Sacramento Valley Field Crops Newsletter

Issue 6 July, 2020

University of California
Agriculture and Natural Resources | Cooperative Extension

In This Issue

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Managing sunflower head moth

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Sunflower moth, or sunflower head moth, are serious pests of sunflower resulting in high yield losses when not controlled. Adults are tannish, about ½-in long, and slender. Eggs are difficult to find because they're usually laid at the base of florets in the flower head. Newly hatched larvae are pale yellow but darken to shades of brown with white stripes and a light-brown head capsule (Photo 1). Tangled mats of webbing on the flower heads are signs of larval activity. Mature larvae drop to the ground, pupate in the soil, and later emerge as adults. There can be 3 generations of head moth per year.

Sunflower moths likely overwinter as larvae in the soil. In colder climates, such as Midwestern states, the moth is migratory. In the Sacramento Valley, moths begin to emerge in June and are generally most troublesome in July and August. Early-planted fields sometimes escape moth damage, as moths seem to build up on early planted fields and disperse into later planted fields.

The only way to manage head moth is through monitoring and the use of insecticides. There are no effective cultural practices or natural enemies to rely on for biocontrol. Sunflower moths are monitored using Pherocon IIB pheromone traps baited with sunflower moth pheromone lures. Two traps are generally placed along the north and south side edges of fields, taking advantage of the prevailing winds to maximize trap catches. Traps should be monitored weekly, and more often during bloom when sunflowers are most sensitive to damage by the moths. When trap thresholds reach 4 or more moths per night, especially in fields blooming in July or later, the field should be treated with an insecticide to prevent damage and crop losses, especially from secondary pathogens.

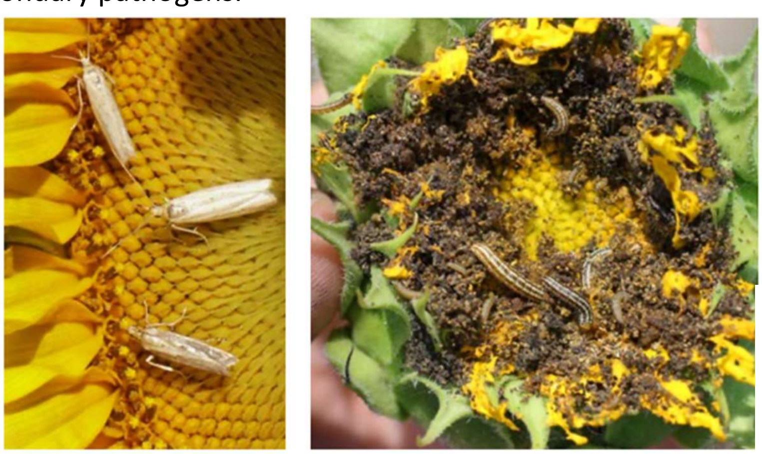


Photo 1. Sunflower head moth adults (left), larvae and damage to sunflower heads (right).

When using insecticides during bloom, protect honey bees to ensure good pollination and seed set. When an insecticide treatment is needed, spray before hives are brought into fields prior to bloom or early in the morning before bees are visiting flowers. Insecticides for head moth control include Coragen, Warrior or Asana, and the *Bt*, XenTari. Coragen does not control adult moths but gives good caterpillar control with recommendations to apply twice, once at the late flower bud stage (R3) and again at the very beginning of bloom (R5.1), to ensure good coverage and protection. Coragen is relatively safe for bees, but applications should be made early in the morning when bees are less active to protect them from harmful effects of sprays. More information about managing head moth and other pests in sunflower can be found in the Sunflower Hybrid Seed Production in California Manual, published last year.

Announcements

UCCE outreach events remain on hold for now though many are going virtual, including the UC ANR Alfalfa and Forage Symposium this winter.

Agronomy Needs Assessment Survey

Our UC ANR Agronomic Crops Program Team will be conducting a statewide survey of clientele crop production needs in the next few months. With budget cuts, retirements, and fewer UC ANR agronomy advisors and specialists, we want to be sure that we are directing limited resources towards addressing critical needs. Please stay tuned for this survey later this summer, which will be coming from Jessie Kanter at UC Davis. We appreciate your participation!

