FEATURES *APRIL 2004*

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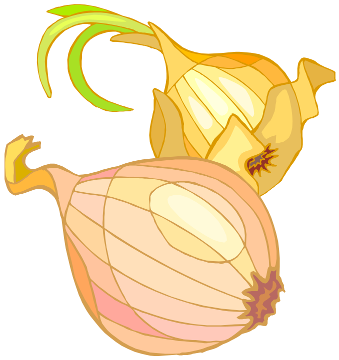

LATE SEASON ONION DISEASE

Thomas A. Turini

Several onion diseases could become apparent toward the end of the season. One is a viral disease that was recently reported in Imperial County and the others are bulb rot diseases.

Iris yellow spot virus (IYSV) was responsible for lesion development on onion seed stalks in Imperial County last year. These lesions appeared as light colored sunken oval spots that were ¼- to 1 ½-inches in length. In some affected fields, a high percentage of the seed stalks lodged before the seeds were completely formed. In Colorado, Israel and Brazil, in bulb onion crops, substantial reduction in bulb size was reported.

IYSV is transmitted by onion thrips (*Thrips tabaci*), which are common in Imperial County onion fields. In addition to onions, IYSV has been reported in iris, jimsonweed, chives and leek.

The symptoms of this disease can appear primarily on one side of the plant and may resemble injury due to a non-infectious cause. To avoid misdiagnosis, it is important that agricultural professionals in this area be aware of this virus' arrival into the Imperial Valley.

Botrytis bulb and neck rot is a problem in Imperial County onions particularly when the necks are damaged before they are well dried. This disease, which is caused by *Botrytis allii*, first appears as a soft, brown rot at the neck. As the disease progresses, the rot moves into the bulb. Bulb rot symptoms commonly occur in storage, but may be noticed in the field. When conditions are humid, gray fungal growth develops on the bulb and between the scales. Black irregularly shaped fungal resting structures (sclerotia) will be produced on the outer neck tissue or the rotten outer scales at advanced stages of the disease.

In the absence of a host, the fungus survives in the soil and in rotted bulbs as sclerotia. The fungus can also be seed borne or taken into field on infected bulbs planted for seed production. Airborne spores can penetrate succulent host tissue without a wound while moisture is present. Necks that are not cured are extremely susceptible to infection. The fungus is unable to penetrate well-dried neck tissue.

To control botrytis neck and bulb rot, make sure the neck is dry before the crop is stored. Avoid late applications of nitrogen fertilizer and don't irrigate late in the season to allow the tissue to dry before harvest. Harvest onions when the crop is mature.

Black mold, caused by *Aspergillus niger*, is characterized by a black discoloration at the neck, shallow sunken lesions on outer scales and clusters of black spores below the outer dry scales. The entire surface of the bulb may turn black and all scales may be affected in advanced stages of the disease. The bulb may become dry and shrivel, but more often a soft-rot bacteria will follow the infection. Spores of this fungus are very common in the air and soil.

Infection occurs where the tissue was injured. The fungus commonly enters where the leaves have dried or were cut, where other disease injured leaves, where disease or injury has killed the roots or where the outer scales have been bruised. Optimum temperatures for disease development are 82 - 92 °F.

Avoid injuring the crop to reduce black mold incidence. Although there are no chemicals for the direct control of black mold, fungicides that control foliar diseases will reduce the incidence of black mold. Black mold development can be suppressed by maintaining transit and storage temperatures below 55 °F.

Blue mold, caused by *Penicillium sp.*, is a common disease that appears at harvesting or in storage. The first symptoms appear as water-soaked areas on the outer surface of the scales. A blue-green powdery mold will develop on the surface of the lesion. In advanced stages of the disease the bulb may become tough and rubbery or a soft-rot may develop due to action by bacteria that may invade tissue affected by blue mold. The fungus commonly grows on dead material and invades onion bulbs through injuries, bruises and uncured neck tissue. Optimum conditions for disease development include high relative humidity and temperatures of 70° – 77°F.

