CENTRAL COAST AGRICULTURE HIGLIGHTS

SEPTEMBER 2010

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Strawberry Plants can be Established with Less Water and Minimal Run-off

Oleg Daugovish
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As the temperatures go up in summer so is the demand for water. However, every October, water pumping doubles even when compared to summer months. This water is used to sprinkler-irrigate newly planted strawberry transplants – very sensitive to drying out and to salts.

After learning about strawberry establishment without overhead water in small scale plots in previous years and in 2009-2010 in collaboration with Reiter Affiliated Companies, Cal Poly engineer Stuart Styles and John Deere were able to run large scale field tests in Ventura County.

We compared standard overhead sprinkler with either partial amount of sprinkler water or drip-only irrigation. Normally, the two drip lines are placed between four future plant rows. In drip-only beds we tested four drip lines, either buried or placed on the bed surface in planting rows, intending to provide water to the plants and to move salts away from them.

Figure 1. In drip-only beds, 4 irrigation lines were placed (left). Additionally, in some beds, we moved these lines to planting holes after plastic mulch was installed and holes cut (right).

Please note that the UCCE Santa Maria office is relocating to San Luis Obispo starting as of 1 October, 2010. UCCE research and extension work will continue as usual in Santa Barbara Co. Specialty Crops and Small Farms Advisor, Mark Gaskell and Strawberry and Vegetable Crops Advisor, Surendra Dara can be reached at 805-781-5940.

Here's what we have learned from this study:

- **Water use** was reduced 34% in drip-only treatments and 20 % in the reduced sprinkler irrigation treatment compared to standard sprinkler irrigation.

- **Runoff** was non-existent in drip-only plots and the furrows remained dry.

- **Soil pore EC (a measure of salinity)** was generally greater in drip only treatments than in sprinkler irrigation treatments, ranging from 3.4 to 7.9 dS/m. In drip-only plots, placement of four drip lines on the bed surface and in planting rows reduced EC of soil in planting holes 10-40%

- **Additional costs** were ~$110/acre for labor for moving drip to the surface and ~$200 for doubling the number of drip lines. These costs may be offset by savings in water and associate runoff treatment and labor for sprinkler pipe movement.

- **Strawberry mortality** was 70% greater in plots where drip tape was buried compared to a standard sprinkler, but was less than 2% in all treatments, a level acceptable for commercial production.

- **Incidence of leaf spot and leaf blotch diseases** on strawberry leaves was 75% less in drip and reduced sprinkler treatments compared to a standard sprinkler.

- **Strawberry plants** were 13-18% smaller under standard irrigation compared to other treatments, but more uniform in size

- **New root biomass** in reduced sprinkler and surface drip treatment was 26% and 51% greater, respectively, than with either standard sprinkler or buried drip irrigation.

- **Early fruit yield** was similar among treatments. Plants in drip-only treatment yielded 13% more and plants in partial sprinkler treatment 8% more compared to those with conventional sprinkler irrigation establishment.

- **Similar fruit yields were obtained in Santa Maria** from multiple applications of sprinkler irrigation as well as single sprinkler irrigation and drip-only irrigation for the rest of the season.

These results suggest that reduced irrigation and precise water placement can be adequate for strawberry establishment, provide substantial savings of water, and may protect plants from water-splashing pathogens. Drip-only establishment, however, may only become possible if increased attention is given to salt leaching prior to planting, accurate and timely soil moisture and salinity monitoring, and flawless water delivery to plants. It may be wise to start with a partial sprinkler system before converting to drip-only water delivery for strawberry establishment.

Figure 2 . If not leached, salts accumulating near plants can injure plants or reduce vigor and root production (left). Drip placement near plants help move the salts away from root zone and aid rapid establishment (right).

Important Soil and Water Acidification Changes for Organic Blueberry Growers

Mark Gaskell
Specialty Crops, Small Farms Advisor
UCCE Santa Barbara County

Acidification of soil and water is a critical step for successful production of blueberries on high pH soils in California and elsewhere where high pH soils are common. Management of soil and water pH has been especially challenging for organic blueberry growers because the materials available for acidification are more limited than in conventional production systems. Large areas of California where blueberries are grown for off-season production are characterized by soil and irrigation water pHs above 7.0 and soil pH must be no higher that 5.0-5.2 for successful blueberry production. While a number of macro and micro-nutrients are less available at soil pH above 7.0, a real limitation for blueberries, is "pH induced iron deficiency chlorosis" – a well documented limitation for successful blueberry growth and production above pH 5.0.

