium nitrate and ammonium nitrate) are used in single applications. These liquid fertilizers are very effective and easy to use but it doesn't take much to burn young trees. I do not recommend using liquid fertilizers on first leaf trees–I prefer to see triple 15-15-15 (15% Nitrogen - 15% Phosphorous - 15 % Potassium) fertilizers used on first-leaf trees. I like to see granular fertilizers placed at least 18 inches from the trunk. With micro-sprinkler and drip irrigation systems liquid nitrogen fertilizers can be used very efficiently and easily by growers. But be careful, I know several farm managers that will not allow more than 10 gallons of UN-32 per acre per application on mature almond trees. UN-32 contains 3.54 pounds of actual nitrogen per gallon, if you put out 10 gallons of UN-32 per acre you added 35.4 lbs of nitrogen per acre. If you have 120 trees per acre and do the math you come up with 4.72 ounces of actual nitrogen per tree– almost 5 ounces! I recommend not applying higher rates than this per application. I have seen nitrogen burn occur more often during hot summer temperatures when trees have elevated transpiration rates and obviously faster nitrogen uptake rates than what would have occurred at a cooler time of the year.

Young almond trees don't require as much nitrogen as older trees. I like Wilbur Reil's (UC Farm Advisor Emeritus) rule of "one ounce of actual nitrogen per year of age of tree for the first five years". That rate can be applied several times per season, but never more than that at any one application. Thus, a first leaf (first year in your orchard) almond tree should not receive more than one ounce of actual nitrogen per any application. A five year old almond tree should not receive more than 5 ounces of actual nitrogen per one single application. The University of California only recommends one ounce of actual nitrogen per one year old tree over the course of the season, but many growers and PCAs feel that this rate is not enough for the growth they desire. So, if you choose to put out five ounces of actual nitrogen per one year old tree, do so in five applications and not all at once!

Brent Holtz, Pomology Advisor and UCCE County Director

Crop Digest: Grapes

The 2012 season started off with Chardonnay budbreak right on the 26-year-average date of March 15th, but slowed down with cool weather and has progressed with alternating periods of cold and above-average temperatures. More recent weeks have had many windy days. It appears as the end of rain season approaches we will finish with about 65% of average. Fortunately some good soaking rains in March and April helped recharge the top three feet, but deep soil moisture is lacking.

As of May 1st the north county has total rainfall at 12.4 inches, compared to 25.8 in 2011, with more in May. The south county has had 8.04 total inches, about 59% of long term average. Much of the rain came early during October through December, with a dry spell mid –winter and a large amount in late February and through March, just before and during budbreak. Most rain events were significant and effective. Effective rainfall needs to be greater than 0.25 inches for one event and greater than the previous week's ET, which is usually very low during winter time. Because of the long dry periods between rains, early-season problems of *Phomopsis* cane and leaf spot or *Botrytis* shoot blight have been non-existent. Day time temperatures have been warmer than average, with cool nights, so that growing degree days (GDD) is only slightly ahead of average. There was a light frost this year, with very scattered effects on Easter weekend, April 7-8. Last year a more severe but localized frost hit the west side on April 8.

There have been some growth and dieback problems on young vines planted in the last four years. Several sites have shown delayed budbreak, erratic and non-uniform shoot growth with some cordon, and even trunk dieback to the graft union. In every case vines were very vigorous strong growing vines in colder locations and in some cases delayed harvest last year. It seems several factors might have contributed in varying degrees, which included: a high rainfall year (25 inches), vigorous vines with a light crop and cool growing conditions, and a heavy rain in early October. A dry fall/winter (one of the driest in recent memory) followed, with some very cold temperatures mid-winter. In two cases with Cabernet Sauvignon, some vine death may require some replanting; otherwise retraining may only be needed in most situations.

This spring, the 2012 situation provides growers with the opportunity to control shoot growth, but caution should be used, as deep soil moisture is lacking and vines may struggle with later-season hot spells.

Unless a cover crop is present vines have only been using about 0.25 inches of water (or very "seat-of-the-pants", about 5 hours worth of irrigation time) per week. During that same period orchards have been using about 0.75 inches of water. That can double soon and increase further whenever the weather does warm up. In a dry year like this it is a good idea to stay ahead of using deep soil moisture, and irrigate so as to maintain deep moisture available for mid to late summer and into harvest in the fall.

