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leaves to completely dry up and die. It appears that garlic rust and leek rust are caused by two different rust species. Control: preventative fungicides.

Fennel: Cercosporidium blight. This leaf blight disease infects primarily the older foliage and rarely affects the new leaves. Affected leaf tips and stems turn brown to black in color, wither, and dry up. Close examination of the stems and leaves shows tiny, discrete, dark brown to black fungal patches. These patches are at first quite small (less than 1/16 inch in diameter) and can be oval, circular, or irregular in shape. If disease is severe, these patches multiply and grow together, resulting in the overall darkened appearance and death of the foliage. If there is sufficient humidity and moisture, a white crusty growth will form on top of the patches; this white crust is made up of clusters of the pathogen's spores. Cercosporidium blight does not kill fennel plants, but can affect growth and result in a poor quality product. Control: no recommended controls.

Artichoke: Ramularia leaf and bract spot. Initial symptoms consist of small (less than ¼ inch in diameter) pale to yellow green circular spots. With time the spots can expand up to ½ inch in diameter and turn brown. Spots are visible from both upper and lower surfaces of leaves. If disease is severe, lesions will coalesce and the entire leaf can turn brown and dry up. White growth of the fungus will usually develop in the center of leaf lesions. Ramularia leaf spot is economically important when the pathogen moves from the leaves to the flower bud bracts. On bracts, brown, irregularly shaped, patchy lesions will form, causing the bracts to curl, split, and dry out. Control: preventative fungicides.

Strawberry: Leaf blotch. Symptoms consist of tan to gray leaf lesions that develop on the first few leaves of the growing transplant. These infected areas tend to grow fairly large; they can expand and cover from 1/4 to 1/2 of the leaflet surface. Leaf infections commonly grow from the margin or edge of leaflets, are irregular in shape, and can be surrounded by a purple red border. An important sign of leaf blotch is the presence of tiny, brown to black, fungal fruiting bodies in the gray blotches. Brown to black petiole lesions can also occur. Control: no recommended controls.

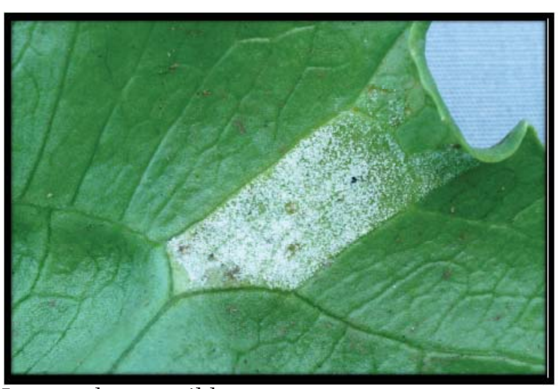
Strawberry: Angular leaf spot. Initial symptoms consist of water-soaked spots on leaves. The spots enlarge to form translucent, angular lesions that are bordered by leaf veins. As the disease progresses, lesions turn into reddish brown spots, which later become necrotic and can merge together, resulting in death of leaf sections. Under humid conditions, the spots ooze a cloudy film of bacteria. Control: no recommended controls.

Plant pathogens are very dependent on suitable weather conditions in order to infect and cause disease.

The rainy weather in late 2009 and spring 2010 is resulting in a number of disease outbreaks in coastal California.

Anthracnose of lettuce

Bacterial leaf spot of lettuce



Lettuce downy mildew

Spinach downy mildew

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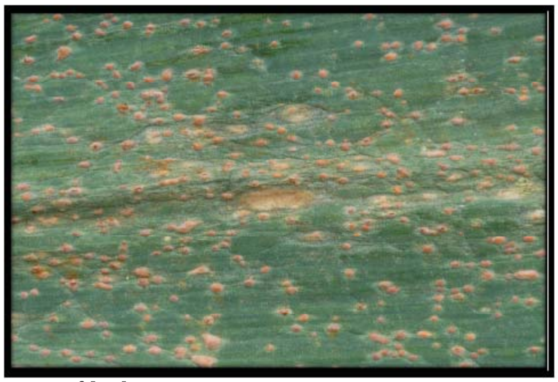
Cladosporium leaf spot of spinach

Bacterial head rot of broccoli



Rust of leek

Cercosporidium blight of fennel

Ramularia leaf spot of artichoke

Leaf blotch disease of strawberry

Angular leaf spot of strawberry

AN INTEGRATED APPROACH FOR ERADICATING LIGHT BROWN APPLE MOTH IN CENTRAL COAST CANEBERRIES IN 2010

Mark Bolda
UC Cooperative Extension
Hillary Thomas
Post Doctoral Scholar, UC Davis

Light brown apple moth (LBAM) is a species of leafroller that was first detected in California in 2007 and is currently present on the Central Coast. It is a class A pest that has been subject to quarantine. This has resulted in strict regulation of its host crops, mandating zero tolerance for larvae in fields or on harvested fruit, and occasioned the financially devastating closure of several fields of caneberries in 2009.

For 2010, Central Coast caneberry growers have a variety of management methods available to them which they can deploy in their efforts to prevent LBAM from being detected in their fields. These methods are (1) mating disruption, (2) insecticide use and (3) cultural management. The following is summary for growers of how best to integrate these three methods to achieve the greatest result.

Mating Disruption: Field trials conducted by UC Davis in the fall of 2009 suggest that pheromone based mating disruption is a promising tool for managing light brown apple moth in caneberries. While these trials tested three possible pheromone application technologies, currently only the twist ties, also known as pheromone rope dispensers, are available.

Mating disruption with pheromone based twist ties is very attractive to use as a management tool, because of low toxicity, compatibility with biological control, high specificity to the target pest, reduced risk of resistance and ease of use. However, the use of twist ties should be supplemented at this time with insecticide sprays and cultural controls because it has not yet been determined whether there is a stand-alone twist tie application rate that will result in zero detection of light brown apple moth in fields, as currently mandated by state and Federal regulatory agencies. Additionally, management of similar looking leafroller species is useful, to reduce the probability of economic loss due to delays for leafroller identification during cooler and field inspections. Twist tie applications for light brown apple moth are target specific and will not be useful for managing other lepidopterous pests such as orange tortrix.

Mating disruption works best when applied over large continuous areas. Twist ties should be placed all across the production field. Non-production fields should be included if they are mixed in production fields so a contiguous area is formed. If possible, it is suggested to place twist ties as far out as the edges of the field or slightly farther where possible, to reduce the probability of a mated female moth flying in from external sources.

