Imperial County Agricultural Briefs

Features

From your Farm Advisors

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Quality Parameters for the Reuse of Wastewater for Irrigation

Khaled M. Bali

Water resources in western states are limited and the availability of fresh water for agriculture will likely decrease to offset the growing demands in urban and industrial regions. Irrigated agriculture will continue to be more dependent on efficient irrigation systems such as drip and sprinkler irrigation systems and marginal water sources such as wastewater generated from agricultural or municipal sources.

The water quality constituents of major concerns for irrigated agriculture include suspended sediment, salinity, nutrients (mainly P and N), Na, Cl, SO_4, HCO_3, B, trace elements, pathogens, and high pH. Some marginal water sources that are not suitable for irrigated agriculture, because of the high salt concentration, are either discharged into waterways or mixed with fresh irrigation water and used for irrigation. While such waters are not suitable for irrigating vegetable crops, using relatively simple treatment methods such as wetlands could significantly reduce the load of sediment, phosphorus and nitrogen. Wastewater sources that are high in salinity and not suitable for vegetable could be used to irrigate forages and field crops.

Wastewater can be used for irrigation, but there are limitations on the suitability of wastewater for irrigation. The following parameters are examples of water quality parameters that must be evaluated prior to the use of wastewater for irrigation:

1- Salinity of irrigation water: The relationship between salinity (EC, electrical conductivity is an estimate of salinity) of irrigation water and crop yield is well established. In general field crops are more tolerant to salinity than vegetable crops. The hazard index for salinity will is dependent on crop type and salinity of irrigation water.
2- Specific ion toxicity: Some crops are sensitive to specific ions such as Na, Cl, and B. Specific ion toxicity depends on the concentration of the ion in irrigation water, crop type, and in some cases, the type of irrigation system. For example, the toxicity effect is compounded if the crop is irrigated by a sprinkler

system but not a problem with drip irrigation.

3- Trace elements: Trace elements are generally present at very low concentrations in surface water sources. However, the concentrations are relatively high in wastewater.

4- SAR: The impact of Sodium Adsorption Ratio on soil structure depends on the value of SAR, EC, and soil type. The impact of SAR-EC on soil infiltration is well documented in the literature.

5- Nutrients: Wastewater is rich in nutrients specially nitrogen and phosphorus. The load and concentration of nutrients in wastewater must be at or below the levels required for optimum crop growth. Another area of concern is the presence of P in suspended sediment and the potential for algal blooms in waterbodies and potential impact on the irrigation systems (example, clogging of drip emitters).

6- Irrigation system: A hazard index for the irrigation system depends on the type of irrigation system. For example, the hazard value for a surface or flood system is low, while the hazard value for a drip system is relatively high. The potential interactions of other factors such as pH, HCO_3, and total suspended solids should be considered.

7- Total Suspended solids (TSS). The presence of suspended sediment and other contaminates adsorbed on suspended sediment in waterways has multiple negative impacts on water quality and may cause environmental problems. The presence of TSS in water depends on many factors. The relationship between TSS and natural runoff events are not well established and depends on the particle size distribution of sediment and flow rate.

The above are example of water quality parameters that need to be evaluated before wastewater or recycled water is used for irrigation. Other water quality may be of concern; therefore, complete analysis of the waste water must be performed prior to using the water for irrigation. The market for wastewater is expected to expand in the near future to meet the continued demand for water in California and other western states.

Squash Lines Resist Virus Pressure in Imperial County, 2005

Thomas Turini, Robert Gilbertson, Ronald Cardoza, Eric Natwick and Jose Aguiar

Turini

Cardoza

Natwick

Viruses transmitted by whitefly can be devastating to squash in the low desert. Over the last 5 years, Squash leaf curl virus (SLCV) and Cucurbit leaf crumple virus (CuLCrV) have been detected in squash grown in Imperial Valley, Coachella and Blythe. Both of these viruses cause the leaves to distort, yellow and fruit and flowers to develop abnormally. Thus, the appearance of the new CuLCrV and the reemergence of SLCV have become a problem for squash production in Southern California.

In Fall of 2005, response of squash varieties and breeding lines to these viruses was evaluated at the University of California Desert Research and Extension Center in Holtville, CA. On 6 September, the trial received the first irrigation. The plants were drip irrigated on Meloland clay loam. Of 29 entries included in the trial, 9 breeding lines showed no viral symptoms and no virus was detected in the tissue. All commercially available varieties exhibited severe virus symptoms and CuLCrV was detected in symptomatic tissue tested.

The field experiment will be conducted again in Fall 2006 and details regarding results of the two studies will be made available at completion.

Symptomless Zucchini

Yellow Zucchini

CulCrV

Soil Testing for an Intensively Managed Crop, Alfalfa

Rick Bottoms, Ph.D.