Project Summaries and Available Resources

Evaluation of Cover Crops on Soil Moisture Dynamics and Demonstration of Winter Cover Crops in a Conventional Farming Rotation in the Sacramento Valley

The first year of this 3-year CDFA funded Healthy Soils Program project is almost complete. This project is in collaboration with the Colusa County Resource Conservation District. Replicated plots of purple vetch, purple vetch and cereal rye mix, and fallow control were planted in Fall 2019. Soil moisture sensors were installed at 6”, 12” and 24” depths and moisture measurements collected until the cover crops were incorporated in the spring. Sensors were re-installed following corn planting in 2020 and will remain in the ground throughout the growing season. This project will evaluate changes in soil moisture dynamics with and without winter cover crops in an annual cropping rotation. In addition, large demonstration plots with different cover crop varieties, including legumes, grasses, and mixes, are planted alongside research test plots.

Unfortunately, the field day we had scheduled at this site for May was cancelled due to COVID. Agronomy Advisor Sarah Light and Liz Harper from the Colusa RCD have started a “Virtual Soil Health Mob” YouTube channel to extend information about Soil Health. Find interviews with local experts related to various soil health topics here. Send topics of interest to Sarah Light, selight@ucanr.edu

Stay tuned for future field days at this site.

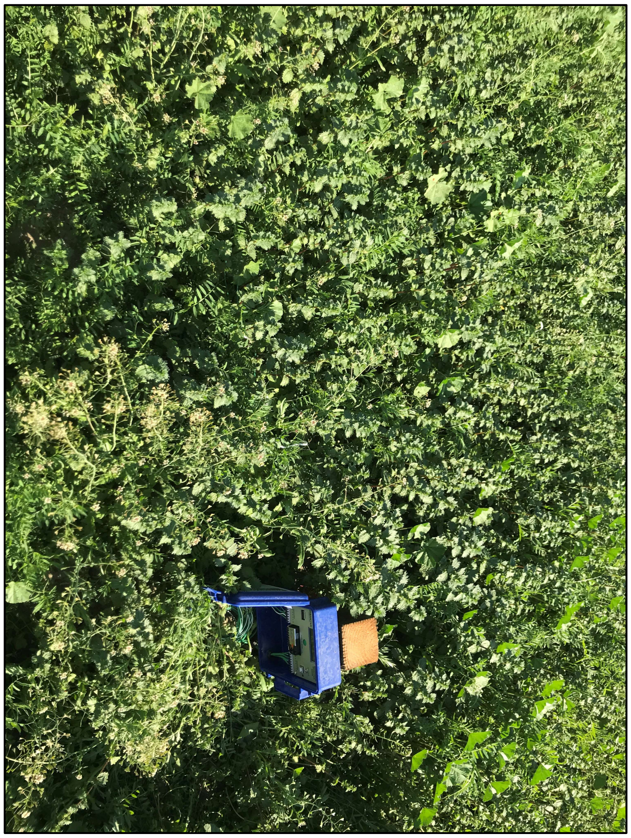


Photo 6: Sensors in cover crop plot prior to termination.