The minimum recommended label rate of 200 twist ties per acre appears to reduce LBAM pheromone trap captures to very low numbers, but does not result in zero detection of moths within a field. Therefore, where economically possible it is recommended that the twist ties be applied at a rate higher than this, up to the higher end label-recommended rate of 300 twist ties per acre. For severe infestations, more than 300 twist ties per acre may be warranted, so long as it remains below the maximum threshold allowed on the label. Twist ties should be attached to the upper trellis wire, and it is recommended that they be wrapped doubly around the wire if operations such as pruning and cane adjustment will be taking place for the duration of their use, which typically will be six months. If in-field monitoring is being conducted and there is a rise in adult moth finds 3-6 months after initial twist tie application, this could be an indication of reduced pheromone release by the dispensers. However, fluctuations in the moth population over time may also account for such a change, with flight peaks anticipated in the spring around April and a fall population peak between October and November. Following the early spring application, if desired, twist ties may be applied again after harvest to target the fall flight peak.

Field trials conducted by UC Davis in the fall of 2009 suggest that pheromone based mating disruption is a promising tool for managing light brown apple moth in caneberries.

Insecticides: Since 2010 is the first year that mating disruption is being put into practice for light brown apple moth, and its efficacy for reducing light brown apple moth populations is not yet fully known, the use of twist ties should be supplemented with the use of insecticides to reduce the probability of an in-field light brown apple moth find. This also has the added benefit of targeting similar looking leafroller species, such as orange tortrix.

Since caneberry hedgerows are smaller and larval leafroller populations lower in the early part of year it is recommended that a program of spraying begin in late February to mid-March. As there is a wide

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variety of good leafroller pesticides available, growers should seek materials that have a lower impact on beneficials and the surrounding environment. Materials should also be rotated to mitigate the potential for resistance to a single pesticide.

Following the initial early season spray, it is important that growers continue to monitor the field for leafrollers. Growers should look for leaf surfaces that are webbed or rolled together, especially those of newly extending laterals. Additionally, look for signs in newly extending laterals for webbing, frass, leaf damage, and the presence of larvae. Another good way to look for leafrollers is to agitate the hedgerow, either by beating or shaking the plants, and collect the fallen material into a bucket or wide, flat container. Carefully sift through this material to detect larvae (early larval instars can be quite small). Concentrate monitoring activities in suspected or previously infested areas.

Any sign of leafroller activity should be a signal to spray. It should be emphasized here that the economic threshold for leafrollers during this period of regulation is zero, and subsequently the threshold for spraying is much lower than one would deploy in an integrated pest management program.

Cultural Controls: Because of the zero tolerance mandated for light brown apple moth infestation in fields, it is recommended that growers impress upon harvest crews the importance of removing suspect rolled leaves, larvae and webbed fruit. Considering that crews are passing over every foot of hedgerow at least three times a week during harvest, they can be very effective in reducing LBAM and other leafroller numbers. An incentive program can be implemented to encourage participation with such a campaign of larval removal.

Because of the zero tolerance mandated for light brown apple moth infestation in fields, it is recommended that growers impress upon harvest crews the importance of removing suspect rolled leaves, larvae and webbed fruit

Proper sanitation practices during the dormant season will be an essential part of light brown apple moth management. Larvae will overwinter in leaf trash and surrounding weeds. Keep weeds to a minimum and move fallen leaves to the middle of rows where they can be disked into the soil.

There are pesticides mentioned for management of leafrollers in this article. Before using any of these products, check with your local Agricultural Commissioner's Office and consult product labels for current status of product registration, restrictions, and use information.

SUMMARY OF 2008-09 LARGE SCALE IRRIGATION AND NITROGEN FERTILIZER MANAGEMENT TRIALS IN LETTUCE

Michael Cahn and Richard Smith, Farm Advisor Monterey County

In 2008 and 2009 five large scale trials were conducted to demonstrate practices to improve irrigation and nitrogen fertilizer management in romaine and iceberg lettuce in the Salinas Valley. Managements included 1) scheduling irrigations based on weather and soil based information, and 2) using the nitrate quick test to match fertilizer rates with the nitrogen needs of the crop at different growth stages. These practices can improve the efficiency of water and fertilizer application, reduce losses and provide tools for optimizing yield and quality of lettuce. The combined nitrogen and water management practices were referred to as the BMP (best management practices).

Procedures Trials were designed to compare the BMP and standard grower practices on large replicated strips in commercial fields located in the northern and southern parts of the Salinas Valley (Table 1). The management strips were 160 feet wide by the length of the field. Trials ranged from 15 to 27 acres in size. Soil textures ranged from silty clay to sandy loam at the trial sites. Trial No. 1 was irrigated with overhead sprinklers throughout the crop cycle; all other crops were irrigated with sprinklers for approximately the first 30 days of the crop followed by surface placed drip tape until harvest. Irrigations were scheduled from estimated consumptive water use for lettuce which was based on CIMIS evapotranspiration data and the water holding capacity of the soil. Applied water of the different management treatments was monitored using flow meters. Nitrogen fertilizer recommendations were based on weekly de-

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terminations of soil nitrate in the top foot of soil using the nitrate quick test. Soil moisture data and plant biomass was compared weekly between management treatments. Leachate during irrigation events was sampled using a suction lysimeter. Yields evaluations of trials were made in two ways: 1) small plots (2, 100 feet^2 13.3 ft plots) located within the management strips for all trials, and 2) cored lettuce using commercial equipment to harvest the center 12 beds of the management strips (data not available for trial 3).

Summary of Results Water and nitrogen fertilizer application was significantly reduced in the BMP treatment (Tables 2& 3), averaging 121 lbs of N/acre and 11.2 inches of water for the BMP treatment and 176 lbs of N/acre and 13.7 inches of water in the grower standard treatment for all trial sites. The greatest reductions in nitrogen fertilizer and water were in Trial 1 and Trial 3, and 139 lbs of N/acre and 7.5 inches, respectively. Trial 2 had the least reduction in water and fertilizer because the grower standard practice was similar to the BMP treatment.

Monetary savings for applied fertilizer and water (Tables 2 & 3) were highest in Trial 1 site ($99/acre) and least for Trial 2 ($15/acre). Average savings in water and fertilizer for the 5 trials was $41/acre. Although average water savings were less than fertilizer savings ($9/acre for water and $33/acre for nitrogen fertilizer), careful water management is needed to prevent nitrogen fertilizer losses through leaching.

Evaluating root distribution and nitrate distribution by digging a pit down to 2.5 feet indicated that most roots were in the top foot of soil, but that most nitrate was lower in the profile (Figures 1 & 2). Monitoring of water use, soil moisture and nitrate concentration of leachate demonstrated that nitrate nitrogen leached below the 2 foot depth in both treatments. Nitrate-nitrogen concentrations in leachate sampled with a suction lysimeter ranged from 105 to 178 ppm (Tables 4 & 5). During germination, there was less nitrate leached in the BMP treatment at one site where the germination water was carefully managed (Table 4), but the magnitude of savings were less at another site where more water applied to the BMP treatment during germination to compensate for hot weather conditions (Figure 3). However, after thinning and the installation of the drip system minimal losses of nitrate occurred in both the BMP and standard treatments because the applied water amounts were close to the crop evapotranspiration requirements. In contrast, following thinning and a sidedress application, higher leaching was observed in the standard treatment during a single sprinkler irrigation application (Table 5) because substantially more water was applied than the crop requirements. Applying water rates closer to consumptive water use in the BMP treatment minimized nitrate leaching and reduced the economic loss of applied nitrogen to the crop.