OK, I am an agronomist / weed scientist by training, and you would expect me to say "Soil is a natural reservoir for nutrients … and a good reservoir…" Soil testing offers a grower the most potential benefit in high input, and intensive cropping which alfalfa certainly is. You get sick, you go to the doctor. What is the first thing their nurse does? She or he takes your temperature. Soil pH is akin to temperature. It is the first thing I want to know about a soil's condition. It tells me naturally what might be a potential problem.

Furthermore, in alfalfa we probably waste a lot of money adding nutrients when there are already plenty there. Perhaps you are more comfortable maintaining a high level of fertility vs. providing what the individual crop needs. That is fine, but don't overdo it. Soil testing spots potential problems.

Do you have someone, as a service, take soil samples for you? Do they do a good job of properly collecting the sample? Plant tissue tests have not been reliable in predicting phosphorus (P) responses with alfalfa harvested at the bud stage. The current standard critical level for tissue testing is to take the sample when the alfalfa reaches the maturity stage of 1/10th bloom

If you apply compost, for example, did you tell them? That means they ought to scrap about ½" off the top of the surface to avoid skewing the soil test results. Your dealer collected soil samples, analyzed them and made a recommendation. Did they give you a copy of the soil test reports? If not, ask for them….understand what they mean and take action. Learn what they look like over time and recognize potential problems if nutrients are in flux.

So what does P provide? Phosphorus helps plants develop good root systems, hastens maturity, and promotes fruiting. Many light soils are so deficient in P that vegetative growth is affected. Phosphorus fertilizers should be applied to the soil in a soluble form. Insoluble P fertilizers, when added to the soil, are not converted to an available form and are of no practical value. There is evidence that even soluble P fertilizers may

become rapidly unavailable in alkaline soils.

Earlier research I did as an agronomist, with a colleague in Missouri, found P being immobile, it moved through the profile very little, approximately ½ inch per year…and that was in heavier soils with higher organic matter levels. Nitrogen, in contrast, is mobile.

Remember soil test we're encouraged to take? It is highly important for proper P nutrition in alfalfa, which requires about 15 lbs. per acre of P_2O_5 per ton of production. And high pH soils are not favorable to phosphorus availability. So if you produce 8 tons of alfalfa per acre for 5 years, you need about 600 lbs. per acre equivalent of P_2O_5.

I like to see producers move toward incorporating at least Year 1 and Year 2 P needs prior to seeding when they can work the P into the root zone. For the same reason producers might think about including even Year 3 P, but at some point in our high pH soils increasing phosphorus will further tie up important micronutrients such as iron (Fe) and zinc (Zn). Your soil test will take you a long ways toward recognizing what phosphorus fertility is needed. Otherwise, if you start with limited P you are essentially completely reliant on surface applied P to provide your needs.

High Temperature Flood Injury

Tom Turini

High temperature flood injury, which is also called anoxia or scald, is a condition that commonly occurs in warm season crops in desert production areas, especially when crops are not planted on beds. This condition occurs when the soils are water logged for long periods of time while temperatures are high. High temperature flood injury is very common in cotton and alfalfa.

Roots require oxygen for respiration. At higher temperatures, respiration rates for roots and soil-inhabiting microbes increase. Therefore, both oxygen use rates of the bacteria and requirements for the crop are increased. The higher the soil temperature, the sooner the plant will be affected by the anaerobic condition that occurs when soils are saturated with water.

Symptoms

Following a prolonged period of waterlogged soil conditions during periods of high temperature (104°-112^oF), it is

common for nearly all the plants in the flooded area to wilt and die within 5-10 days. If the roots are examined in the early stages of the disease, the xylem becomes brown in color. Later, the root may collapse due to a soft rot presumably due to invasion of the dead or weakened tissue by bacteria. There will frequently be an unpleasant odor associated with this soft rot. Affected portions of the field will be in areas where the soil had been waterlogged for the longest period of time, which is typically at the tail end of the field or low lying areas.

Control

The best control for this problem is through careful water management. If possible, irrigations should be avoided while air temperatures are above 104°F. Flooding for short periods (about 4 hours) when temperatures are high reduces the likelihood of injury. However, some soils remain saturated for a long period of time following irrigation due to soil conditions, the slope of the land or the length of the run. Planting on beds and taking steps to insure that the field is well drained will reduce the likelihood of the occurrence of high temperature flood injury.

In addition, in alfalfa, the incidence and severity of this condition is greater on recently mowed plants. Avoid irrigating alfalfa after a mowing until enough re-growth has occurred that the plant will not be completely submerged.