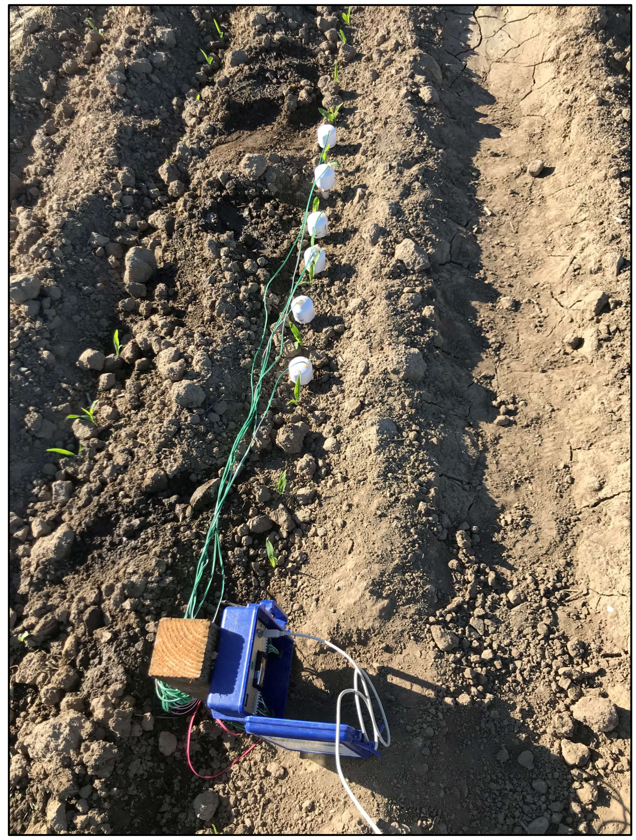


Photo 7: Sensors between emerged corn plants

Achieving Efficient Nitrogen Fertilizer Management in California Wheat

For the past several years, the UC ANR Small Grains group has been working with Cooperative Extension Specialist Mark Lundy on a state-wide project to improve nitrogen use efficiency in California small grains. The Lundy lab has created a model for the different wheat growing regions in our state to optimize nitrogen management. Growers establish N-rich zones in the field prior to planting to serve as an in-season reference for the rest of the field. Then, in-season soil and crop measurements are collected and used to determine the likelihood of the crop responding to additional nitrogen application in-season. Now that the model has been validated, we are extending knowledge on how to implement this practice across small grains growing regions in our state, including a site in Colusa County. The first year of this three-year project is complete. This project allows for growers to increase the bottom line in small grains production because it can reduce fertilizer costs through modifying in-season applications based on crop demand. In addition, this management practice reduces nitrogen loss to the environment.

Unfortunately, the field day planned for March 2020 was cancelled due to COVID. We are continuing to disseminate information online and will host field days in the future. Visit the UC Small Grains page on the Agronomy Research and Information Center (www.smallgrains.ucanr.edu) to find these resources, including new blog posts specifically about this project, tools that can be used in the field.

Contact Sarah Light, selight@ucanr.edu, with questions about implementing this practice on your farm.

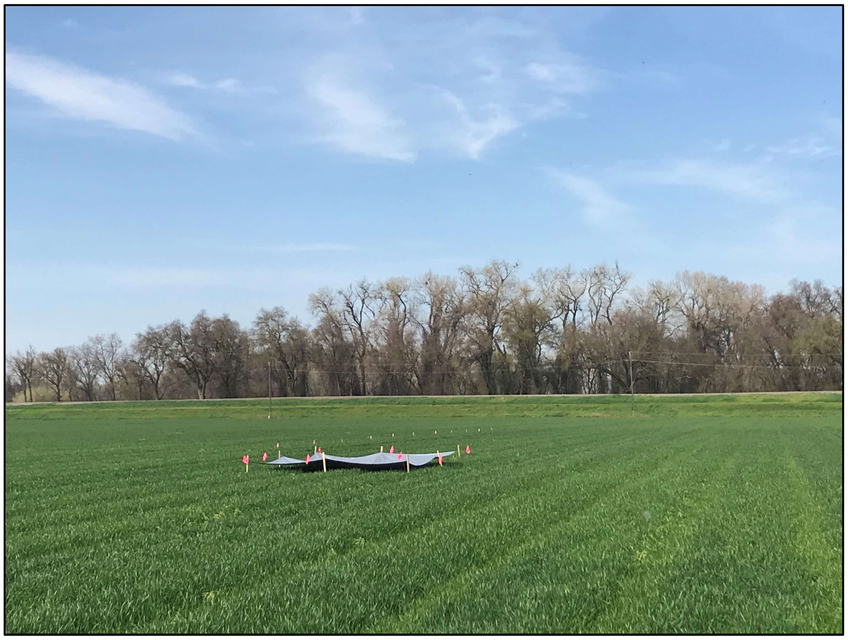
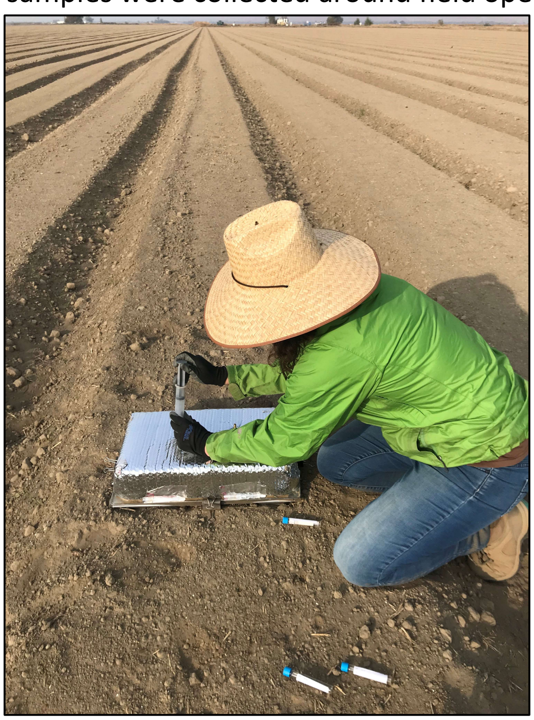