Soil nitrate levels were higher in the BMP treatment over the course of the growing season in spite of the lower total nitrogen application. This observation indicates that by applying irrigation water at rates close to consumptive use of the crop, nitrate can be effectively maintained in the root zone and leaching losses can be minimized. This can save growers money (Table 2) and help to safeguard water quality.

Large scale commercial yield evaluations in four of the trials indicated that the BMP treatment yielded from 98 to 101% of the standard treatment (Table 6).

Conclusions

These trials demonstrated that careful water management and nitrogen fertilizer management can result in equivalent yields, save money and provide water quality benefits. In addition, reducing nitrate leaching could minimize nitrogen loading to our regional aquifer. The main tool for improving irrigation scheduling for lettuce is using CIMIS evapotranspiration data and soil water holding properties to estimate a reasonable irrigation schedule that will maintain yields and minimize percolation of nitrate. The nitrate quick test can provide guidance for management of fertilizer nitrogen. Taken together these techniques can provide growers with tools to help make decisions to improve the efficiency of lettuce production.

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Table 1. Planting date, lettuce type, varieties, irrigation method and soil types at trial sites.

Trial	1st irrigation	harvest date	days to harvest	lettuce type	variety	soil type
Trial 1	6/28/2008	9/3/2008	68	iceberg	Gabilan	Rincon clay loam
Trial 2	7/14/2008	9/16/2008	65	romaine	Sun valley/Platinum	Chualar sandy loam
Trial 3	8/23/2008	10/31/2008	70	romaine	Altura	Cropley silty clay /Salinas clay loam
Trial 4	5/14/2009	7/23/2009	71	iceberg	steamboat	Chualar Loam
Trial 5	8/3/2009	10/9/2009	68	romaine	green towers	Chualar Loam

Table 2. Applied nitrogen fertilizer and soil nitrate levels in BMP and grower standard treatments, and and fertilzer cost savings at trial sites.

Trial	Total Applied Nitrogen (lbs N/acre)		N Fertilizer Reduction (lbs N/acre)	Fertilizer Cost Reduction ($/acre)[1]	Mean Soil Nitrate (over season) (ppm NO3-N)		Total N Uptake at Harvest (lbs N/acre)	
	Standard	BMP			Standard	BMP	Standard	BMP
Trial 1	248	110	139	83	33.3	47.0	134	142
Trial 2	77	65	12	7	18.3	19.5	149	133
Trial 3	200	154	46	28	19.5	20.4	86	93
Trial 4	180	134	47	28	18.7	17.7	165	173
Trial 5	175	**144**	31	18	41.3	26.9	120	119
Average	176	121	55	33	26.2	26.3	131	132

[1] nitrogen fertilizer valued at $0.60/lb

Table 3. Applied water in BMP and grower standard treatments during germination and post germination.

Trial	Total Applied Water (inches)		Estimated Crop ETc (inches)	Irrigation requirement[1] (inches)	Water use reduction (%)	Energy Savings[2] ($/acre)
	Standard	BMP				
Trial 1	17.7	14.7	10.1	13.4	17	15.5
Trial 2	9.9	8.7	7.6	8.9	12	7.6
Trial 3	19.4	11.9	6.7	8.7	39	18.1
Trial 4	10.7	10.4	7.0	8.4	3	1.2
Trial 5	10.9	10.1	6.1	7.6	7	3.2
Average	13.7	11.2	7.5	9.4	16	9

[1.] irrigation requirement = ETc/DU; DU = distribution uniformity of the irrigation system

[2.] assumes energy costs of $0.15/kWhr, operating well depths of 75 feet for south county trials, and 150 feet for north county trials

Table 4. Estimated nitrate nitrogen losses due to leaching during germination of lettuce: Trial 2, July 10 to July 24, 2008

Management Treatment	Applied Water[1]	Crop ET	Soil Moisture Storage	Percolation	NO3-N concentration in leachate	Nitrogen loss by leaching	Value of Fertilizer lost[2]
	———	———	inches	———	ppm	lb/acre	**$/acre**
BMP	2.4	1.2	0.0	1.2	116.4	31.4	18.85
Standard	3.5	1.2	0.3	2.1	104.9	49.5	29.67

[1] July 10 - July 24, 2008

[2] N fertilizer value = $0.60/lb

The main tool for improving irrigation scheduling for lettuce is using CIMIS evapotranspiration data and soil water holding properties to estimate a reasonable irrigation schedule that will maintain yields and minimize percolation of nitrate. The nitrate quick test can provide guidance for management of fertilizer nitrogen. Taken together these techniques can provide growers with tools to help make decisions to improve the efficiency of lettuce production.

Table 5. Estimated nitrate-nitrogen loss due to leaching during one sprinkler irrigation, post thinning: Trial 1, July 25 to July 29, 2008

Management Treatment	Applied Water[1]	Crop ET	Soil Moisture Storage	Percolation	NO_3-N concentration in leachate	Nitrogen loss by leaching	Value of Fertilizer lost [2]
	-------------	inches	-------------		ppm	lb/acre	**$/acre**
BMP	0.8	0.6	0.0	0.3	174	11.2	6.74
Standard	1.4	0.6	-0.1	0.9	178	37.3	22.40

[1] July 25 - July 29, 2008

[2] N fertilizer value = $0.60/lb

Table 6. Commerical yields of BMP and grower standard treatments.

Trial	small plot harvest: Grower	small plot harvest: BMP	small plot harvest: BMP relative to Standard (%)	commercial harvest: Grower	commercial harvest: BMP	commercial harvest: BMP relative to Standard (%)
	Total CFR[1] Yield (tons/acre)			Total CFR Yield (tons/acre)		
Trial 1	27.3	27.8	102	21.6	21.4	99
Trial 2	26.5	23.0	87	13.9	14.0	100
Trial 3	12.1	10.5	87	--	--	
Trial 4	38.6	40.2	104	30.0	29.5	98
Trial 5	14.4	14.8	103	9.0	9.0	101
Average	23.8	23.2	96	18.6	18.5	100