Biofuels

Juan N. Guerrero

The other day I filled up my pickup, it was already about 60% full, and paid about $42; I was stunned. Cost estimates for production costs for fall planted crops are unknown, because we have no idea of what fuel costs might be. Outrageous fuel costs will probably cause a spike in inflation rates. President Bush recently stated that we in the U.S. are addicted to foreign oil and he announced that the federal government would increase programs to produce more biofuels.

Other countries in the world are far ahead of the U.S. with regards to biofuel production and use. The U.S. produces about 3.4 billion gallons of ethanol, about 3% of its energy needs, while Brazil produces about 4 billion gallons of ethanol or about 40% of its energy needs. In 2003 Brazilian auto makers started to make cars that run on “flex-fuel”, either gasoline or ethanol or combinations of both. About 35 to 40% of the autos in Europe are fueled by diesel, many of which use B100 or

biodiesel. Much of this biodiesel is made from rapeseed oil. In Southeast Asia, biodiesel is made from palm oil. The U.S. needs to catch up, with regards to biofuels.

The production of biofuel will have a tremendous effect on U.S. agriculture. But, what exactly are biofuels? Biofuel is the resultant energy source from the conversion of biomass (plant derived) to fuels, chemicals, power materials. The conversion to a biofuel economy would be a boon to agriculture, decrease us dependence on foreign oil, avoid the use of MTBE and other toxic fuel additives, reduce air and water pollution, and reduce greenhouse gas emissions. There are two principal sources of fuel for bio-refineries. Biomass combustion, such as the burning of wood, has been known since the beginning of time. Biomass combustion is not energy efficient, however. Heating biomass with oxygen may convert the biomass to a liquid or gaseous fuel and is more energy efficient. The other process is the hydrolysis of cellulosic biomass to sugars and lignin. Rather than producing starch, as with grains, the production of plant material rich in cellulose, hemicellulose, and lignin would be another goal of agriculture. Forages are rich in cellulose, hemicellulose, and lignin. Cellulose is found in plant cell walls. A sheath of hemicellulose and lignin envelope the cell wall and give structure and rigidity to the plant. After the biomass is ground, it is pre-treated in a dilute acid to hydrolize the hemicellulose into its component sugars, mainly xylose. The cellulose is then enzymatically hydrolyzed into glucose. These basic sugars, xylose and glucose, are then fermented into ethanol. Residual lignin may then be gasified or burned as a fuel source. The process is not rocket science.

However, much research in biofuel production is still required. Which plants would be the most efficient and cheapest to grow for the production of cellulose, hemicellulose, and lignin? Which plants would be the best for the production of plant oils for biodiesel? The engineering methods for enzymatic hydrolysis of cellulose to glucose require more efficiency.

President Bush has stated that biofuel technology should be a national goal, I think we all agree.

??? **GASOLINE ONLY** ???

Emopasca Leafhopper Management In Alfalfa

Eric T. Natwick

Imperial County alfalfa growers occasionally suffer losses to spring and summer hay cuttings due to leafhopper infestations. Many species of leafhoppers may be found in alfalfa, but species in the genus *Empoasca* are primarily responsible for injury and yield reductions. Three species have been found damaging alfalfa in California: The potato leafhopper *(Empoasca fabae)*, the southern garden leafhopper (*E. solona)* and *E. mexara*. All three species cause identical injury. The prevalent species in the Imperial Valley are *E. solana* and *E. mexara*.

Other leafhoppers associated with alfalfa are distinguished from *Empoasca sp.* by their brown or grey color. Adult *Empoasca sp.* leafhoppers are small (1/8 inch long), bright green, wedge-shaped insects that have piercing and sucking mouthparts and jump and fly readily when disturbed. Nymphs are also green, wedge-shaped and run rapidly sideways or backward when disturbed. The unusual rapid movements by the leafhopper and their shape easily distinguished them from lygus bug nymphs or slow moving aphids. *Empoasca sp.* leafhoppers damage alfalfa through the removal of sap, but the main concern for hay producers is a type of injury referred to as "hopper burn". Hopper burn symptoms result from the injection of salivary toxins into the plant during leafhopper feeding. An early symptom of hopper burn is a characteristic V-shaped yellow area on the leaf tip. This symptom should not be confused with nutrient deficiencies or diseases, in which yellowing of foliage typically begins at leaf margins. As damage increases, the yellow area spreads over the entire leaf and the field takes on a yellow color. Alfalfa regrowth can be severely stunted, resulting in yield losses. Hay quality can be affected by severe leafhopper injury via reduction in both the protein and vitamin A. Yellowing and stunting symptoms following a heavy *Empoasca sp.* leafhopper infestation may carry over into one or two subsequent cuttings, even through the leafhoppers are no longer in the field.