It seems gophers and voles may have started a new cycle of increased population. They are active at this time and probably need some attention, even with the benefit of owls, hawks and snakes (or cats). Owl boxes and raptor perches help, but control is needed before they reproduce and litters begin to disperse. See the UCIPM guidelines for some ideas:

Voles http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7439.html

Gophers http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7433.html

Continue to be on lookout for vine mealybug (VMB) as it spreads. There are options for control, and Movento (spirotetramat) returned last year as a possible choice of several materials. VMB is now becoming active enough to begin looking. Vigilance is needed, so look in areas of bird roosting and watch for high traffic spots of ants that lead into vines.

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Rainfall Seasonal 2002-12

	Total	% Avg	OctNovDec	Jan	Feb	Mar	Apr	May	Jun
2002	**16.3**	**93**	9.7	2.0	1.0	2.5	0.2	0.9	0
2003	**15.2**	**86**	8.7	0.6	4.7	1.1	0.1	0.1	0
2004	**15.3**	**87**	9.2	0.6	0.9	0.6	3.6	0.4	0
2005	**23.1**	**131**	10.4	3.2	3.3	3.5	1.4	1.3	0
2006	**23.4**	**133**	7.1	5.4	1.1	5.2	3.8	0.8	0
2007	**12.1**	**69**	4.6	0.3	4.3	0.6	2.3	T	0
2008	**13.7**	**78**	4.5	7.3	1.8	0.1	0	0	0
2009	**15.1**	**86**	4.0	1.9	5.3	1.9	0.7	1.3	0
2010	**19.2**	**109**	6.1	4.5	3.6	1.8	2.9	0.3	0
2011	**26.3**	**149**	12.1	1.4	4.1	5.8	0.2	1.4	1.3
2012	**12.4**	**70**	3.0	2.9	1.3	3.3	1.9		
Average	**17.6**		7.2	2.7	2.9	2.4	1.5	0.7	0.1

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Light brown apple moth (LBAM) is spreading in the Manteca and Tracy areas and unfortunately may begin to be seen near several of the landscape nursery operations around the county. Be on the lookout. It is controllable as is the more traditional pest of omnivorous leaf roller. LBAM does unfortunately require quarantine and more paperwork. For more information: http://www.ipm.ucdavis.edu/EXOTIC/lightbrownapplemoth.html

The good news is European grapevine moth (EGVM) *Lobesia botrana* quarantine was lifted for San Joaquin County. If you have any questions give me a call (for those of you still with the old office number, my new number is 953-6119).

There are big challenges for the 2012 season, but wine sales are up and after two short crops, there is new vine and new site planting going on. Nursery will be tight, so order early this coming year if any replanting is needed. Consumers are looking for value and Lodi remains a good place to grow quality grapes for quality wine in a good, but competitive market.

Good luck in the twelfth year of the second millennium!

Paul Verdegaal, Viticulture and Pomology Advisor

Scouting in Alfalfa Fields—What We're Seeing

Recently, we have seen and heard of some cases of stem nematode in alfalfa. Some of it is in the Delta region, but other cases have been found in eastern parts of the county. What is out there is not of epidemic proportions, but there has been enough inquiry that we figured an article might be helpful.

Plant parasitic nematodes are tiny roundworms that can only be seen under a microscope. They are damaging to plants because they use their piercing and sucking stylets to feed on cell contents. Alfalfa stem nematode (*Ditylenchus dipsaci*) feeds on the plant stems and crowns. Symptoms of the pest include swollen and discolored nodes, shortened internodes, fewer shoots, and stunted growth (Figure 1). The nematode may also move up the stem to leaf tissue, destroy chloroplasts, and cause "white flags." Generally, stem nematode is a problem during the cool, wet conditions of fall and spring. Given our mostly dry winter but recent cool, wet spring, the pest has become apparent a little later than usual. This could lead to reduced yields in first cuttings this year.

Stem nematodes only travel short distances on their own, perhaps only inches per year. They are spread longer

Figure 1

distances, however, with the movement of soil, debris, or irrigation water. Sanitation is important in preventing the spread of this pest. Rotating out of alfalfa for two to three years to non-host crops – like small grains, beans, or corn – is another important strategy for reducing future outbreaks because stem nematode has a limited host range. When rotating out of alfalfa, make sure to eliminate volunteer alfalfa plants as part of your weed management program, as these volunteer plants could continue to harbor the pest. Finally, when replanting, make sure to use resistant varieties. The National Alfalfa Alliance publishes a list of varieties with stem nematode resistance (http://www.alfalfa.org/pdf/2012%20NAFA%20Variety%20Leaflet.pdf).