Photo 8: Fertilizer exclusion zone in wheat field prior to in-season nitrogen application

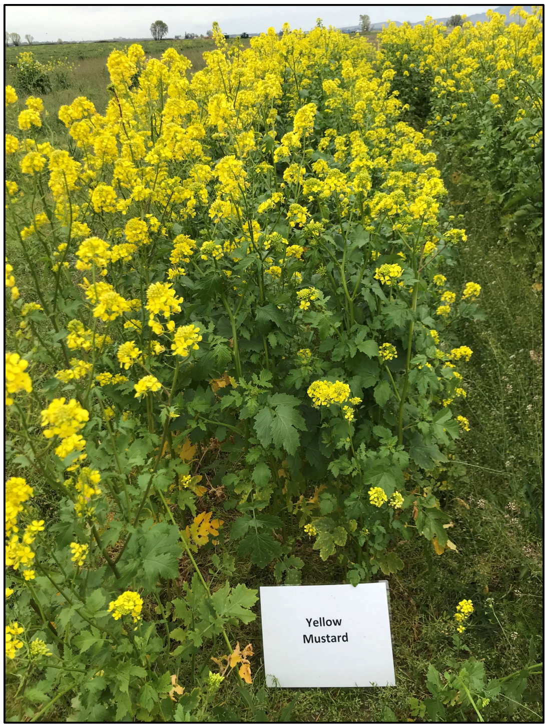
Multi-site demonstration of conservation management practices for soil health and greenhouse gas emissions reduction

UCCE Agronomy Advisor Sarah Light and Vegetable Crops Advisor Amber Vinchesi-Vahl have finished the final year of the 3-year statewide cover crop project supported by the CDFA Healthy Soils Program. This project includes a demonstration and research site in Sutter county. Two rates of vetch (low and high) were planted in replicated research plots alongside a no-cover crop control. Greenhouse gas emission samples were collected around field operations (irrigation and tillage) and weather events (rain) that would stimulate microbial activity. Soil samples were collected annually, and cover crop biomass and percent residue cover were quantified. In addition, small, single-row plots of various cover crop species (legumes, grasses, and mustards) were planted to demonstrate how they perform in our Sacramento Valley climate.



Unfortunately, the final field day planned for March was cancelled due to COVID but project findings are being compiled into a project summary and will be disseminated later this summer.

Photo 5: Farm Advisor Sarah Light collecting greenhouse gas emissions sample in the fall before cover crop planting