Blue mold can be controlled by avoiding wounding the bulbs at harvest and by promptly curing the neck tissue. Bulbs should be stored at temperatures below 42°F.

In general, minimizing bruising or wounding of the bulbs at harvest, curing the necks, and by maintaining cool temperatures in storage and transit can reduce the incidence and severity of the bulb rot diseases.

ARMYWORM MANAGEMENT IN WHEAT AND SUDAN GRASS

Eric Natwick

The armyworm, *Pseudaletia unipuncta* (Haworth), is a widely distributed and injurious cutworm. It destroys grass and grain crops over wide areas. An attack by armyworms is often sudden and severe. Armyworm larvae have may be found in bermudagrass, wheat and sudangrass. Plantings of wheat and sudangrass may now be at risk of being infested.

Control: It is essential for effective profitable control that any armyworm infestation is discovered early. Inspect crop regularly for armyworm as well as other pests. Armyworms hide under ground litter, under lodged wheat, in soil cracks or in plant whorls during the day. Look for feeding injury to foliage. Damage to leaf blades is diagnostic, typically angular notches as apposed to round-shaped notches caused by feeding of grasshoppers and other species of worm pests. Recommended insecticides are Bt (*Bacillus thuringiensis* var. *Kurstaki)* products, Lannate SP and LV, and Sevin® 80S, 80WSP and XLR Plus.

Biological Control: *Apanteles militaris* is a common parasite of armyworm. The larvae of this wasp live within the armyworm and upon reaching full larval growth emerge to form white cocoons on leaves, under plant litter, or within the cracks in the soil where armyworms hide during the daylight period. Check fields for evidence of parasitism and take this into account when making a treatment decision.

Host Plants: Armyworm prefer grasses for food and are particularly destructive to small grains, corn and forage grasses, such as sudangrass. Armyworm problems often start and are most severe in weedy fields infested with grassy weeds such as jungle rice, barnyard grass, or bermudagrass. They may occasionally migrate as larvae to other crops such as alfalfa or sugar beets. Armyworms eat the succulent leaves of forage grasses and grain crops first. These plants may be stripped of foliage. Larvae chew angular notches in the leaves.

Biology: Armyworm moths aggregate and fly long distances carried by the wind. As moths alight in green fields, females deposit hundreds of eggs. Larvae emerging from eggs usually go undetected until serious damage to the crop calls attention to their presence. They may be numerous, more than 30 per square foot, feeding at night and hiding under plant litter, under lodged wheat, or in cracks in the soil during daylight hours. Numerous armyworms may completely devour a crop before growers can apply control measures. If their food supply becomes exhausted, the larvae aggregate and crawl to fresh fields.

Eggs are laid by female moths in narrow bands on leaf blades or under the leaf sheaths. The eggs are minute, greenish white and globular. Small larvae are pale green, while full-grown armyworms vary in color but are usually brown with varying degrees of blackish mottling and white flecks. The armyworm is frequently mistaken for the fall armyworm, but the armyworm has a dark dorsal half and pale ventral half; the opposite is true for the fall armyworm.

Armyworms overwinter as partially grown larvae in the soil or underground litter. With arrival of warmer spring weather, larvae resume feeding and development. Upon reaching maturity larvae, they cease feeding for 4 days then pupate. The pupal period may last 15 to 20 days. Adults emerging in May and June mate with peak sexual activity 5 hours after sunset. One mating is sufficient, but multiple matings may occur. Prior to egg laying, females feed for 7 to 10 days on sweet substances like honeydew, nectar or decaying fruit. Eggs are laid at night in clusters of 25 to 130 on grass or grain in folded blades or under leaf sheaths. Females live for about 17 days and can produce up to 2000 eggs.

The incubation period for eggs is 6 to 10 days. First, instar larvae feed on the upper leaf surface down to the parenchyma leaving the lower surface intact, creating a membrane window. Larger larvae feed from the leaf edge devouring all leaf tissue. Armyworm larvae feed at night and hide during the day.

