Sacramento Valley Field Crops Newsletter
Issue 2 Winter, 2018

University of California
Agriculture and Natural Resources | Cooperative Extension

In This Issue

Submitted by:

Sarah Light
UCCE Farm Advisor
Sutter-Yuba and
Colusa Counties

Managing Weevils in Alfalfa Hay Production

Rachael Long, Pest Management & Agronomy Advisor, Sacramento, Yolo, Solano Counties
Tom Getts, Weed Ecology and Cropping Systems Advisor, Lassen County

It's that time of year again to watch for those evil alfalfa weevils! Weevils are key pests of alfalfa, causing yield and quality losses mainly to the first alfalfa hay cutting. The alfalfa weevil complex includes the Western, Egyptian, and Eastern strains that are all likely the same species *(Hypera postica)*. Each year, growers throughout the country deal with this devastating pest. Telltale signs of weevil damage are small holes in the leaves of the new growth during the winter and spring, depending on field location. Damage is most severe to the first cutting, with large uncontrolled infestations potentially causing damage to the alfalfa regrowth under windrows within the second cutting.

The Central Valley and low desert areas have the Egyptian strain, which thrives in hot, dry climates. The Intermountain area traditionally has had the western strain, which prefers cooler conditions, but with recent warmer winters, the Egyptian strain may now have a stronger presence there. This may be the reason we're seeing huge outbreaks of weevils in areas that historically have not been a significant problem. The western strain has also always been under some biocontrol by parasitoid wasps (parasites), but not the Egyptian strain. Alfalfa weevil resistance to pyrethroids in the Intermountain area near Mount Shasta is also causing control problems.

Management Practices
Management practices for weevil control can be found on the 2017 UC IPM guidelines for alfalfa hay, http://ipm.ucanr.edu/PMG/r1300511.html

Biocontrol: There's some biocontrol of the western alfalfa strain by parasites (parasitoid wasps). However, the Egyptian alfalfa weevil kills parasites by encapsulating and killing the eggs that the wasps lay inside them. Insectivorous birds are also known to feed on alfalfa weevils.

Cultural practices: Early cutting reduces yields and weevils can continue feeding under the windrows on the alfalfa re-growth, so is not recommended (unless it is used for green chop).

Overseeding with other forage species that weevils don't feed on (like oats or red or berseem clover) makes up for the loss of alfalfa production from weevil damage. However, mixed forages will change the quality and the marketability of the hay and therefore overseeding is only recommended for older stands in the last years of production to help boost yields.

'Sheeping off', or close winter grazing, during winter time when the alfalfa is dormant helps reduce weevil numbers and damage to the first cutting when the sheep feed on stems

where weevils lay eggs. However, timing is important (alfalfa must be dormant) and watch for excessive soil compaction and overgrazing.

Monitoring: Alfalfa fields should be monitored to time insecticide treatments when weevils are feeding on the crop. If sprays are applied too early, a second treatment may be needed, which is costly and could lead to issues with insecticide resistance (see pyrethroids below). Monitor fields with a sweep net using the UC IPM guidelines for alfalfa hay. The current threshold is 20 weevils per sweep. However, far fewer weevils can do a lot of damage depending on the height of the alfalfa and when it is cut, so it's important to watch the fields for injury, especially stubble fields that cannot be sampled with a sweep net.

Insecticide Choices: It's critical to rotate the following different insecticide modes of action (MoA's) for alfalfa weevil control, in order to prevent insecticide resistance from developing:

Organophosphates: Chlorpyrifos (Lorsban) is becoming more difficult to use due to regulations. Malathion has a shorter residual than other insecticides such as pyrethroids.

Pyrethroids (Warrior, Baythroid): Overall good weevil control, however, alfalfa weevils have been showing pyrethroid insecticide resistance within the Intermountain region, specifically in the Scott Valley area near Mount Shasta.

Indoxacarb (Steward): Good weevil control, but more expensive, needs favorable weather conditions to be effective, gives about 2-weeks residual (pyrethroids offer closer to 3 weeks of control), and does not control aphids. Steward is a stomach poison, so the weevils must ingest it to kill them. Lower rates can be used in warmer areas when the weevils are actively feeding. Higher rates are needed where it is colder and weevils may not be as active. Good results with longer residuals have been obtained by mixing Steward with pyrethroids for weevil and aphid control.