While there are a number of strong acids and acidic fertilizers than may be used in conventional berry production, up until now, acidifying materials are more limited and costly for organic berry producers. The only materials previously approved for acidifying the soil in organic production fields have been citric acid and concentrated food grade vinegar (acetic acid). Mined sources of ground elemental sulfur were previously approved and are available for soil application in certified organic production.

The USDA - National Organic Program on July 2, 2010, approved the application of sulfurous acid via irrigation water. Sulfurous acid is produced by burning high purity (>99%) sulfur by bubbling the sulfurous acid gas

into the irrigation water. The National Organic Program updated the National List of Allowed and Prohibited Substances so that sulfurous acid may be used in organic crop production. The National List was amended to allow sulfurous acid to be used on-farm to reduce excessive alkalinity in soil or water by adjusting the pH of water used for irrigation. The changes were based on recommendations submitted by the National Organic Standards Board (NOSB).

Sulfur burners for acidifying irrigation water have been around since at least the 1970s but were not previously permitted for certified organic production. The primary restriction now for use in organic systems is that elemental sulfur from a mined source - with at least a 99% purity - must be used as the sulfur source for burning. Also the injection machine must be equipped with advanced gas recycling equipment to avoid loss of more than 1% of sulfur as gas to meet Federal EPA standards. In the burning process, the burning creates SO_2 gas with the alkaline water creating a mild solution of sulfurous acid. Sulfurous acid is a relatively weak acid that is not as dangerous to handle or corrosive of irrigation equipment as are stronger acids.

This initial injection of sulfurous acid can be expected to lower the soil pH to the low 6.0-6.5 range initially, depending on the initial pH and the nature of the bicarbonates present. When the sulfurous acid mixes with the soil however, soil microorganisms including *Thiobacillus* spp. will further oxidize the sulfurous acid in the soil to sulfuric acid, further lowering the pH.

Organic blueberry growers on soils with pH above 5.0 should continue to regularly surface-apply elemental powdered sulfur to soil. These elemental S applications are also permitted under NOP and are an economical way to lower soil pH. The addition of elemental sulfur to the soil surface is a very slow process – requiring 18-36 months or more to acidify the root zone. But this is a continuing way to add sulfur to the soil and slowly and continually maintain the desired pH range. Acidifying water has the duel effects of acidifying the soil through application of sulfurous acid and neutralizing the bicarbonates in irrigation water that otherwise would reverse the effects of other direct attempts to acidify the soil through periodic sulfur addition. Acidification of the irrigation water also aids in avoiding deposits of precipitated carbonates that could otherwise plug irrigation emitters.

A key component of the NOP rule requires growers to address the importance of maintaining and improving soil quality.

Growers do this by several methods including growing green manure crops, adding composts and manures, reduced cultivation, selecting appropriate cultivation equipment and minimizing soil erosion. In the arid western states, growers using subsurface water to irrigate crops, often need to address the problem of poor water quality typically due to excessive alkalinity caused by bicarbonates and carbonates, and the negative impact this water has on soil quality. Reduced water quality is caused when rainwater dissolves sodium and hydroxide (among other ions) from granite rock, a common parent material in the western US. When the hydroxide reacts with atmospheric carbon dioxide, bicarbonate is formed in the water. Carbonate is formed when two hydroxides react with one carbon dioxide.

Application of high bicarbonate or carbonate water with a pH greater than 7 reacts with soluble soil calcium to form insoluble calcium carbonate lime. This causes pores within the soil to seal. Alternating wet and dry cycles leads to greater accumulation of the lime and reduced water infiltration. To eliminate the bicarbonate and carbonate from the water growers can inject sulfurous acid (sulfur dioxide) by utilizing an onsite sulfur burner. The hydroxide is neutralized by the hydrogen ions within the acid.

Keeping soil pores open allows for greater exchange of gases, improves water penetration and drainage, enhances root penetration, improves soil biological activity and reduces the opportunity for plant pathogens to develop. Application of water to sealed ground leads to greater surface movement of water that result in uneven soil moisture patterns, greater soil erosion and transfer of water outside of the target zone. As a result, growers apply water at slower rates and that leads to greater energy consumption. Using treated water would also aid to keep irrigation lines free of minerals and organisms such as slime. Sulfurous acid certainly has a lower environmental footprint compared to citric acid, the most widely used irrigation line cleaner.

In an example we are familiar with, a grower had to withdraw his apple orchard from organic production within two years of removing a sulfur burner from his irrigation system in order to save his trees. He now grows all of his fruit using conventional techniques by using sulfuric acid treated water. (as I understand it, the owner of this land wrote a detailed letter on the situation, however I did not see it within the electronic submissions).