There are 6 larval instars requiring 4 to 6 weeks to complete larval development. The last instar lasts about 7 days and these large worms consume more than 80 percent of all foliage eaten during the entire larval period. Full-grown larvae pupate in flimsy cocoons under litter or in earthen cells 2 to 3 inches in the soil. In warm climates such as ours, there may be 5 or more generations per year.

HAY STOCKS DOWN – CA HAY PRICE OUTLOOK STILL BULLISH FOR 2004

By Seth Hoyt, California Agricultural Statistics Service

Herman Meister*

Hay stocks in California on December 1, 2003 totaled 2,048,000 tons, down 8% from December 2002. Hay stocks in the seven western States were down 2% from a year ago. Higher stocks in Arizona and Utah were more than offset by declines in Idaho, California and Oregon. Nevada stocks were estimated to be down 3% but sources indicated that supplies of non-test, dry cow alfalfa hay were above normal in some areas.

The outlook for alfalfa hay prices improved in recent weeks with a rally in the milk futures market and a very strong butter market. Cheese prices were also firming in early February. In December when I spoke at the Alfalfa Symposium in Monterey, Chicago Mercantile Exchange (CME) Milk Futures prices for the first six months of 2004 ranged from around $11.25 to $11.75 per hundredweight (cwt.). Except for the $11.77 price for February, milk futures prices on February 6th were trading from $12.20 to $14.57/ cwt. for the balance of 2004, with June through November ranging from $13.15 to $14.57. While the California Overbase milk price dropped from $12.75 in October to $11.39/cwt. in December 2003, there are indications this trend could reverse in the coming months.

The announcement from the Monsanto Company that 2004 supplies of BST will be down around 50% was bullish to the 2004 milk market. BST increases milk production and it's estimated that 25 to 30% of dairy cows nationwide receive it. The plant in Austria that manufactures BST for Monsanto is having challenges with quality control and will reduce production and correct the problems. This, along with reduced milk production due to winter weather in the eastern part of the U.S., caused milk futures prices to surge higher. According to sources, some U.S. cheese buyers were trying to buy supplies for spring through fall of 2004 because of concerns about reduced milk supplies in the months ahead.

Other developments that may be positive for the alfalfa hay market are the higher price of protein feeds and feed grains and the ban on feeding blood meal and chicken litter to cattle. While soybean and cottonseed meal prices have been substantially higher than a year ago, they are now being joined by stronger canola meal and distillers dried grain prices. Adding to the strong protein feed market is the ban on blood meal and chicken litter as cattle feed (due to the BSE discovery). As a result, there is good demand from some dairy hay buyers for alfalfa hay with higher crude protein tests. I mentioned in Monterey in December that it appeared that the feed corn market, in spite of a very large U.S.

harvest in 2003, could be bullish the first half of 2004 due to export demand. While export demand has been good, lower than anticipated U.S. corn stocks was also a big factor for the current strong market. On February 6th, corn prices were near contract highs on the CME.

Our first indication of hay acres in California will be in the March 31 Planting Intentions report. While this report includes all hay, the trends are pretty consistent with the trend on alfalfa hay acres. Seed company representatives and trade sources indicate that alfalfa hay acres could be about the same in the northern half of California, but will probably be down in central California. Sources mention that the decline in alfalfa hay acres in central California could be due to an anticipated increase in cotton planting. The Imperial Valley Irrigation District (IID) reported 147,000 acres of alfalfa hay on January 13, 2004, down 16,000 acres from the same period last year, a 10 % decline. Growers in the Palo Verde Valley were coming closer to inking a water deal that would idle a significant amount of alfalfa hay acres in that area.

I was asked in late December what impact the BSE (Mad Cow Disease) discovery would have on the alfalfa hay market in 2004. The only impact I could see was a possible increase in milk production if dairy producers, due to a depressed slaughter cow market, culled cows at a slower rate and put bearish pressure on the alfalfa hay market. However, with the rebound in slaughter cow prices in January, and the ban on the slaughter of downer cows, it appears there will be very little, if any impact on hay growers from the BSE discovery. One source thought the ban on downer cows may help the cull rate on dairy cows as dairy producers try to avoid dealing with downer cows. A reminder to all of us involved with agriculture was how one event can drastically change the market on an agricultural commodity. The drop in the live cattle and cattle futures markets the day after the December 23 BSE announcement and the swift ban on U.S. beef exports by many countries was pretty amazing. The irony is that record high beef cattle prices the U.S. enjoyed in the fall of 2003 were mainly due to the BSE finding in Canada last May. Live cattle imports from Canada have still not been restored.