Spinosad (Entrust): Entrust has always been intended for organic production with up to 70% weevil control, but has a shorter residual than conventional insecticides. It's the best insecticide we have for controlling weevils in organic alfalfa fields.

Alfalfa weevils are increasingly becoming difficult to control. With a grant from the California Department of Pesticide Regulation (2016-19), we are testing new insecticides and re-evaluating the economic threshold levels for weevil control in alfalfa production in California. Stay tuned for results!

Strategies to Reduce Disease on Your Farm

Sarah Light, Agronomy Advisor, UCCE Sutter, Yuba, Colusa Counties

Plant diseases cause an estimated $8 billion per year in crop loss in the United States alone. Although some loss is unavoidable, there are on-farm management strategies that can be used to reduce diseases on farm. There are three factors that have to interact in order for disease to happen. This is known as the disease triangle. Without these three factors occurring at the same time there is no risk of disease. These factors are a susceptible host, the pathogen, and the right environment. To prevent disease from occurring, we can manage for one or more of these factors.

Susceptible host:

- *Plant resistant varieties when they are available*, especially if there is a history of disease in the field.
- In some cases, varieties may all be resistant, but may vary in tolerance to the disease—grow a more tolerant (less susceptible) variety.
- If the field is known to be infested with a given pathogen, *rotate with non-hosts*.

The Right Environment:

- Changing planting date to *avoid favorable environmental conditions*.
- Managing plant canopy to promote air flow and reduce humidity may help reduce damage from many fungal and bacterial diseases, which are favored by high temperature and moisture.
- Similarly, in some cases soil management, may reduce a favorable soil environment for the pathogen. For example, preventing water pooling around roots can reduce impacts of many crown and root diseases.

The Pathogen:

- *Prevent the pathogen from coming on to your farm* by maintaining clean equipment and machinery (including trucks, work boots, and tools) and planting disease free seeds. Buy seeds from reliable sources that ensure high quality control. In some cases, pre-plant seed treatments may be effective.
- Destroy existing inoculum as you are able (manage crop residue if necessary).
- Reduce the growth of the pathogen population and *break disease cycles on your farm* by incorporating non-susceptible crops in your rotation.
- Control weeds that harbor diseases and which will allow pathogens to reproduce on your farm.
- If you have disease on your farm, *avoid spreading it throughout by cleaning your equipment* and avoiding unnecessary spread of soil from field to field. If the pathogen is moved by an insect vector (eg. many viruses), in some cases spread can be managed using insecticides.
- Apply pesticides (bacteriacides, fungicides) to protect your crop from pathogens.
- Reduce the pathogen levels in the soil using soil solarization, fumigation, or other soil treatment strategies.
- In addition to managing for one of these three factors, a fourth element to disease progression is time. Recognizing early and late stage disease symptoms can improve on farm management decisions. Treatment options and economic thresholds may change throughout the season. *Tracking the history of disease on your farm is important for effective long-term management.* Information about diseases of specific crops can be found at: http://ipm.ucanr.edu/PMG/crops-agriculture.html.

Accurate Diagnosis is Necessary for Disease Management

Sarah Light, Agronomy Advisor, UCCE Sutter, Yuba, Colusa Counties

Crop health can be impacted by both biotic and abiotic disorders. **Biotic** disorders are caused by living organisms (fungi, nematodes, bacteria, viruses) while **abiotic** disorders are caused by non-living organisms. This includes things like herbicide damage, environmental factors (water and heat stress), nutrient deficiencies or toxicities, mechanical damage, and salinity issues. *Biotic and abiotic disorders are managed differently and accurate diagnosis is important for effective management*.

If there is a plant health issue, there are several clues to differentiate between biotic and abiotic disorders. One is the distribution pattern in the field. Some abiotic problems, like nutrient deficiency or widespread herbicide damage, tend to be spread across the whole field. Others are more concentrated in certain areas of the field; for instance, herbicide drift tends to effect plants on the edge of roadways or field borders and whole rows or sets of rows are affected if there is an irrigation system issue leading to water stress. In contrast, biotic disorders *tend* to be patchily distributed—although this is not always the case, this is a good rule of thumb for determining whether you might have a biotic disease issue.