The Washington State Department of Agriculture Organic Program allowed sulfur burners prior to the introduction of the NOP, as they recognized the severe impact untreated water has on soil quality in the drier regions of our state.

I'm also attaching a couple of pictures from my collection so you can see the impact of untreated water on eastern WA soils. The photos are taken from one of the best operated organic farms in WA State. This is a very proactive farmer who practices an intensive soil building program and uses good quality irrigation systems designed and installed by irrigation professionals. I tried to get this grower to attend the NOSB meeting in person, but as this is a busy time of year for growers, he just can't afford the three days away to make comments in person.

Central Coast Strawberry Advisors Visit Nurseries

Surendra Dara
Strawberry and Vegetable Crops Advisor
UCCE Santa Barbara and San Luis Obispo Cos

Strawberry advisors, Mark Bolda (Santa Cruz Co), Surendra Dara (San Luis Obispo and Santa Barbara Cos) and Oleg Daugovish (Ventura Co) recently visited different high elevation strawberry nurseries in the northern California and southern Oregon. They were accompanied by Curt Gaines, Plant Licensing Field Representative from the UC Davis InnovationAccess-Technology Transfer Services. This is a customary visit that advisors make every year to interact with nursery plant producers and learn about new developments, pest problems and other challenges. This visit enables the advisors to be prepared for potential issues that might arise in the production fields.

Unusually cool spring weather hindered the nursery plant growth and a shortage of strawberry transplants has been expected for this planting season. According to various estimates the shortage can be anywhere from 15-20% and varies from cultivar to cultivar. Nursery owners are doing their best to minimize the plant shortage.

Closely monitored irrigation and fertilizer regimen, use of plastic tunnels to promote early plant growth and protect from frost, intensified hand-setting of runners, and timely pest and disease management are among many measures that nursery owners take to ensure healthy and adequate plant growth. Many have emphasized their commitment to provide high quality nursery stalk for the growers despite the anticipated shortage. Delayed digging can give additional time for the runner growth and help increase the number of transplants available for the production fields. However, timely planting is an important factor and may not allow many growers to wait.

As growers look for alternative sources to meet their transplant needs caution should be taken to purchase them from reputable nurseries whether they are out of the state or country.

In anticipation of the transplant shortage, it has been found out that many growers have pruned their fall and summer plantings to facilitate a second season fruit production from existing plants. It should be noted that such continuous cropping can increase the pest burden in the following season.

New UC short-day cultivars, Benicia and Mojave will be available for the field production this year. Both cultivars give higher yields and have better quality than some of the existing cultivars.

▲ Mark Bolda examines the transplants.

◀ Curt Gaines, Oleg Daugovish, and Mark Bolda look over as Scott Scholer from Lassen Canyon Nurseries explains about their nursery plant condition.

Invitation for Strawberry Meeting in Santa Maria

Strawberry Production and Pest Management Meeting

Thursday, 9 December 2010

Shepard Hall, Santa Maria Public Library

421 S McClelland St, Santa Maria, CA 93454

DPR and CCA Continuing Education Credits have been requested

08:00 Registration - No fee

08:30 Research and regulatory update

Dan Legard, Director of Research, California Strawberry Commission, Watsonville

08:50 Update on fertilizer management in organic strawberries

Mark Gaskell, Specialty Crops Farm Advisor, UCCE, San Luis Obispo

09:15 Update on microbial control of arthropod pests of strawberries

Surendra Dara, Strawberry and Vegetable Advisor, UCCE, San Luis Obispo

09:40 Update on strawberry herbicide evaluations and registrations

Steven Fennimore, Weed Specialist, UCCE, Salinas

10:05 Break

10:15 Foliar and fruit disease management in strawberries

Mark Bolda, Strawberry and Caneberry Advisor, UCCE, Watsonville

10:40 Southern California strawberry research update: Varieties and production

Kirk Larson, Pomologist and Strawberry Production Specialist,

UC South Coast REC, Irvine

11:10 Growing strawberries in substrates: Challenges and opportunities

Tom Sjulin, Consultant and Ian Greene, California Strawberry Commission

11:35 Raised-Bed Trough (RaBeT) system for strawberries: Irrigation and water retention of substrate media

Dong Wang, Research Leader and Soil Scientist, USDA-ARS Water Management Research, Parlier

12:00 Question and answers and conclusion of the meeting

12:30 Lunch

Please pre-register by 29 November, 2010 by contacting Surendra Dara at (805) 781-5940; 2156 Sierra Way, Ste. C, San Luis Obispo, CA 93401. Email: skdara@ucdavis.edu

Spanish interpretation will be provided