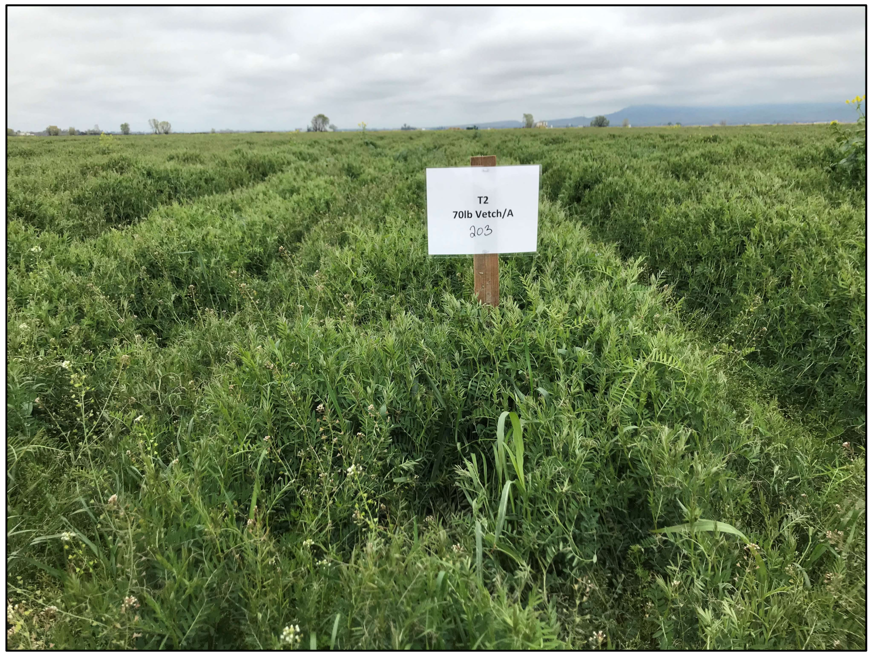


Photo 4: Small plot of yellow mustard

Photo 3: High rate of vetch research plot on March 17, 2020.

University of California Hemp Trials

Year 2 of UC hemp field trials are continuing this season. Last year two varieties at three planting densities were evaluated for CBD production at two UC research facilities, including UC Davis. Preliminary measurements of crop water use were taken. This year, UC research will replicate the work from last year as well as begin to evaluate optimizing irrigation for this new crop. In addition, Sarah Light and Brad Hanson documented hemp crop damage from commonly used herbicides in the Sacramento Valley.

Photos have been added to the UC IPM Herbicide Symptoms database and can also be found here.

Photo1: Glyphosate damage on hemp

Biochar Resource

There is increasing interest in biochar but very few decision-making tools exist for biochar selection. Biochar is variable depending on feedstock and production method and product selection is critical to achieve the intended goal. Prior to beginning at UCANR, Agronomy Advisor Sarah Light worked on a biochar project at the USDA in Oregon. The Pacific Northwest Biochar Atlas (www.pnwbiochar.org) includes case studies, information about biochar, and decision making tools for growers including a Biochar Selection Tool and a Biochar Property Explorer.

Blackeye Variety Trial Results

The findings of the 2019 Blackeye Varietal Improvement Project are available. Last year, field trials were conducted around the state including in Colusa and Sutter Counties. Breeding lines were evaluated for grain yield, grain quality, agronomic characteristics, lygus and black bean aphid resistance, and Fusarium wilt resistance. This year, test sites have been planted in Colusa and Yolo Counties. Findings from last year can be found here.

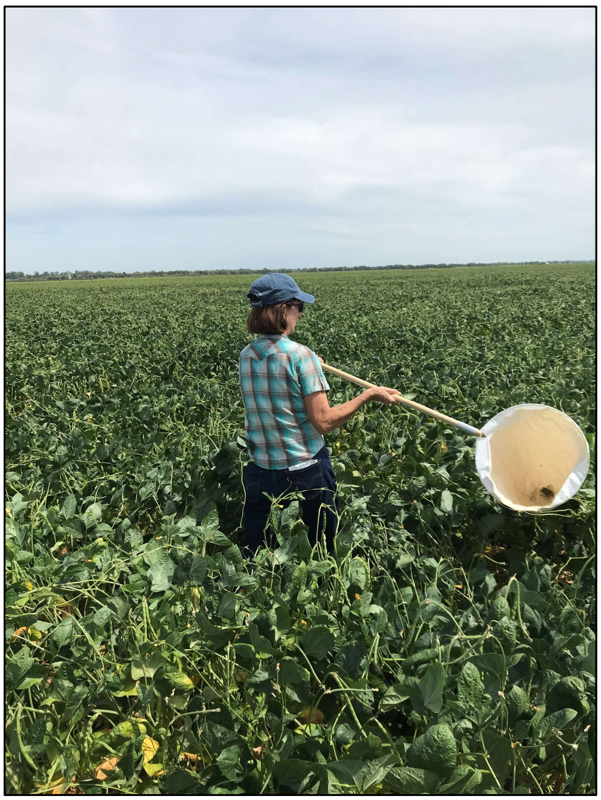


PHOTO 2: Farm Advisor Rachael Long sweeping blackeye variety plots to evaluate lygus pressure.

When is nitrogen fertilization of alfalfa beneficial? Almost never!