In addition to stem nematode, we also wanted to tell you about another pest that we have seen in alfalfa. In this case, a picture is worth a thousand words (Figure 2)! This outbreak of two-spot spider mite (*Tetranychus urticae*) was seen in a three-year-old alfalfa field in the eastern part of the county. The picture shows hundreds of eggs on one leaf as well as juveniles and adults. The eggs are yellow and spherical, and the adults are distinguished by two dark spots on their backs. Damage from spider mites appears as yellow stippling on the leaves, but severe infestations can desiccate leaves and stunt plants.

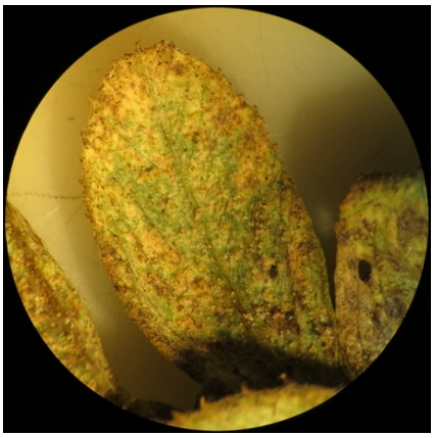

Figure 2

Damage like this is rarely seen in our region and is usually warded off by winter rains or timely irrigation. Our dry winter could have been the cause of this outbreak, but this could also be a result of hormoligosis. Hormoligosis is a condition where pesticide application stimulates certain pests to reproduce. An early-season pyrethroid

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application, for example, to control Egyptian alfalfa weevil could have eliminated spider mite natural enemies and induced hormoligosis. What would probably be the best management for mites in this quantity is an early cutting. After the cutting, it would be important to walk the field and reassess. If there is still an infestation, a miticide might be necessary.

While this seems to be an isolated case, it would probably be worthwhile to take a walk through your alfalfa fields and check for spider mites. An infestation like this will take some crafty integrated pest management!

Michelle Leinfelder-Miles, Delta Crops Advisor and
Mick Canevari, Agronomy Advisor Emeritus

Groundwater Nitrate Study: Why? What? and Where Do We Go From Here?

Earlier this year, scientists at UC Davis released a report entitled "Addressing Nitrate in California's Drinking Water, With a Focus on Tulare Lake Basin and Salinas Valley Groundwater." Perhaps you have heard about this report already, even read bits and pieces of it, or maybe you have read it in its entirety. The 80-page main report is accompanied by eight technical reports, and all are available at the website groundwaternitrate.ucdavis.edu. To attempt to summarize hundreds of pages in a one-page newsletter article would be impossible but with this article, I will attempt to summarize why this report was generated, some key findings, and some food for thought for us to consider now and in the future.

In 2008, the California Legislature passed a law that required the State Water Resources Control Board (Water Board) to investigate groundwater nitrate levels in the Tulare Lake Basin and the Salinas Valley. Essentially, legislators wanted answers to some questions. *How much nitrate is in the groundwater? How did it get there? What can we do to reduce it? How much will it cost?* To help answer these questions, the Water Board contracted with UC Davis to get some answers. The UC Davis findings will be included as part of a larger report that the Water Board will provide to the Legislature.

The UC Davis report states that there are two major problems caused by nitrate in groundwater. The first relates to public health because drinking water nitrate levels above 45 milligrams per liter exceed the California Department of Public Health's level for safety. The study found that 254,000 people in the study areas are at risk of having drinking water nitrate exceeding this level. Cropland was reported to be the source of 96 percent of the human-generated nitrate found in groundwater. The second problem caused by nitrate in groundwater is the cost of cleaning it up. Clean-up measures could include water treatment and/or new wells and could have costs of $20-35 million per year. The report went on to say that addressing the problem will require a multi-pronged approach of providing safe drinking water, reducing sources of contamination, collecting data, and providing funding to support all of these needs.