[1] CFR = Cored for region

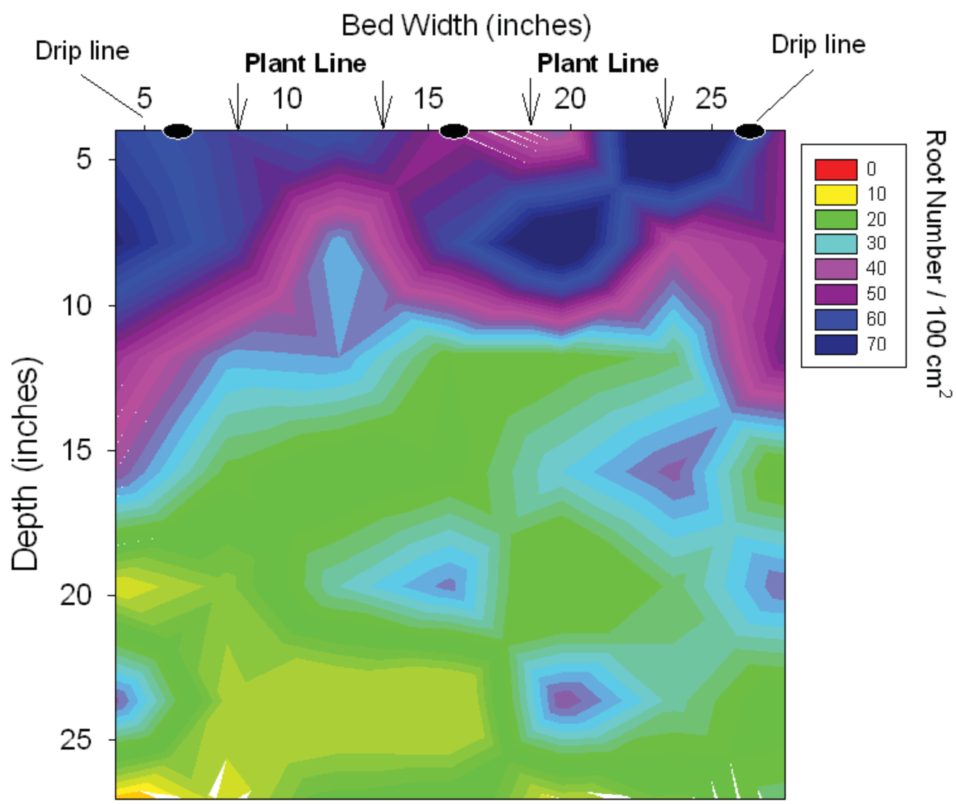

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Figure 2. Soil nitrate distribution two weeks before harvest -
Six seedline 80-inch beds with three drip lines (outside plant lines not shown)

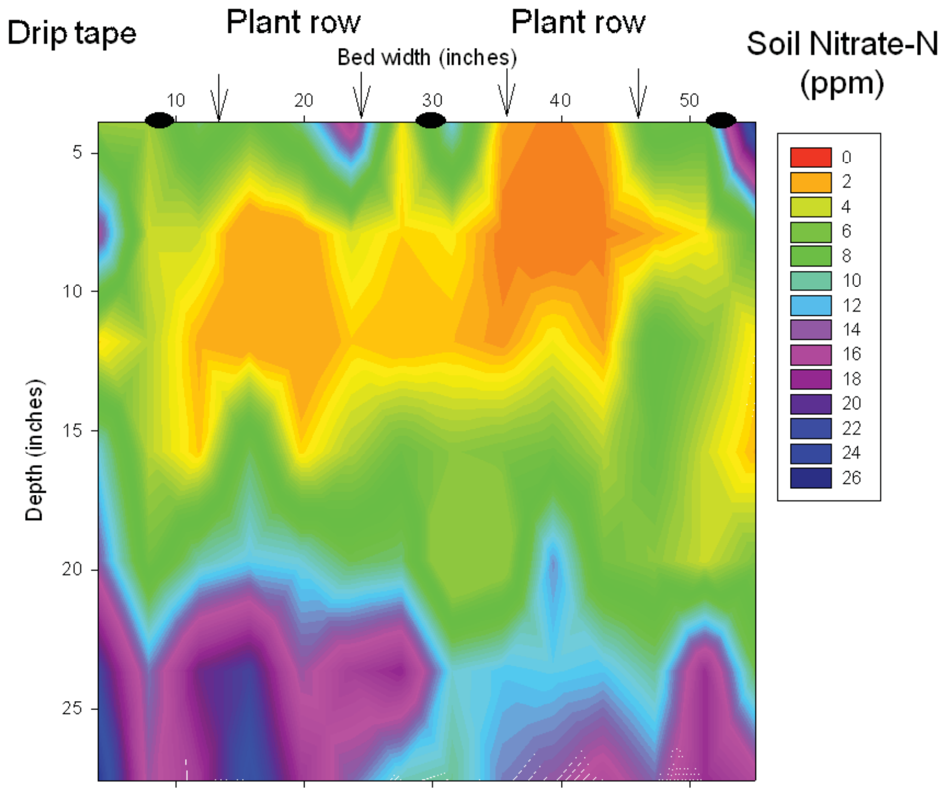
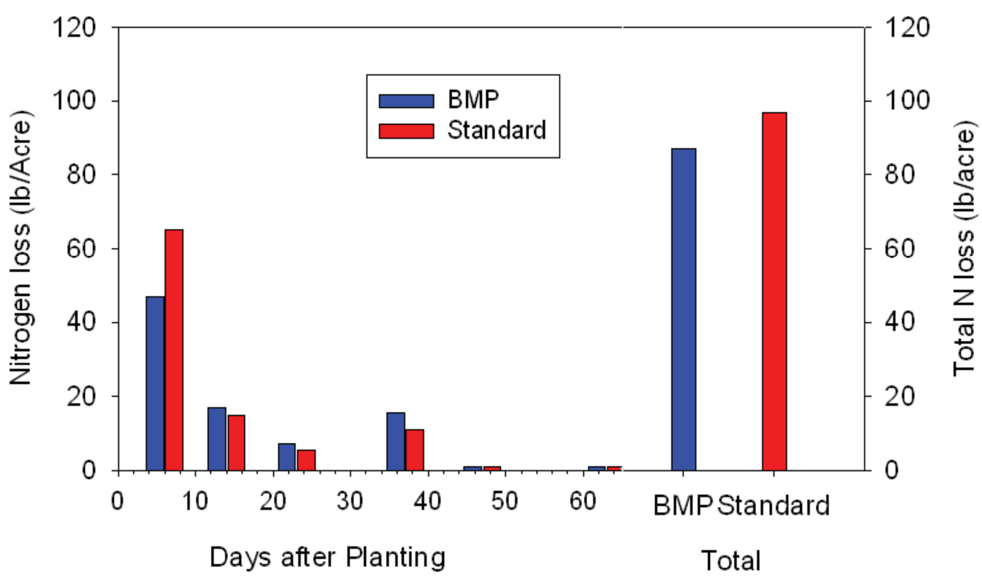


Figure 3. Estimated nitrate leaching losses for BMP and Grower treatments.