Rachael Long, UCCE Farm Advisor, Yolo-Solano-Sacramento
Dan Putnam, UC Davis Plant Sciences Extension Specialist

Nitrogen (N) fertilizer is generally not required for alfalfa production since alfalfa can obtain its own N from N-fixing nodules. Alfalfa fixes most (70-90%) of its N needs from the air through a symbiotic relationship with Rhizobia bacteria residing in alfalfa root nodules. Since 78% of our air consists of nitrogen gas, this supply of 'free fertilizer' is inexhaustible.

Although there have been some reports of yield and forage quality increases with N applications to alfalfa, actual research results have been mixed. That is, sometimes there is a modest yield response by alfalfa to N but most of the time, there isn't. There may be slight increases in Crude Protein associated with N fertilizer, but these are usually due to presence of non-protein N. Non-protein nitrogen in the plant is considered detrimental by animal nutritionists, since it requires energy to metabolize this excess N. Grassy weeds are also much more of a problem in N-fertilized alfalfa fields.

These are the reasons that nearly all U.S. universities do not recommend N fertilizers for alfalfa under most circumstances. However, there are certain situations when nitrogen fertilizer applications to alfalfa are thought to be warranted. What are these, and is N fertilizer really justified in all such situations?

1. **Seedling alfalfa** – applications of small amounts of N with phosphorus as a starter fertilizer is a common practice. Nitrogen-fixing nodules may require a period of 2 to 4 weeks to develop and sometimes up to 3 cuttings to be most effective. During this establishment phase, the plant relies on soil and fertilizer nitrogen. If the soil contains more than 15 ppm available nitrogen at planting time, the soil can usually supply the needs of the crop before nodulation becomes established; thus, nitrogen fertilizer is not required. But in situations with depleted soil N, a small amount of N fertilizers applied at seeding can actually stimulate nodule formation. But don't overdo it! Nitrogen fertilizer rates ranging from 20 to 70 pounds per acre have been reported to inhibit nodule formation. Typically, the amounts of N contained in (for example) 11-52-0 fertilizers applied at planting are sufficient.
2. **Cold soils** – Responses to nitrogen fertilizer have been reported in cold soils, particularly those low in soil nitrogen. The soil temperature range for nitrogen fixation is about 40 to 85°F, with an optimum range of 68 to 78°F. When soils are very cold, sometimes small amounts of N fertilizers can stimulate growth, enabling the plant to re-establish nodulation and normal N_2 fixation as conditions warm up.
3. **Hot soils** – the possible negative effect of high temperatures on nitrogen fixation has been suggested as a cause for decreased yields during the summer. Exposed soil surfaces can get hot after alfalfa cuttings (in the top 2 to 4-inches); however, most of the nodules are deeper, in the 3 to 12-inch range, so not generally affected. Heat can have a negative effect on plant growth in general, not necessarily on nodulation. If heat, cracking soils, salt, and stress have compromised plant growth, N fertilizers won't necessarily fix that.
4. **Waterlogged or shallow soils** – Proper root growth requires air to function, and waterlogging, especially combined with a shallow soil, is detrimental to nitrogen fixation as a result of poor root growth and anerobic conditions. However, research in California documented that N applications in saturated soils did not enhance alfalfa yields as the plants needed air to grow, not N. If you see yellowed, seemingly N-starved alfalfa plants after wet periods, just wait for sunnier, drier conditions—N fertilizers won't really help.