Here are two examples of abiotic disorders in field crops in the Sacramento Valley from last summer:

From left to right: picture 1, 2, 3, 4.

In this sunflower field, there were symptoms that could have indicated there was a disease problem. Some plants had rotten, foamy heads (Picture 1), and others had discolored vascular (stem) tissue consistent with a wilt (Picture 2). However, when these samples were taken to the lab, no consistent pathogen was recovered from all of the samples. This means that even if there were some biotic infections in the field, *that wasn't the main source of the problem*.

The only *consistent symptom we observed throughout the whole field* was discoloration on the top of the sunflower heads (Picture 3). In the end, we concluded that the problem was related to heat stress and sunburn, a result of a sensitive variety and a very hot summer. When plants are stressed, they may be susceptible to secondary infections. Identifying the primary issue is important for making management decisions so that you don't treat for something that isn't causing crop loss.

Picture 5 and 6

We observed stunted plants in this bean field. There was a pattern in the field and the most affected plants were near the road (Picture 5). There was concern that this could have been caused by herbicide drift. Additionally, we observed calloused stems consistent with certain herbicide damage (Picture 6). However, when we walked out into

the field, we found that all of the bean plants in the field in the healthy and affected areas had the same callousing on the stems. This means that the calloused stems were not causing the issue so we continued to investigate.

We observed that the soil was very compacted in the area of the field where the plants were stunted and concluded that this was what was causing the problem. Upon talking to the farmer, we learned that the affected area was where water pooled during the heavy rains last winter. This was further evidence that there was poor drainage and compacted soil in that part of the field.

In both of these examples, there were secondary symptoms on the crops that were not causing the primary problem. Many diseases have similar, if not identical symptoms and accurate diagnosis is required for effective and economic treatment. If you are struggling to diagnose a disease on your farm, your local farm advisor can help. For some crops, there are excellent pocket guides that you can use to narrow down the problem. *It is important to know what a normal, healthy crop looks like in order to correctly identify what the issue is.* Other important factors to note include when and where in the field symptoms occurred, patterns of affected plants in the field (which vary by disease), and any potential spread throughout the field. Sometimes it can be hard to diagnose the issue if plants are too far gone.

Additional information on herbicide damage symptoms can be found at: http://herbicidesymptoms.ipm.ucanr.edu/?src=sub. Additional information for pest and pathogen identification based on crop can be found at: http://ipm.ucanr.edu/PMG/crops-agriculture.html

Concepts in Soil Nitrate Management in Wheat and Other Winter Grasses

Sarah Light, Agronomy Advisor, UCCE Sutter, Yuba, Colusa Counties
Konrad Mathesius, Agonomy Advisor, UCCE Sacramento, Solano, Yolo Counties

When thinking about nitrogen (N) in soils, it's helpful to go back to the basics and to remember the 4Rs: right rate, right source, right time of application, and right placement—which is tied to method of application. These four factors are integral to a nutrient management plan that optimizes crop productivity and reduces nutrient loss into the environment. As part of nitrogen management plans, growers have to consider all four simultaneously and keep in mind that when managing for N, the goal should be to achieve optimum soil nitrate-N concentrations that are required for crop demand. If there is more nitrate-N than crops can take up, nitrate will leach. If there is insufficient nitrate-N, plant growth will be limited by N. With increasing pressure on growers to do more with less, investing in nitrogen management can help growers meet their goals.

Most growers are familiar with the "4R's": Right rate, Right source, Right time, Right place. The four R's are essentially an answer to the nitrogen cycle, a complex series of interrelationships between soil microbes and their surrounding environment. In the spring, when the soil warms up and soil microorganisms become active, organic N sources are converted to crop available forms (thus total N in soil, as opposed to nitrate-N, is not typically a good indication of plant-available N). It is this 'awakening' of the soil in spring that also triggers grass crops to aggressively push roots and begin to tiller in preparation for a high rate of nitrogen uptake.

Thus growers need to think about where the nitrogen is coming from, where it will be when crops need it. But how can you check on that in-season?