EFFICACY OF NOVEL INSECTICIDES ON LEPIDOPTEROUS PEST MANAGEMENT IN LETTUCE

Jian Bi, Entomology Farm Advisor; Kim Vu and Nick Lumbreras, Laboratory Assistants, University of California Cooperative Extension

Lepidopterons are serious pests of lettuce crop in the Central Coast region. Major species among them are the beet armyworm <*Spodoptera exigua*>, the corn earworm <*Helicoverpa zea*> and the cabbage looper <*Trichoplusia ni*>. Their larvae (worms or caterpillars) feed on lettuce foliage and the feeding damage can directly decrease yields. In addition, the beet armyworm and corn earworm often burrow into lettuce heads. The presence of feeding damage, larvae and frass can render the lettuce unmarketable. Insecticides are important components of integrated pest management and the use of chemical insecticides still remains the most effective way of reducing lepidopterous pest populations on lettuce. However, repeated applications of same insecticide can result in increased potential for development of resistance. Introduction of novel insecticides into the currant insect pest control program is a valuable strategy for resistance management. Here we report results for several novel insecticides against lepidopterous pest in lettuce from our 2009 field trials.

Beet armyworm, corn earworm and cabbage looper are serious pests of lettuce.

The experiment was conducted in a commercial head lettuce field at Salinas. Head lettuce seeds (var. Sniper) were planted on July 23 in two rows on 40-inch wide beds. The plants were thinned on August 13 to 8 inches apart in rows. The following novel insecticides were tested: Durivo 2.5 SC, Coragen 1.67 SC, Voliam Flexi WG and Voliam Xpress ZC. Durivo is a pre-mixture of active ingredients from Platinum and Coragen. Voliam Flexi is a pre-mixture of active ingredients from Actara and Coragen while Voliam Xpress is a mixture from Warrior and Coragen. In addition to control of aphids, control of lepidopterous pest is expected from these mixtures.

Insecticides applied at the recommended concentrations were as follows: Durivo at 13.0 fl oz/acre, Coragen at 5.13 fl oz/acre, Voliam Flexi at 7.0 oz/acre, and Voliam Xpress at 9 fl oz/acre. Durivo and Coragen were shanked on August 28 into the center of the bed in 20 gallons per acre. Durivo was also applied as a direct spray (also known as “line spray”) toward the crown of plants with a four-nozzle handled boom calibrated to deliver 60 gallons per acre. Voliam Flexi and Voliam Xpress were applied as foliar sprays on August 28, September 11 and 18 with a rate of 30 gallons per acre. Control plots were left untreated. Lettuce plants were sampled every 3-7 days from September 1 to the harvest maturity. Numbers of Lepidopterous larvae in each of the plants were recorded.

Durivo, Corage, Voliam Flexi and Voliam Xpress showed significant activity against beet armyworm, corn earworm and cabbage looper.

Lepidopterous pests presented in the experimental plots were exclusively the beet armyworm, the corn earworm and the cabbage looper. Larvae were detected in some of the plots starting from Sept 21 sampling date (Table 1). Compared to numbers in the control, numbers in Durivo, Voliam Flexi and Voliam Xpress treated plots were significantly lower on the Sept 25 sampling date. On Sept 29 sampling date, total larval numbers in Durivo, Coragen and Voliam Xpress treated plots were significantly lower. Deep- and surface-soil applied Durivo showed similar efficacy against the lepidopterous larvae (Table 1). In addition to the effective control of aphids in our previous report, these results demonstrated that Durivo, Coragen, Voliam Flexi and Voliam Xpress have significant activity against lepidopterous pest.

Table 1. Effect of insecticide treatments on total numbers of Lepidopterous larvae

Treatment	Sept 21 (larvae/plant)	Sept 25 (larvae/plant)	Sept 29 (larvae/plant)
Durivo surface soil	0 b	0 b	0 b
Durivo deep soil	0 b	0b	0 b
Coragen	0.25 ± 0.10 a	0.20 ± 0.16 ab	0 b
Voliam Flexi	0 b	0 b	0.10 ± 0.07 ab
Voliam Xpress	0 b	0 b	0 b
Untreated control	0.15 ± 0.08 a	0.45 ± 0.26 a	0.25 ± 0.10 a

Soil treatments were applied on August 28. Foliar treatments applied on August 28, September 11 and 18. Adults in 5-10 plants in each of the four replicated plots were counted. Means in a column followed by different letters are significantly different at $P < 0.05$.

GOLDSPOTTED OAK BORER, AN OAK PEST NEW TO CALIFORNIA

Jian Bi, Entomology Farm Advisor

Goldspotted Oak Borer is an invasive pest attacking oak trees.

The Goldspotted Oak Borer, *Agrilus coxalis* Waterhouse, is a serious insect pest of oak trees. Larvae bore between bark and sapwood area of the trunk, branches and roots, and often penetrate the wood by mining, resulting in death of branches or the whole tree. In San Diego county, this pest has killed 20,000 oak trees and many more trees are infested. It may spread further north in California. This pest was not known to occur in California until it was first detected in 2004 in San Diego county. It may have been inadvertently introduced to the region by importation of oak firewood. In 2008, it was found in the same county attacking a range of oaks including live oak, canyon live oak and California black oak.

Description

The adults are smaller than a penny, about 7/16 inch (10 mm) long and 1/16 inch (2 mm) wide. They are bullet-shaped, with 6 golden-yellow spots on the dull metallic-green colored wings. Larvae are white without legs. Mature larvae are about 13/16 inch (20 mm) in length and 1/8 inch (3 mm) in width. Pupae are located in the outer bark and are usually in white color. Where eggs are laid is unknown but probably in bark crevices. In southern California, preliminary research shows that borers complete one generation in a year. Mature larvae are found from late May to late October in oak trees. Adults are active from June to September. They are native to southeastern Arizona, southern Mexico and northern Guatemala.

Signs of Infestation

On the surface of trunk and large branches, Goldspotted oak borer damage can cause black or red bark staining. When the outer bark is removed, large amount of liquid can drain from the dead tissue. Larvae mainly feed on wood surface, resulting in galleries. These galleries are dark-colored and are generally in meandering pattern and in vertical orientation. Adults exit from the bark and exiting holes are usually in "D" shapes. On coast live oak, the bark can be removed by woodpeckers. The presence of larvae and their galleries, adult emergence holes, and the associated woodpecker damage are positive signs of the borer infestation.

Goldspotted Oak Borer has not been detected in the Central Coast area.

Management

Logs and firewood from the Godspotted Oak Borer-infested area should not be transported because the transportation can be a significant way to spread the pest into non-infested areas. Chipping wood into one-inch pieces is an effective method to eliminate the borer population. Covering oak firewood with 1/4 inch (6 mm), UV-stabilized and durable plastic tarps in spring and securing all the edges of the tarp to the ground can prevent adults from escaping. Seasoning oak firewood, removing the bark and placing the wood in direct sunlight can kill the borer. Research is underway to test the efficacy of insecticides for protecting oak trees against the borer. Introduction of its natural enemy is also under study.