5. **Poorly-nodulated fields -** If you see overall yellowing of foliage in an otherwise normal field, with just an occasional green plant, start digging up plants to see if nodulation is a problem. Nodules are small polyps on the roots, which have a reddish color inside when broken. If you don't see nodules (be careful-they fall off easily), or if the nodules are not reddish, that's a sign of poor nodulation. This could be because of lack of the proper inoculum (alfalfa specific: *Rhizobium meliloti*, available commercially), or because of low pH or micronutrients (for example, molybdenum), or other factors. *What to do?* Some short-term N fertilizers will be beneficial, but more importantly, re-inoculate the field with water-run inoculum applications to re-establish nodules. Also correct for soil factors such as pH.
6. **Molybdenum deficiency** – Molybdenum (Mo or "moly") is essential for nodulation and assimilation of biologically fixed nitrogen in the plant. Therefore, molybdenum deficiency in alfalfa may lead to nitrogen deficiency, and molybdenum deficient plants respond to nitrogen fertilizer. Add Moly to correct a deficiency.
7. **Low pH soils** – Though not a problem for most of our soils, alfalfa requires a pH of 6.5 or above for optimum nitrogen fixation. If you have a pH below this level, consider applications of lime.
8. **Alfalfa-grass mixtures –** Nitrogen fertilizer is usually recommended for mixtures of alfalfa with a grass in order to realize the yield potential of the grass. However, although this maximizes yields, it also tends to favor the grass in mixtures, so the alfalfa will likely be crowded out to a greater degree.
9. **Compromised root systems -** Factors such as excessive root disease, root pruning due to cracking soils, winter injury, water-logging short cutting cycles, lack of proper fertilization, deficit irrigation, or other issues can result in highly compromised roots, particularly loss of fine root hairs, which are the 'powerhouses' of nutrient absorption. In these cases, applications of small amounts of N fertilizers may improve short-term growth so that the roots can begin to re-generate. However, this should be done in combination with other practices, such as extending the harvest schedules, good drainage, or paying more attention to irrigation or fertilization practices. Alfalfa has an excellent capacity to recover from severe stresses, but once roots have sufficiently recovered, N-fertilization should cease. Examine the roots to assure nodulation is re-established.

In summary: There are some growers who routinely apply large amounts of N fertilizers to alfalfa, especially in desert soils. In our view, this is a mistake. The science doesn't support it. It's expensive, requires fossil fuels, and isn't necessary. If nodulation (infection with beneficial bacteria which fix nitrogen) is not successful, try harder to solve that problem. It could be an issue of making sure that viable bacteria of the right species and strain is applied successfully to a field (and re-applied if necessary), correcting a soil factor such as low pH, salt, or low molybdenum, or improving irrigation practices so that roots are not as compromised. Some desert growers routinely apply N fertilizers, but if they examine the economics of this practice, it's rarely beneficial. In rare circumstances, application of modest amounts of N to 'jump start' alfalfa growth can assist if the roots are compromised, the plants are young, the soils are cold, or other stresses exist, but this should be looked on as only a short-term mitigation measure, not a routine practice.

Fusarium root rot in lima beans

Rachael Long, UCCE Farm Advisor, Yolo-Solano-Sacramento

Last month, I looked at a lima bean field in the Sacramento Valley that showed poor seedling emergence, scattered throughout the field (photo 1). I took samples to the UC Davis Plant Pathology lab and the main pathogen consistently recovered from the roots was Fusarium root rot, a fungal disease caused by *Fusarium solani f. sp. phaseoli*. This pathogen is specific to beans and field peas and will not infect other field crops. A few bean seedlings also had Rhizoctonia and Pythium (also fungal pathogens).

Rhizoctonia and Pythium commonly cause seedling damping-off in dry beans. However, plants usually outgrow these pathogens, particularly if the seed is treated with a fungicide and conditions favor rapid emergence. Finding Fusarium root rot in bean seedlings was a surprise because this disease is most commonly encountered during mid- to late season, where it is one of the causes of early maturity ("cut out").

Fusarium solani attacks underground stems and roots of plants. In established plants, early infection is characterized by elongated reddish streaks on the roots. As the disease progresses, these eventually form reddish-brown lesions that will surround the entire root, causing decay. The above ground plant symptoms of affected plants included yellowing, wilting, stunting, and dieback. On seedling plants, what I saw was dieback of plant tips, stems that were a bit swollen, and roots that were tannish in color and not well developed (Photo 2, diseased roots on left, healthy on right).

Fusarium root rot causes little damage to unstressed plants, but under conditions of drought, poor nutrition, or oxygen-stressed, waterlogged soils, Fusarium root rot can cause plant dieback and yield losses, particularly in fields with a long history of bean production. In this particular lima bean field, soil moisture was lost, causing plants to be extremely water stressed. Crop rotation, use of seed treatments, and closely watching field conditions to ensure plants are not stressed will help manage Fusarium root rot. This disease tends to be a problem in fields with a long history of bean production. More information on diseases in dry beans can be found on the newly revised UC IPM guidelines for dry beans.

Photo 1. Seedling lima beans infected with Fusarium root rot, causing seedling dieback.