The bottom line for California hay growers in 2004: After two challenging years, it appears that the alfalfa hay market is poised to make a recovery.

*Reprinted with permission from Seth Hoyt, California Agricultural Statistics Service. The article can also be found in the California Alfalfa and Forage (CAFA) newsletter. CAFA is a worthwhile organization that supports the promotion of the alfalfa and forage industry. For information about membership, contact Aaron Kiess at 415-892-0167 or email him at akiess@cmc.net

HAY QUALITY VARIATION

Juan N. Guerrero

Baled alfalfa hay is a natural feed, and therefore naturally inclined to have variation, even when baled under similar conditions. At swathing go out and measure plants, you'll be surprised at the variation, even when you have planted all one variety in the field. Variation is a given when describing alfalfa hay quality. To determine if there is a difference between two average values, agricultural scientists measure the nature of variation within the two average values to determine if the two averages are "statistically" different or not. When a lab analyzes a hay sample, typically only ***one gram*** of ground hay is analyzed to determine the quality of tons of hay! It is therefore vitally important that the hay sample sent to the lab be correctly taken. Even at a certified lab, a 10 g hay sample may be evaluated, five *one gram* samples analyzed, and five different quality values may result, all done correctly. The "normal" range of variation for Crude Protein is ±0.5%, for Neutral Detergent Fiber ±1.0%, and for Acid Detergent Fiber ±0.7%. The alfalfa hay TDN value is calculated from the ADF value, therefore the normal variation for TDN is about ±0.5%. In California, at 100% dry matter, %TDN = 82.38 – (0.7515xADF%).

The single greatest error that is committed in submitting hay samples is inadequate number of samples. Hay samples must be taken from one single cutting, from one field, only from one variety, cut the same day, and representative of no more than 200 tons. Hay samples should be taken as close to sale date as possible. Hay samples taken soon after baling and the hay sold months later, are of little value. Long storage periods adversely affect hay quality, especially summer storage in the desert. At least 20 ***random*** core samples of hay should be taken from a single hay lot (<200 tons). The coring device should be at 3/8 inch in diameter and should penetrate the butt end of the bale at least 18 inches. The 20 core samples should be pooled and then sent to the lab.

At times, hay producers shop around for a lab that gives "good" results (high values). Great care must be taken to submit samples to certified labs only, where supposedly no sample bias exists. Labs are often under pressure from clients when samples result in low values. It is OK to split samples and send the split sample to two different labs. If the lab values are grossly different for the same sample, then send another sample to a third lab. Remember, use only *certified labs* that subscribe to lab verification methods.

Sometimes hay samples are sent out of the state, and hay RFV (Relative Feed Value) as well as TDN values are reported. TDN is calculated from the ADF value, while the RFV is calculated from ADF and NDF values. Since RFV is calculated from two values, it is prone to even more variation than TDN. To further complicate the issue, other states may use other equations to calculate TDN. When confusion arises regarding TDN or RFV, refer to the original NDF and ADF values. Chemists actually measure NDF and /or ADF; TDN and RFV are calculated values.

Another source of variation in lab reports is DRY MATTER percentage. The chemical attributes of the hay, NDF and ADF, are reported as 100% dry matter. Hay in the field, on the truck, or in the manger is not 100% dry matter. In California, hay is traded on the 90% dry matter basis. As dry matter increases, the corresponding TDN value also increases. For example, a particular hay has a TDN of 58% at 100% dry matter, at 90% dry matter the same hay will have 52.2% TDN (the TDN value is diluted by the moisture content).