What to do if you see the Goldspotted Oak Borer?

The Goldspotted Oak Borer has not been detected in the Central Coast area. If you suspect the Goldspotted Oak Borer, please contact Jian Bi, the Entomology Farm Advisor in the UC Cooperative Extension at 831-759-7359.

Goldspotted Oak Borer adults

Larvae

Larval feeding galleries

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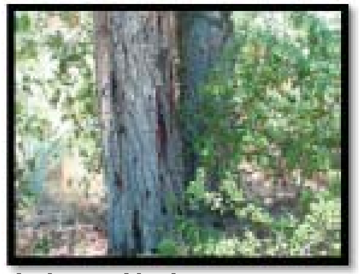
Adult emergence holes



Black or red bark staining

Outer bark removed by woodpeckers

Photo credits: USDA Forest Service.

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FINE TUNING NITROGEN MANAGEMENT FOR VEGETABLE PRODUCTION

Richard Smith, Vegetable Crop and Weed Science Farm Advisor

Summary: New proposed regulations by the Regional Water Quality Control Board (RWQCB) may change nitrogen (N) fertilization practices in the Salinas Valley. The best tool for managing N fertilization is the nitrate quick test which measures residual soil nitrate; this information can be used to adjust nitrogen fertilization rates either up or down. Effective water management is also critical to reducing the loss of nitrate from the root zone. Other technologies that may have a role in further fine tuning nitrogen management include slow release fertilizers and nitrification inhibitors, but both technologies have challenges that limit the extent of their impact. Fall applied nitrogen is highly susceptible to nitrate leaching in significant winter rain events and appears to be a bad investment in most years.

Background: If approved, new regulations included in the renewal of the Irrigated Lands Discharge Waiver by the RWQCB, Region 3 proposed on February 1, 2010 have the potential to greatly impact vegetable crop fertilization practices in the Salinas Valley. Many growers have reduced fertilization rates over the past few years and feel they have made efforts to safeguard the environment. In spite of these efforts, the regulations as proposed will likely expect greater reductions in nitrogen application rates.

In the accompanying article in this issue of Crop Notes entitled, "Summary of 2008-09 large scale irrigation and nitrogen fertilizer management trials in lettuce" we discussed reductions in nitrogen fertilizer use that were achievable by utilizing timely information on residual soil nitrate levels and careful irrigation to minimize losses of nitrate by leaching beyond the root zone. The use of the nitrate quick test and careful irrigation are the most important tools that a grower can use to successfully reduce nitrogen fertilizer rates without jeopardizing yield. This is important because as we move from fertilizer programs that have a buffer of N built into them to leaner fertilizer programs, weak areas of the fields may be more evident and the risk of economic losses becomes higher. It is therefore important to use tools, such as the nitrate quick test for nitrogen and ET for irrigation management decisions which are both reliable and help improve N use efficiency.

In the 2008-09 trials it is interesting to note that in three of the five trials we applied less fertilizer N than was taken up by the crop. This underscores the importance of residual soil N provided by both prior crop residues as well as mineralization of soil organic matter. As an example, in a 2008 trial conducted on 2nd crop romaine following rapini,

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New proposed regulations by the Regional Water Quality Control Board (RWQCB) may change nitrogen (N) fertilization practices in the Salinas Valley. The best tool for managing N fertilization is the nitrate quick test which measures residual soil nitrate; this information can be used to adjust nitrogen fertilization rates either up or down.

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we applied 65 lbs N/A to 6 seedline romaine; the romaine contained 133 lbs N/A in the crop biomass at harvest which indicated that over half of the N in the crop came from non-fertilizer sources.

Slow Release Fertilizer: Slow release fertilizers have the potential to provide a best management practice (BMP) by providing metered amount of nitrogen over time for crop growth from an initial application. However, during the main part of the growing season, when fertilization of crops is unhampered by weather, their use does not seem justified. However, they may provide benefits during winter production when the highest rainfall and greatest potential for leaching occurs. We conducted trials on the slow release fertilizers Duration and Polyon from 2000 to 2003 on winter-grown broccoli. One of the challenges that we encountered during these trials was low rainfall which did not create leaching conditions that would have highlighted the touted benefits of the slow release materials. In addition, we confronted high residual nitrogen in the soil at the beginning of each trial. In spite of these obstacles, all fertilizer treatments yielded higher than the untreated control, but there were no differences between fertilizer treatments or rates (Table 1). In these trials, slow release fertilizers looked promising, but the biggest obstacle to their adoption was the cost, which at that time were substantially more expensive than standard sidedress materials.

A nitrification inhibitor is a chemical which inhibits the conversion of ammonium to nitrate. This is desirable in some situations because ammonium is positively charged and is less subject to leaching. An effective nitrification inhibitor would be a useful tool for retaining a higher percentage of applied nitrogen in the root zone.

Nitrification Inhibitor: A nitrification inhibitor is a chemical which inhibits the conversion of ammonium to nitrate. This is desirable in some situations because ammonium is positively charged and is less subject to leaching. An effective nitrification inhibitor would be a useful tool for retaining a higher percentage of applied nitrogen in the root zone. Currently there is one proven nitrification inhibitor, dicyandiamide (DCD); a nitrogen fertilizer containing DCD (Agrotain Plus, manufactured by Agrotain International, LLC) is commercially available for use in California. In a study conducted on field corn, this material appeared to improve nitrogen use efficiency of applied fertilizer. Two field trials were conducted on lettuce in 2008. In the first trial residual soil nitrogen levels were high and no yield response or improvement in soil nitrogen status was observed (Table 2). In the second trial, there was a yield response to all fertilizer treatments over the untreated control, but differences between fertilizer treatments were not observed (Table 3). Tim Hartz conducted both laboratory and field trials that indicated that DCD is susceptible to leaching, and its effect can be quickly lost. His results may be a partial explanation for the lack of better results in these trials. In my mind, nitrification inhibition remains a useful concept and deserves further evaluation.

We monitored the fate of fall preplant N applied at bed listing and found it to be highly susceptible to leaching by a sizeable rain event.

Fall Nitrogen Application: We monitored the fate of fall preplant N applied at bed listing and found it to be highly susceptible to leaching by a sizeable rain event (Figure 1). The nitrate in the first foot of soil moved down to the 2nd foot and beyond during the series of storms during the week of January 18th. We recognize that N applied in the fall is often as part of triple carrier fertilizer. In such cases, the quantity of N in these materials should be minimized (eg 1-3-3 ratio vs 1-1-1 ratio). If P and K are not needed, fall N applications appear to be a good place to economize on N fertilizer applications.