In the agriculture community, the report was anticipated with apprehension for the obvious reason that it essentially puts a target on agriculture to reduce nitrate loading. The report does make the case for nitrogen needs in agriculture. It states that nitrogen (in plant-available forms like nitrate) is essential for plant growth and global food production, which will need to increase by over 70 percent in the next 40 years according to literature cited. Additionally, nitrogen is part of a balanced, natural cycle in the environment among the atmosphere, soil, plants, animals, and water. The issue at hand is that we interrupt this balance when we add nitrogen to the system, and when excess nitrate-nitrogen is lost to the environment, it sticks around for decades. So, where do we go from here?

One thing we need is a better understanding of crop nitrogen use efficiency (NUE). We need to learn how to optimize timing and rates of fertilizer applications so that a greater fraction of the applied nitrogen is recovered in the harvested crop. Currently, crop nitrogen recovery is estimated at 30-40 percent. Best management practices could increase that value two-fold, but adaptive research is needed to better understand how crop, soil, and irrigation all contribute to nitrogen uptake and loss at different application rates and timings. Certain crop rotations may reduce the need for nitrogen applications, and we must look at varying synthetic fertilizer applications if manure is applied or if groundwater (having some level of nitrate) is used as the irrigation source. Additionally, we must better understand barriers to adopting best management practices, such as costs or risks to crop quality or yield.

As the new Delta crops farm advisor, I anticipate that I will be working, at least in part, on projects related to nitrogen and/or nutrient management. Groundwater in the Delta is a whole other can of worms that will be unique from other areas of the state; nevertheless, like in the rest of the state, we need a better understanding of NUE in Delta crops, under Delta soil and irrigation conditions. This is the food for thought that I will be chewing on and I welcome you to chew on it, too.

Michelle Leinfelder-Miles, Delta Crops Advisor

The Added Value of Cooling! Dairy Cows

It is relatively easy to measure the effects of heat stress on milk production and reproduction in lactating pens. In the summer months, volume of milk drops and pregnancy rates start to decrease in July and continue to decline through the fall. In response to these changes, many dairies have added fans and soakers (sprinklers, etc.) to lactating pens, which are turned on as temperatures near 70°F. The science justifying cooling cows in the lactating strings is well documented, but have you ever wondered what cooling can do for your dry cows?

Findings of a recent study were published in the Journal of Dairy Science, illustrating the value of cooling dry cows. From the month of May through November mature dry cows were assigned to one of two groups: cooled or not cooled. Both groups of dry cows were housed in the same barn, fed the same ration, and managed in a similar fashion. The only differences were that sprinklers and fans were utilized in the cooled group, beginning when temperatures reached 70°F. After calving, both groups were housed in a freestall barn with cooling. During the study, the average temperature-humidity index (a measure of how hot it feels when relative humidity is factored with actual air temperature) was 76. To put this index into perspective, the average "max" temperature-humidity index in California's Central Valley during the months of May-November (2011) was 82. In short, the heat was comparable with typical California conditions.

Non-cooled cows produced 15% less milk, or 11 pounds LESS milk each day after calving up to 40 weeks in milk. Two key factors contributed to the observed reduction in milk yield by non-cooled cows. One, non-cooled dry cows ate 16% less feed each day during the dry period, leaving them less prepared for the subsequent lactation. Although not statistically significant, cooled dry cows tended to eat more dry matter after calving and as lactation advanced. Second, the non-cooled, heat stressed dry cows had less mammary cell development in the dry period, thus compromising subsequent lactation performance after calving. The cell damage to the udder was further quantified by the fact that the heat stressed dry cows tended to have higher somatic cell scores during lactation than cooled dry cows.

What could this mean to the average dairy producer? Let's use a 1,000 cow dairy for our example (Figure 1). In California's Central Valley, we had 214 days with temperatures of 70°F or greater during 2011 (7 months). Assuming heat stress at 70°F, our example dairy calved 581 cows that were stressed due to heat in 2011. If each cow lost the same amount of milk as reported in the Journal of Dairy Science study, with an average milk price of $16 per CWT, these dairy cows would have produced less milk - $286,837 less in the first 280 days of lactation compared with cows cooled during the dry period. But wait, the scenario gets worse! This simplified example fails to account for other losses, in particular reduced reproduction that would only increase the cost of not cooling your dry cows. Cooling dry cows makes economic sense because what happens during the dry period impacts the subsequent lactation and reproductive performance of your cows.