Empoasca sp. leafhoppers attack several other crops. *Empoasca sp.* leafhoppers

migrate to nearby alfalfa fields when plants in neighboring crops, such as sugarbeets, are senescent or during harvest.

Look for leafhoppers during weekly field monitoring with a standard 15 inch insect sweep net. When symptoms first appear, sample a minimum of 4 to 6 areas over the entire field by taking 10 sweeps in each area and counting the number of adults and nymphs. Leafhopper infestations usually begin on the field margin so be sure to include field edges in your samples.

An insecticide treatment should be applied for leafhopper control if the alfalfa crop is two or more weeks away from harvest and if counts reach five leafhoppers per sweep. Treat alfalfa scheduled to be harvested in ten days to two weeks if counts reach 10 *Empoasca sp.* leafhoppers per sweep. It is not unusual for leafhopper infestation of treatable magnitude to be confined to the first 50 to 100 feet of the field margin, in which case only the field margin should be treated.

Common sense should be utilized when applying treatment thresholds. Heavy leafhopper infestations on young re-growth immediately after harvest are more damaging than similar infestations later in the growth cycle. Alfalfa under stress from other insects, diseases, or lack of water is more susceptible to injury than stress-free alfalfa. Alfalfa within a week of harvest may be able to tolerate very heavy leafhopper populations without yield loss, but re-growth should be monitored closely.

Poisonous Crop Residues

Tom Turini

Many substances toxic to growing plants are released as crop residues break down. During decomposition, crops disked into the field release compounds, such as acids, aldehydes, amino acids, coumarins and glucosides. If a crop is planted in a field before decomposition is complete, the crop may be damaged.

The inhibitory effect of one plant on another by the production of a chemical substance that is released into the soil is called allelopathy. Allelopathic substances can inhibit seed germination and damage roots, resulting in poor stand establishment and reduced vigor.

Poor stands, stunted plants and light green or yellow foliage characterize damage due to the toxic affect of crop residues. The number and length of roots are reduced and root tips are often discolored. Distribution of symptoms within an affected field may be consistent with patterns associated with soil movement by farming equipment, or may have a random distribution throughout the field. Symptoms will be more severe in lighter textured soils, so symptoms

may be more severe in areas with a sandier soil within a field.

There are several disorders that can cause symptoms similar to those caused by toxic crop residues. However, if there are large quantities of crop residues in the beds, toxic residues are the likely cause. If the crop residue is toxic, roots will be discolored where there is contact with crop residue.

Sudangrass and corn residues are particularly damaging, however residues of other crops can also release toxic compounds. Cole crops don't appear to be affected crop residues, but onions, lettuce, sugar beets and carrots can be damaged.

Injury from crop residue can be avoided by allowing sufficient time for residue decomposition. A period of 30 days in a well-aerated, moist soil is sufficient in most cases. The amount of time that a crop residue and associated toxins will remain in the soil will depend upon temperature, moisture, the size of the residue fragments, and the type and quantity of microorganisms present. Fine chopping and high temperature and moisture levels increase the rate of residue decomposition.

RETIREMENT ANNOUNCEMENT

The University of California Cooperative Extension would like to extend an invitation to you to attend a Retirement Party/Dance for

Refugio A. (Cuco) Gonzalez

to be held on July 29, 2006 at the Barbara Worth Resort at 5:00 P.M. If you would like to receive an invitation to this event, please contact us at (760)352-9474 or e-mail to: atietz@ucdavis.edu to reserve your spot on the invitation list. No reservations /monies will be taken after July 14, 2006. The cost of the dinner has yet to be determined, but please call early to get your name and address on the list!

CIMIS REPORT

Khaled Bali and Steve Burch*

California Irrigation Management Information System (CIMIS) is a statewide network operated by California Department of Water Resources. Estimates of the daily reference evapotranspiration (ET_o) for the period of June 1 to August 31 for three locations in the Imperial County are presented in Table 1. ET of a particular crop can be estimated by multiplying ET_o by crop coefficients. For more information about ET and crop coefficients, contact the UC Imperial County Cooperative Extension Office (352-9474) or the IID, Irrigation Management Unit (339-9082).

Please feel free to call us if you need additional weather information, or check the latest weather data on the worldwide web (visit http://tmdl.ucdavis.edu and click on the CIMIS link).

Table 1.Estimates of daily Evapotranspiration (ET_o) in inches per day

Station	June		July		August	
	1-15	16-30	1-15	15-31	1-15	16-31
Calipatria	0.39	0.40	0.39	0.38	0.35	0.32
El Centro (Seeley)	0.36	0.38	0.38	0.37	0.32	0.29
Holtville (Meloland)	0.38	0.39	0.39	0.38	0.34	0.31

* Irrigation Management Unit, Imperial Irrigation District.