Figure 1. Loss of nitrate from fall applied fertilizer from the top foot of soil following series of winter storm events during week of Jan. 18 and Feb. 22, 2010

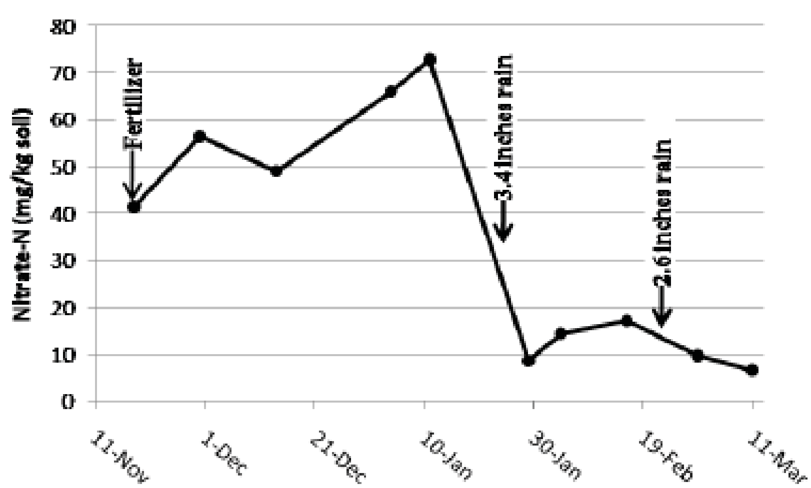

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Table 1. Three year summary of broccoli yield: 2000 - 2003

Treatment & lbs N/A	Total No. Heads	Total Wt. (lbs)	Mean Head Wt.
Duration 100	173.2	85.3 a[1]	0.50 a
Duration 150	171.8	85.6 a	0.50 a
Duration 200	173.5	86.1 a	0.50 a
Polyon 100	177.8	88.8 a	0.50 a
Polyon 150	178.5	89.4 a	0.50 a
Polyon 200	170.4	88.2 a	0.51 a
Standard 200	177.5	87.3 a	0.50 a
Untreated	173.0	80.5 b	0.46 b

1 – Numbers followed by the same letter do not differ at 95% confidence interval.

Table 2. Trial 1: Harvest evaluation on May 24.

Treatment total lbs N/A applied	Untrimmed yield lbs/A	Mean head weight Untrimmed lbs/head	Nitrogen in tops percent	Nitrogen in tops lbs/A	Trimmed head weight lbs/A	Mean head weight Trimmed lbs/head
198.1 (Standard)	89,022	2.9	3.9 a[1]	115.7	51,929	1.7
146.6+ Agrotain	82,495	2.8	3.4 c	113.9	54,344	1.8
146.6	81,075	2.7	3.7 ab	118.5	49,199	1.7
119.1+ Agrotain	82,420	2.7	3.4 c	104.6	50,070	1.6
119.1	89,207	2.8	3.6 b	134.1	47,205	1.5
Untreated	83,229	2.7	3.4 c	112.0	46,262	1.5

1 – means followed by the same letter do not differ from each other at 95% confidence interval

Table 3. Trial 2: Harvest evaluation on August 11

Treatment total lbs N/A applied	Untrimmed fresh biomass lbs/A	Untrimmed dry biomass lbs/A	nitrogen in tops Percent	Nitrogen uptake in tops lbs/A	Trimmed fresh biomass lbs/A	Percent marketable after trimming
155 (Standard)	63,424.5	3,855.4	2.9 a[1]	110.3 a	30,572.2	48.3
119+ Agrotain	63,205.5	3,642.1	2.7 a	96.3 a	26,334.6	42.2
119	67,654.8	4,096.4	2.5 ab	104.1 a	32,352.9	48.4
85+Agrotain	61,366.4	3,764.0	2.4 b	90.3 a	29,818.9	49.3
85	71,945.1	4,193.8	2.5 ab	106.3 a	32,731.8	45.5
Untreated	44,442.2	2,903.7	2.1b	61.2 b	26,046.8	61.4

1 – means followed by the same letter do not differ from each other at 95% confidence interval

NITROGEN AVAILABILITY FROM LIQUID ORGANIC FERTILIZERS

Tim Hartz, Richard Smith and Mark Gaskell

Providing sufficient soil nitrogen availability to reach maximum yield potential can be a challenge in organic production. While cover cropping is generally the most economical way to provide plant-available N in organic systems, it is not always practical, nor can cover cropping always provide sufficient N availability. Composted manures contain significant amounts of N, but the rate at which that N becomes plant-available is usually quite slow. Consequently, there is often a need for supplemental in-season N application. In recent years a number of liquid organic fertilizer products have become available; since they can be applied through irrigation they offer an organic grower more flexibility in N management than dry organic fertilizer products like feather meal. There is little solid information regarding the N availability from these liquid organic fertilizers, so in 2008 we conducted a study to document the N mineralization dynamics of three commercial products.

Liquid organic fertilizers can provide relatively rapid N availability. We believe that a key to this rapid availability is that a substantial portion of the organic N contained in these fertilizers is in simple chemical forms such as amino acids, which can be rapidly broken down.

The fertilizers chosen for this study, Phytamin 801, Phytamin 421 and Biolyzer, were made from a variety of feedstocks ranging from fishery wastes to crop residues (Table 1). Through laboratory analysis we determined the concentration of total N (all forms) and mineral N (NH4-N and NO3-N, the plant-available forms). Additionally, we filtered fertilizer samples to simulate the removal of particulate matter by drip irrigation filters, and measured the amount of N associated with that particulate matter. The fertilizers ranged from 2.6 to 6% total N; both Phytamin products had a substantial amount of mineral N. All products had a significant amount of particulate N. This is important for two reasons. First, this N may be removed by filtration when injected into a drip irrigation system, and represents a potential economic loss to the grower. Second, it underscores that these products contain particulates that may pose a clogging threat to drip emitters, and care should be exercised when injecting these products into a drip system.

We collected soil from two fields under organic management, then dried and screened them for uniformity. Dry soil samples were wetted to field capacity moisture content using either water, or solutions of the fertilizers. The wetted soil samples were put in sealed containers to maintain moisture content, and placed in temperature controlled chambers at either 59 or 77 oF (15 or 25 oC); these temperatures represent typical coastal winter and summer soil temperature, respectively. At 1, 2 and 4 weeks, soil NH4-N and NO3-N concentrations were determined; at each time 4 samples of each soil x fertilizer combination were measured. The increase in mineral N concentration over time (compared to the change in the unfertilized soils) represented net N availability from the organic fertilizers.