Figure 1. Example California Dairy

# cows in the herd	1,000
# mature dry cows calving each month	83
# months with heat stress (HS)	7
# days with HS	214
# cows calving with HS	581
# days milk yield affected	280
Pounds of milk lost/cow/day	11.02
Total milk (lbs) lost due to calving in HS	1,792,734
Milk value lost – all cows calving in HS	$286,837
Milk value lost/day in 280 d of lactation	$1,024

Jennifer Heguy, Dairy Advisor, UCCE Stanislaus/San Joaquin Counties

Jed Asmus, Nutritionist, Etchebarne Inc.

No Consistent Agronomic Benefit of Humic Acid Applications to Processing Tomatoes

Fertilizer products containing humic substances (most commonly humic acid) are being marketed as a way to reduce fertilizer use without sacrificing crop growth or yield. Humic acid (HA) products are commonly soil-applied, normally in conjunction with a liquid fertilizer. Humic substances have been reported to stabilize soil structure, increase cation exchange, stimulate soil microflora, enhance nutrient availability, and increase crop growth and yield. So do these products work? While there are plenty of scientific reports demonstrating positive effects, the vast majority of the studies showing a positive crop response have been conducted in hydroponic or sand culture experiments, rather than in field soils. However, Tim Hartz and Tom Bottoms at UC Davis Plant Sciences Dept. have conducted field trials with a number of different commercial products containing humic acid.

They found that in soil incubation studies with a low organic matter soil (0.8%), HA did increase the amount of phospholipid fatty acids which are indicative of microbial activity. However, in slightly higher organic matter soils (2.5%), no effect of HA on microbial populations was observed.

In field trials conducted in processing tomatoes, preplant P fertilization alone increased early plant growth

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as well as leaf P and N levels (compared with no P applied), but the application of humic acid plus P provided no advantage over P fertilization alone. Likewise, the P-fertilized plots, as a group, yielded better than non-P-fertilized plots, but humic acid did not affect yields. Fruit soluble solids were not affected by P fertilization or humic acid.

So why have some previous studies shown effects while these studies did not? For one, in previous studies, conducted mostly in hydroponic or sand-culture systems, the concentration of humic acid was higher. To scale the concentration up to a field situation would mean applying around 45 pounds of active ingredient of humic acid per acre, while typical soil application rates for commercial products are only a few pounds per acre. The high cost of HA products is a constraint on the application rate; costs are around $5 per pound. The other factor which might explain a lack of effect in a field situation is that field soils contain native dissolved organic matter which can perform some of the same functions as applied HA, thereby minimizing the impact of the added HA. In other words, if you are growing in sand with very low organic matter, then you may see a benefit of adding humic acid products, but most of our processing tomatoes are grown in soils with at least a small quantity of organic matter which can provide many of the same benefits, for free!

Brenna Aegerter, Vegetable Crops Farm Advisor

Alternative Castration Methods

I was recently at the Sierra Foothill Research and Extension Center with some local ranchers who were reading some of the posters of research that has been done on the station. One project in particular piqued some interest and I thought I would summarize it since it apparently wasn't a very well publicized project among cattlemen.

Ted Adams and Cindy Daly along with other researchers at UC Davis back in the mid 90's conducted a project looking at a chemical method of castration. GnRh – Gonadotropin-Releasing Hormone – is the hormone that starts the sequence of development of the testicles in bulls. Without going into an in-depth endocrine and hormone discussion, think of GnRH as the handle of the faucet. Turning the faucet on releases a flow of hormones that starts testicle development and puberty. If you can turn the flow off, you can prevent testicular development and essentially "castrate" the bull calf. Using this theory, Adams and Daly created an anti-GnRH immunization that can be administered in a shot, creating a chemical castration.

An early paper looked at feedlot performance of steers and bulls immunized against GnRH. What they found was that the immunization reduced testicular growth but

did not affect performance traits or testosterone levels at slaughter. Traditional castration reduced live and carcass weight, average daily gains, and dressing percent, but improved yield grade when compared to bulls and immunized bulls.