In the case of grasses such as wheat and barley, nitrogen will be gathered from the soil and used to generate growth or stored it in its tissue throughout its lifecycle, but the greatest demand for nitrogen in wheat and barley occurs during stem extension (From 1st node into boot; see: Feekes Stages 6-10). If there is rain on the horizon, for reasons mentioned above, the return on investment for nitrogen fertilizer application is greatest when it is applied at

tillering (for more on this, visit this UC ANR Small Grains Blog post from last year[1]). This will help ensure that any applications are in the right place at the right time during subsequent stem extension. With this in mind, top dressing, if required, is recommended prior to Feekes stage 5; however, this year's lack of rain means growers without access to irrigation may be unable to carry out further N applications.

But what if current levels of soil nitrate are enough? Generally speaking, nitrogen applications will depend on more than just the weather. Do you even need to top-dress? How much pre-plant fertilizer was applied? More importantly: how are your plants doing? There are several ways to manage this.

1) *Soil nitrate quick tests*. Soil nitrate strips can be used with minimal equipment expenses. These give you a snapshot of how much nitrate is in your soil. The reading will be given in PPM-Nitrate which generally equates to about 4x that number in pounds per acre of N, but that number will need to be adjusted somewhat for moisture and soil type. The 4x is an easy reference to the top foot of soil, where about 60%-75% of the root zone will be located in most wheat crops. Despite the name, the quick test require some amount of preparation and needs to be adjusted for factors like moisture content and organic matter, but once you're established it's pretty easy to get a good ballpark reading on nitrogen status. For instructions on how to get started with this, visit the Sacramento Valley Field Crops blog[2] or reach out to your county UCCE Agronomy Advisor.

2) *N-rich strip combined with NDVI fly-over or the NDVI Green Seeker*. The Green Seeker is a hand-held device used to measure NDVI of a crop. This is a good way to get a reading on your crop's nitrogen status; however, it is really only useful when used in comparison with a nitrogen-rich strip.[3] This allows for growers to see the relative status of your crop compared to a purposely-over-fertilized area of your fields. The idea being that if there were a deficiency, it should be indicated by the difference between plants in the N-rich strip and those in the rest of the field. The Green Seeker is thus designed to numerically indicate the NDVI value of the crop, which can be used to indicate a difference in the crop's colors that may not be easily visible to the human eye. The cost of the Green Seeker can be prohibitive, but the UC Small Grains Program is working with Agronomy Advisors to get Green Seekers in the offices of the Sacramento Valley, which they'll be able to use next year provided growers have planted a high-nitrogen strip. Growers looking to get one of their own can reach out to local Trimble dealers.

3) Another tool available to growers is the *At-Leaf sensor* which measures chlorophyll, and hence 'greenness'. Like the Green Seeker, the At-Leaf sensor works best in combination with an N-rich strip (something to keep in mind for next year if you didn't put one down this year). More information on At-leaf sensors can be found on their website[4].

These principles are applicable to other types of crops as well. In conjunction with CDFA's Fertilization Guidelines[5] they can be a powerful tool in fertility management and can ultimately help growers make the most of their nitrogen budgets.

---

[1] http://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=23096
[2] http://ucanr.edu/blogs/SacValleyFieldCrops/
[3] For information on how to setup a nitrogen-rich strip, check out the Sacramento Valley Field Crop's Blog: http://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=24986
[4] http://www.atleaf.com/
[5] https://apps1.cdfa.ca.gov/fertilizerresearch/docs/guidelines.html

Italian Ryegrass Management in Sacramento Valley Wheat

Mariano F Galla, Agronomy & Weed Science Advisor, Tehama, Butte, Glenn Counties

Italian ryegrass (*Lolium perenne spp. Multiflorum)*, is an annual grass common in Sacramento Valley orchard and field crops (Figure 1). This species germinates and matures approximately at the same time as winter cereals and is highly competitive for soil nutrients during the time when wheat is tillering. It can also interfere with harvest and, due to competition for nutrients and water, can cause up to 80% reduction in winter wheat grain yield (Liu et al., 2016). Given this competitive pressure and what looks to be a relatively dry winter, monitoring fields for Italian ryegrass now, during tillering, is critical.

There are several ways to determine whether or not you should spray…

If you are going to spray, keep in mind that the biology of Italian ryegrass means it is very quick to develop resistance to certain classes of herbicide. Below are several examples of herbicides that can be used in rotations.