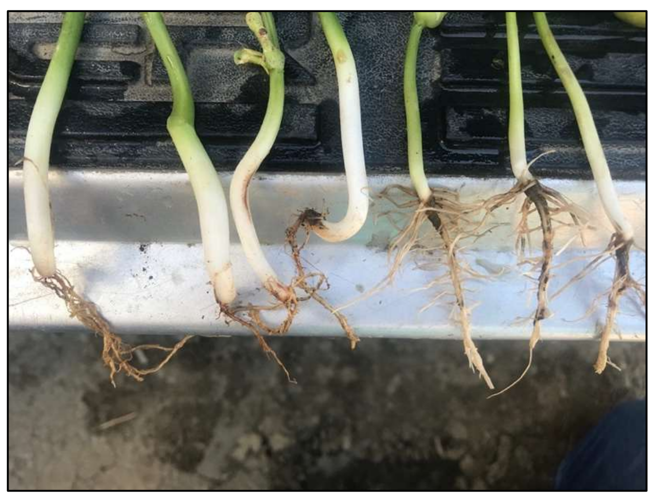


Photo 2. Seedling lima beans infected with Fusarium root rot (left 4 plants with tannish-colored stunted roots) compared to healthy roots (right 3 plants).

Research update: Developing integrated southern blight management tools and risk forecasting for Northern Central Valley growers

Megan McCaghey, Post-Doctoral Researcher
Cassandra Swett, UC Davis Plant Pathology Extension Specialist

Southern blight, caused by the fungus *Sclerotium rolfsii,* is a soilborne pathogen that is increasingly becoming problematic in many crops including tomato, potato, sunflower, bean, and pepper, likely due to higher spring and summer temperatures. Initial symptoms of southern blight include a yellowing of the foliage with slight darkening of the stem just above the soil line. Lesions on the stem at or near the soil line develop rapidly, girdling the stem and sudden and permanent wilt of the plant. The fungus grows downward on the stem, rotting the cortical tissue. White mats of mycelium develop on the stem and nearby soil. In a few days, tan to brown spherical sclerotia (tiny compact masses of hardened, fungal mycelium) may appear on the mycelial mat. The sclerotia are a good diagnostic feature of this disease in many crops, but are rare in some, like tomato.

Infections by *S. rolfsii* are triggered by warm temperatures and moist soil conditions. The inconsistent development of southern blight from year to year makes it hard to determine when or if fungicides might be needed in a given year. To address this problem, we are developing a risk forecasting tool which can alert growers to southern blight risk events in the growing season, to inform when fungicide applications are required to control the disease. This summer, we are collecting data on soil temperature, soil moisture, and disease incidence in annual cropping systems throughout the Central Valley to develop a predictive model, which we are validating in controlled trials in collaboration with UCCE Advisors Brenna Aegerter and Jaspreet Sidhu. While fungicides can effectively control southern blight, dense canopies and a lack of crop registrations limit their usefulness; moreover, there are limited fungicide options available to organic producers, who are often the most impacted by this disease.

A second goal of our project is to provide an integrated management toolkit for southern blight, which includes organic options. This involves generating information on better or worse crop rotations in southern blight infested fields, continuing work we started with UCCE Advisors Amber Vinchesi-Vahl and Sarah Light in 2018. We are examining changes in fungal densities in soil following planting to various crops over three years (2018, 2020, 2021). We're also exploring pathogen-suppression using: 1) chitin amendment to stimulate microbes that break down chitin, and in turn the chitin-based survival structure of *S. rolfsii,* and 2) soil solarization in the fall to kill the pathogen in the soil.

The deliverables from this project will include a disease forecasting tool, information on crops that are severely affected by the disease and increase southern blight loads in fields (to avoid) and crops that are less affected and do not increase southern blight loads (to rotate with more susceptible crops), as well as soil treatment strategies for infested fields. This project is supported by the USDA NIFA Postdoctoral Fellowship and the California Potato Board. Collaborators include Brenna Aegerter, Rachael Long, Mrinalini Narayan, Kelley Paugh, Jaspreet Sidhu, Amber Vinchesi-Vahl, UCCE Colusa County, and the UC Davis Department of Plant Pathology. For more information, contact Cassandra at clswett@ucdavis.edu.