Further papers compared performance of bulls, immunized bulls, and castrated steers. Half of each group was also given Synovex C with initial treatment (castration and first shot of immunization) and Synovex S at weaning and feedlot entry. The immunized bulls also received a booster immunization when they entered the feedlot. What they found was the immunized bulls and animals given Synovex had less testosterone and scrotal circumference at weaning. Also, immunization, Synovex, or the combination of both significantly reduced scrotal circumference, testis weight, and tissue concentration of sperm at slaughter. At slaughter, only immunization continued to reduce levels of testosterone. The carcass weight was similar for immunized bulls, both synchronized and unsynchronized, implanted steers and unimplanted bulls, the control. Immunization and Synovex reduced the masculinity of the carcasses of bulls.

Another paper looked at testis function, aggressive behavior and carcass traits for bulls immunized at different ages. They immunized the bulls at 1, 4 or 6 months of age. Bulls and steers were used as controls. For this project, all immunized bulls received another immunization at 12 months of age. They found that age of first immunization did not have an effect of on anti-GnRH titer at slaughter (levels of immunization to prevent the release of GnRH). Testis weight was also affected as was testosterone levels by immunization. Immunized bulls were similar in feedlot gains and final weight as bulls, as found in other projects. But, aggressive behavior was reduced and carcass quality improved.

All of the research projects support using an immunization against GnRH can effectively castrate bulls in a non-invasive manner as well as provide enough residual level of testosterone to reduce the need to implement animals. While this work was done awhile ago, I have not heard of

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any movement to make this a commercial option for cattlemen to use as an alternative to surgical castration.

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Learning Spanish

As a native of Chile, I am frequently asked questions about Spanish, and the benefits and difficulty of learning it. I hope this article will also be of interest to those learning other languages. It is the third and final article in a series on learning a second language (for other articles, see http://www.cnr.berkeley.edu/ucce50/ag-labor/7article/articles.htm). I am assuming that your interest is in conversing in another language, rather than just being able to read.

It pays to be bilingual. Although it is not an easy task, surely there are benefits from learning another language. My oldest son related the following story he heard in Uruguay, "A skinny cat stood for hours waiting for the mouse to walk out from behind the hole, so he could nab him. He was having little success. A fat cat walked by, inquired about the nature of the difficulty, and volunteered to show the skinny cat the ropes. The cats moved to a new vantage point where they could observe the hole without being seen. Next, the plump cat barked, "Woof, woof." The mouse, confident that a dog had scared his nemesis away, thought it safe to venture out only to be nabbed and devoured by the chubby cat. "You see," explained the fat cat, "it pays to be bilingual."

How difficult is it to learn another language? Some individuals have a knack for picking up another language. But for the rest of us, learning a foreign language requires much effort and sustained commitment over a long period of time. This is why setting a preliminary goal of picking up some *polite expressions* and *basic vocabulary* is not so hard—and can be a lot of fun. While it is easier for youth to learn another language, it is never too late to start. More than short term, intense efforts, the key to learning a new language is setting aside time to listen over a long period of time—hopefully five or six days a week. I believe that even a few minutes a day—as long as we are consistent—can give us surprisingly positive results. Obviously, more challenging goals will require additional effort. Repetition, and more repetition, will begin to create the magic of learning. The key, then, is to have staying power and not to expect results overnight. Create realistic goals and stick to them.
A good way to get started is by listening, and then listening some more. Hearing music is especially helpful; when words are sung, vowels are drawn out so their major pronunciation points are emphasized. Whether we use a computer program, an audio program, or smartphone apps, I recommend that we resist the temptation of pronouncing words and expressions out loud at first, but instead listen to these several times before attempting to pronounce them. Give your brain the opportunity to slowly absorb new material. Be patient with yourself. It generally takes hearing some words multiple times before we begin to incorporate them into our vocabularies. In a second phase of learning, we may not *recall* a word, but will *recognize* it upon hearing it. With time, we can move a word into a third phase, where it is so deeply embedded in our minds that we have perfect recall.

When we are put on the spot we may temporarily forget even mastered words. But as soon as we relax a bit these come dancing back into our minds. With time and usage, this willingness to put ourselves on the spot helps to cement what we have learned. Language, like other types of learning, requires constant usage. Even in our native language, we sometimes cannot recall a word or expression and it seems to be *on the tip of our tongue*. I like to think of human learning as pouring water over a pot with small (and sometimes not so minute) holes. The water being poured into the pot represents knowledge; the holes, our forgetfulness; and finally, the water level in the pot, our ability to retain information. We lose unused vocabulary, but gladly not entirely. As we begin to *relearn* it, it comes back quicker. This is why it is so important not to get discouraged and stick with it.