Pre-emergent herbicides are not commonly used in small grains production in California, but there are several options for post-emergent herbicides. Steve Wright and his group conducted some testing and found that Osprey, Simplicity CA, and Axial were effective in controlling Italian Ryegrass. Broadleaf herbicides, such as Express or MCPA, can also be mixed with Simplicity CA and Axial to broaden the spectrum of weeds controlled (Figure 2).

Unfortunately, cases of Italian Ryegrass populations resistant to one or more herbicide modes of action have been reported in California and in other states. Brunharo and Hanson (cit newsletter) reported a population of Italian Ryegrass from Hamilton City resistant to Gramoxone, Envoy and Osprey. In Oregon, Liu et al. (cit) found a ryegrass population resistant to pinoxaden, the active ingredient of Axial.

In the Sacramento Valley, the short rotation interval already limits the availability of effective herbicides because of safety concerns for the next crop. The spread of herbicide resistant ryegrass could further reduce our viable options. If you're looking for more information or are interested in cooperating in Italian ryegrass management trials feel free to contact me at the UCCE office (530-865-1105) or via email: mfgalla@ucanr.edu

Additional information on weed management can be found on the UC IPM guidelines for small grains: http://ipm.ucanr.edu/PMG/r730700211.html

Figure 1 Italian Ryegrass

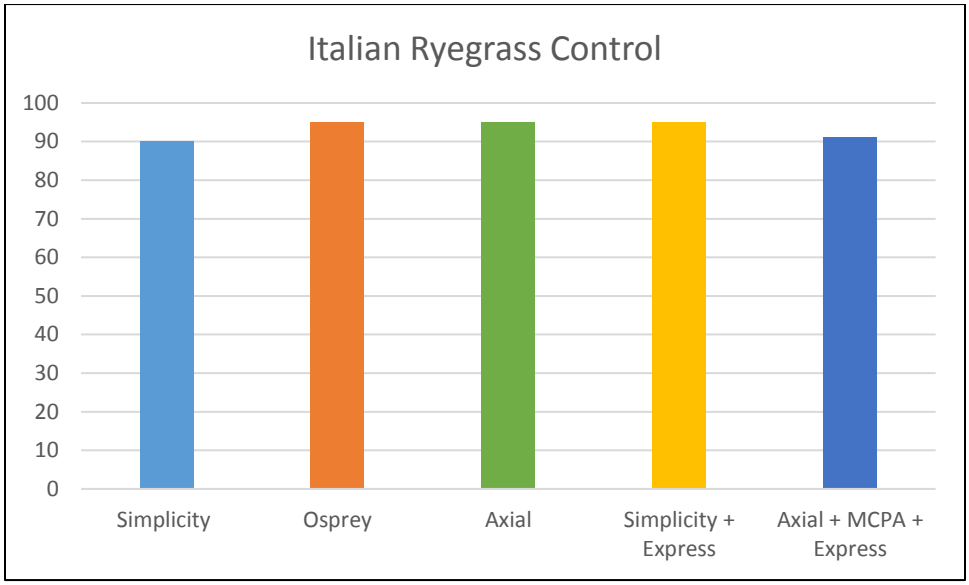

Figure 2 Percent Italian ryegrass Control in Wheat, Visalia 2012 (Courtesy of Steve Wright)

Liu, M., Hulting, A. G., & Mallory-Smith, C. (2016). Characterization of multiple herbicide-resistant Italian ryegrass (Lolium perenne ssp. multiflorum) populations from winter wheat fields in Oregon. *Weed Science*, *64*(2), 331-338.

Brunharo, C. and Hanson, B. (2017). Italian Ryegrass management in perennial crops in California. http://ceglenn.ucanr.edu/newsletters/Weed_Management_Notes70842.pdf

Research Update: Preventing Rodent Damage to Subsurface Drip Irrigation in Cracking Clay Soils

Konrad Mathesius, Agronomy Advisor, UCCE Sacramento, Solano, Yolo Counties

Last year several growers spoke about their difficulties with keeping mice damage down in subsurface drip irrigation systems in cracking clay soils. This seems to be a common problem in the Sacramento Valley and, aside from being a major headache for growers, can increase labor costs substantially. Cracking clay soils create an ideal environment for rodents in crops such as sunflower and wheat where fallen seed acts as a source of food in addition to the natural shelter of the cracks from predatory raptors or other predatory vertebrates. Damage can be so bad in some cases that growers simply rip out their old irrigation line after wheat is harvested in rotation.