The rate of N mineralization from these fertilizers was quite rapid (Table 2). Phytamin 801 and Phytamin 421 had more than 60% of their initial N content in mineral form after 1 week of incubation, and more than 70% after 2 weeks. Biolyzer, which had the lowest initial N content, had significantly lower N availability, but still had 40-55% of initial N content in plant-available form within 2 weeks. N mineralization slowed after 2 weeks, with only marginally higher N availability after 4 weeks. There were small but statistically significant soil and temperature effects on fertilizer N availability, with greater N availability found in soil 2, and at 77 oF. Nitrification (the conversion of NH4-N to NO3-N) occurred rapidly; averaged across fertilizers and soils, more than 90% of mineral N was in NO3-N form after 1 week of incubation at 77 oF, or after 2 weeks at 59 oF (Fig. 1).

The particulate material contained in these liquid fertilizers has been finely milled, and therefore has a high surface area that facilitates microbial degradation.

These results suggest that liquid organic fertilizers can provide relatively rapid N availability. We believe that a key to this rapid availability is that a substantial portion of the organic N contained in these fertilizers is in simple chemical forms such as amino acids, which can be rapidly broken down. Another factor may be that the particulate material contained in these liquid fertilizers has been finely milled, and therefore has a high surface area that facilitates microbial degradation. Prior research suggests that organic fertilizers formulated from animal wastes have more rapid breakdown than those formulated from plant materials, and that was the case in this study as well. The speed with which the mineralized N was converted to NO3-N, even at 59 oF, undercuts the rationale for the use of Chilean nitrate.

The foundation of organic N fertility is soil building through cover cropping and compost application, but in situations in which additional N availability is needed, liquid organic fertilizers can provide a quick boost. The cost of these products will limit their use, but clearly they can be a valuable tool for organic growers.

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Table 1. Initial nitrogen content and form of the liquid organic fertilizers

Fertilizer	Feedstock	Nitrogen content (%) total	NH_4-N	NO_3-N	particulate[z]
Phytamin 801	fish waste, seabird guano	6.0	1.3	0.04	0.5
Phytamin 421	soy meal, plant extracts	4.0	0.5	0.7	0.7
Biolyzer	grain fermentation	2.6	0.2	0.2	0.6

z potentially removable by drip irrigation system filtration

Table 2. Nitrogen availability from organic fertilizers, as influenced by temperature and time of incubation.

Weeks of incubation	Fertilizer	% of fertilizer N in plant-available form: Incubation at 59 °F Soil 1	Incubation at 59 °F Soil 2	Incubation at 77 °F Soil 1	Incubation at 77 °F Soil 2
1	Phytamin 801	79 a[z]	85 a	83 a	93 a
	Phytamin 421	62 b	65 b	71 b	75 b
	Biolyzer	35 c	36 c	42 c	50 c
	mean	59	62	65	73
2	Phytamin 801	83 a	89 a	83 a	95 a
	Phytamin 421	71 b	71 b	72 b	80 b
	Biolyzer	40 c	45 c	45 c	55 c

z means within columns within incubation times separated using Duncan's multiple range test, $p < 0.05$

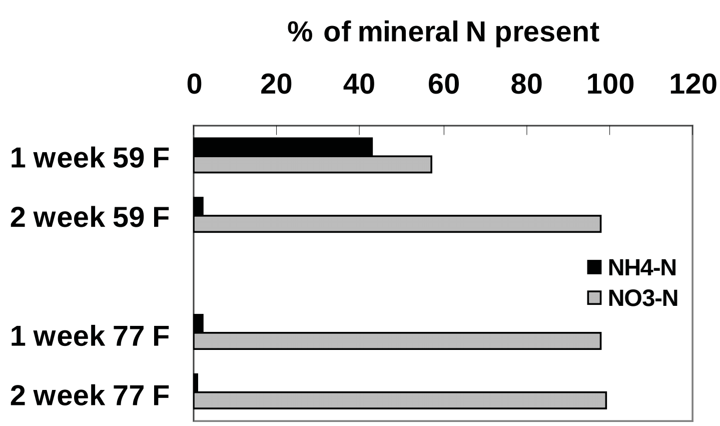

Fig. 1. Effects of incubation time and temperature on the form of mineral N present

The foundation of organic N fertility is soil building through cover cropping and compost application, but in situations in which additional N availability is needed, liquid organic fertilizers can provide a quick boost. The cost of these products will limit their use, but clearly they can be a valuable tool for organic growers.

FARMERS SHOULD MAKE A SKIN CHECK A PRIORITY

Farming has plenty of challenges, but probably one of the hazards that farmers worry about the least are the dangers from working the sun year-round, but farmers should pay attention to the condition of their skin. Since research shows farmers are among the least likely workers to receive a skin examination by a physician, it's important that farmers perform regular skin self-examinations, which could mean the difference between life and death.

It's as easy as "ABC" to remember how you can identify a mole or lesion that needs the attention of a dermatologist:

Asymmetry (one half is unlike the other)
Border (irregular, scalloped or poorly defined)
Color (Varies from one area to another)
Diameter (the size of a pencil eraser or larger)
Evolving (changing in size, shape of color)

To help farmers minimize their risk of skin cancer, the American Academy of Dermatology recommends that everyone Be Sun Smart:

- Use water-resistant sunscreen with a sun protection factor (SPF) of at least 30 on all exposed skin, before heading out to the field or pasture. Re-apply approximately every two hours, even on cloudy days.
- Wear long-sleeved shirts, pants, a wide-brimmed hat and sunglasses.
- Stay in the shade when possible, and make sure your tractor has a sun umbrella. The sun's rays are strongest between 10 a.m. and 4 p.m.
- If working near water, snow or sand, seek extra shade because these surfaces reflect the sun's rays and increase your chance of sunburn.
- Look at your skin after each harvest. Ask a partner to help. If you notice any moles or spots changing, growing or bleeding, make an appointment to see a dermatologist.

The Academy offers a downloadable Body Mole Map which is available at www.aad.org/checkspot.
For more information about skin cancer, visit the SkinCancerNet section of www.SkinCarePhysicians.com.

CENTRAL COAST WINEGRAPE SEMINAR

WHEN: Tuesday April 13, 2010
WHERE: Monterey County Agricultural Center
1432 Abbott Street, Salinas, CA, 93901
TIME: Registration, 1:00 pm – Meeting 1:30 – 5:00 pm

Agenda

Gopher Control Strategies in a Vineyard Setting – Roger Baldwin, Wildlife Pest Management Advisor, UC Kearney Agricultural Center, Parlier

Beneficial Outcomes of the UC Davis Grape Breeding Program – Andrew Walker, Professor, Department of Viticulture and Enology, University of California, Davis.

The Role of Rootstocks in Achieving Vine Balance – James Wolpert, Viticulture Specialist, Department of Viticulture and Enology, University of California, Davis.

Invasive Insect Pest Threats to California Vineyards – Larry Bettiga, Viticulture Farm Advisor, University of California Cooperative Extension, Monterey, Santa Cruz and San Benito Counties

PCA and CCA credits have been requested. For more information or directions call (831) 759-7350. Please call ahead for arrangements for special needs - every effort will be made to accommodate full participation.

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