Developing an ear and training our tongues. Human sounds vary from pronouncing the letter "eñe" in Spanish, rolling the tongue to make an "erre" sound, or the various clicking sounds in the African Khoisan languages. English speakers take for granted their ability to say "sheep" and not have it sound like "ship." As an amateur radio operator I had to learn Morse code. The dots and dashes, at first, seemed to blend so all the letters sounded the same. With time I began to distinguish their sounds and rhythms. A friend gave me some good advice. "Don't even attempt to learn how to send code," he said. "Once you have learned how to listen, *sending* the code is the easy part." My friend was correct. This advice is only partially true for learning foreign languages. While we still benefit from focusing on listening and more listening in our new target language, it will also require

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effort to speak properly. Our mouth, cheeks, nose, and tongue, along with breathing in or out will need to be applied in different ways in order to effectively produce the right sounds.

The very worst approach to learning a new language is to use a phrase book, where a word's phonetic pronunciation is given (transliterated) based on a language other than the target language being learned. Many language CDs, tapes and computer programs come with a manual that includes phonetic pronunciations. Unless it is an emergency, these aids need to be avoided so your Spanish does not sound as bad as my English. Having said this, looking at the written language can sometimes be helpful when it is difficult to determine which letter a native speaker is pronouncing (such as may be the case with the letters d, t, or p, which at times may be challenging to differentiate).

Are there different types of Spanish? National and regional differences in vocabulary do exist, but they are minor, probably involving less than ten percent of the words used in Spanish. Nations and regions incorporate some native vocabulary into the language. For instance, seaweed is *alga marina* in most Spanish-speaking nations, while in Chile we use the native *cochayuyo* for edible seaweed. Apricots may be known by a number of different names, including *albaricoque* or *chabacano* in México and *damasco* in Latin America. Differences between Spanish-speaking nations are underscored when slang is used, and minimized when a more formal Spanish is utilized.

False friends. When it comes to vocabulary building, English speakers have a great advantage when learning Spanish, as so many words have a common etymology or root. These cognates make it so much easier to learn without having to completely start from zero. Sometimes we encounter ***faux amis*** (or, false friends), that is, words that sound the same, come from a common etymology, but over time have come to take on different meanings. (In contrast, false cognates are words that sound alike but never had a common root.) A young woman, after some coaxing, was prodded by her boss to say a few words in Spanish to a group of colleagues. "*Estoy muy embarazada*," she began. And turning to point to her supervisor, added with a smile, "*¡Y toda la culpa es de él!*" (She thought she was saying, "I am very embarrassed and it's his fault!" Instead, she had exclaimed, "I am very pregnant, and it's his fault!").

Are there differences in accents? National and regional differences in accents are much more pronounced than differences in vocabulary. Four very general types of Spanish accents would include those that (1) emphasize the letter "z" as distinct from the "s" (e.g., parts of Spain); (2) have a *nasal* quality (e.g., Cuba, and some Central American nations); (3) accent a different part of the word (sen**TA**te vs. **SIÉN**tate) and tend to use a "sh" sound (e.g., Argentina, Uruguay); and (4) *non-nasal* (e.g., México, Colombia, Chile), often with regional "sung" qualities. So, given a choice, it is ideal to learn Spanish from someone in the target nation that most interests you.

Learning Spanish, or another language, then, takes commitment, but the rewards are enormous, even if your focus at first is only on learning some very basic vocabulary and polite expressions.

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Calendar of Events

Blueberry Open House and Tasting
Wednesday, May 23, 2012
8:00 AM - 11:00 AM
Kearney Agricultural Research and Extension Center,
9240 South Riverbend Ave., Parlier, CA

Online registration at http://ucanr.org/bbopenhouse2012 is preferred at a cost of $10 per person. Cash or check will be accepted at the door, beginning at 8 a.m. Please call Karen at the Tulare County UC Cooperative Extension office for more information. (559) 684-3300

New!
University of California website on
Nutrient Management for Vegetable, Fruit & Nut Crops
(http://ucanr.org/sites/nm/)
Nutrient Management information organized by crop (horticultural crops only), and by topic (e.g. organic production, soil & plant testing, etc.). Also contains training modules (short narrated presentations) and a list of online resources for nutrient management information.

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Notes from the Field

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