Last winter UCCE installed several valves and soil moisture sensors on a grower's fields on the western end of Yolo County where many of the cracking clays (vertisols) such as Capay Clay can be found.

The 2", 4mm drip line was installed at an 8-inch depth. Some of the rows were watered thoroughly throughout the season, while some of the lines were shut off completely to simulate a standard dry-down schedule. 'Wet' rows thus remained closed (there were roughly 2-4 inches of surface crust), while 'dry' rows were allowed to dry out and open up, exposing some of the drip line to rodent gnawing and exploration deeper into the profile.

This experiment was meant to look at the extremes between treatments as a way to tease out whether or not soil moisture status had any effect on rodent damage to drip lines. Results indicate that, in these clay soils, keeping soils closed with extra irrigation might help ward off smaller rodents, in this case, mice or voles. **But the results are preliminary and cannot yet be recommended for growers.** Variables such as rodent population, damage relative to

gradations of soil moisture, and time of irrigation application have yet to be fully tested, but the overall experiment did indicate a relative difference between treatments.

Drip lines were run for about 24 hours once a week. This may have been excessive, but this ensured that soil sensors at depths of 6 and 8 inches were close to field capacity throughout the entire growing season. The water was cut off shortly before harvest to reduce compaction risk from harvesting equipment. No additional water was added after harvest, the assumption being that wheat transpiration had ceased and soil moisture would drop in the profile more slowly than it had during the season.

Future experiments will help provide some information about how much water is effective and at what point it becomes potentially detrimental to prevention efforts. Future experiments will also look to measure the relative efficacy of other techniques such as drip line wall thickness, mounding, and irrigation shut-off date.

This ultimately boils down to dollars and cents. Even if these experiments continue to show promising results for rodent damage control, if the cost of water to keep the soil closed around the drip line is greater than the labor required to fix the blocks, or if either of those are more expensive than replacing the drip line altogether, then growers will need to carefully weigh up their options; but if California risks losing acreage in subsurface drip irrigation due to increasing labor costs, then this technique is certainly worth examining further.

If any growers are looking to try these techniques out on their own land, they should start with a small area of ground and speak with their county Agronomy Advisor to ensure a sound experimental setup. Keep in mind that this experiment was conducted on cracking clay soil and that different soil types may create a different environment for rodents (damage might be worse on loamy sand, for example). Growers should invest in moisture sensors to monitor their soils around the drip line. Growers should also bear in mind the fact that the 'wet' rows were not wet at the surface but were over-watered during the season. 24-hour sets once a week on 12-inch spacing at 0.25 gph means approximately 20 inches in three months, which is close to the crop's evapotranspiration for that time period, but essentially discounts any residual soil moisture from winter rains. Finally, use a systematic approach to counting any damage at the end of the season to help you better understand whether an experimental technique worked or was just a result of an exceptional weather pattern i.e. use flags to mark repairs and carefully note which areas are being given different treatments.

Stay tuned for additional updates moving forward.

UC Resources

UCANR has many resources for agronomic crops. The Agronomy Research and Information Center provides resources by crop for many important commodities: http://agric.ucdavis.edu/

The UCANR catalog has publications available in English and Spanish: http://anrcatalog.ucanr.edu/

In collaboration with CDFA, new California specific fertilization guidelines have been developed for many crops grown in the Sacramento Valley: https://apps1.cdfa.ca.gov/fertilizerresearch/docs/guidelines.html

The Weed Research and Information Center has comprehensive resources related to weed management including a weed identification tool and information on diagnosing herbicide injury: http://wric.ucdavis.edu/index.htm

The UC Integrated Pest Management Program provides information by crop about diseases, weeds, insects, nematodes, and vertebrate pests: http://ipm.ucanr.edu/PMG/crops-agriculture.html

Finally, UC has many relevant blogs including the Small Grains Blog, and our local Sacramento Valley Field Crops Blog. A full list of UCANR blogs: http://ucanr.edu/blogs/blogcore/blogroll.cfm?sort=a