The feeding value of hay is more than its TDN value. Hay may have a high TDN value but be very dry and brittle; cattle will have problems eating all the hay. The hay may have a high TDN value, but if a few oleander leaves got into the hay, it not good for the cattle! The hay may have a high TDN value, but was stored in the sun for a while and be bleached on the outside with most leaves gone from the outside layers of hay, not esthetic. The bottom line for the value of hay is how it feeds and how much milk the cows produce.

Source: D. H. Putnam; http://alfalfa.ucdavis.edu

BROWN MIDRIB FORAGES

Herman Meister

Plant Characteristics

Brown midrib (BMR) forages are unique genetic mutations incorporated into conventional plant breeding schemes of forage sorghums. These warm season plants contain the BMR trait, which gives the plant a low lignin content while increasing digestibility. Lignin is the component of the cell walls that is generally regarded as the primary factor limiting forage fiber digestion. Lignin is also responsible for the support and structure of the sorghum plant.

The BMR trait was identified and introduced into sorghums about 15 years ago. The major reason that BMR sorghums have not been successful in the past is due to lodging. Through continued breeding efforts, a compromise has been reached which provides a plant which does not lodge easily, but still has low lignin which increases digestion and animal performance.

Some BMR's also have a photoperiod sensitive trait. This means that the plant will go into the reproductive state only when day length reaches a certain point (days shorter than 12 hours and 30 minutes). In the northern states, the plant will not head-out. In tropical areas, it will head-out very early. In our area, these long daylengths occur in the first part of April.

Cultural Information

BMR's can be planted when soil temperature reaches 60° F. They should be planted from 0.5 to no more than 1.0 inch deep. It can also be no-tilled into the stubble of small grain crops. Unlike sudan for hay production, high seeding rates do not increase tonnage. Seeding rate studies suggest a planting rate of 25-30 lb./acre. Nitrogen requirements are around 100 lbs. per acre for the first cutting and 50 lbs. for subsequent cuttings. Soil tests or previous crop history can be used to adjust these amounts.

BMR's have a wide harvest window and can be harvested any time prior to heading. Good yields have been obtained when the first cutting is taken about 70 days after planting. Harvesting prior to heading will assure optimum quality for feeding. Unlike many forages, fiber deposition is retarded and quality is maintained as maturity increases. Leaving a stubble height of 6-8 inches will promote rapid regrowth from meristematic tissue and will assist in lowering the nitrate content of the feed.

Reports indicate that BMR sorghums require less of water than corn silage. A study performed by Texas Agricultural Experiment Station (TAES) at Bushland, Texas showed that BMR type sorghums can be grown with 44% less water than silage corn with out sacrificing yield. Of equal importance are reports of feeding trials conducted by University of Nebraska and TAES which show that BMR forages sorghums can produce quality silage on par with corn. To date, genetic control of the lignification process through manipulation of the BMR trait has offered the most direct approach to reducing lignin content and increasing digestibility of BMR forages.

Demonstration Trials

BMR forages have the capacity to produce high tonnage in a short time. In one trial, 12 tons with 3.6 tons of dry matter was produced in 65 days. It was baled and fed as dry cow feed. The producer reported that the acceptability of the feed by dry dairy cows was excellent. In another case, milk production was maintained as feed was changed from corn silage to BMR silage.

Feed Analysis

Standard feed analyses of BMR's may show no increase in feed value over standard forage sorghums. All forage feed analysis should include invitro digestibility to avoid underestimating the energy content of the feed. The selection process to determine appropriate hybrids to be planted should include yield as well as digestibility. All BMR hybrids will vary as to adaptation to cultural practices, harvest schedules, and feed value. Consult your feed nutritionist and local seed representative for proper hybrid selection.

ESTIMATING EVAPORATION FROM WET SOILS.

Khaled M. Bali and Rick L. Snyder

How long does it take for my field to dry up after a rainfall event? How can I minimize soil compaction after rainfall events? How can I estimate crop coefficients during the early stages of crop growth? To answer these questions, you need to estimate evaporation from wet soils or nearly wet after irrigation or rainfall events.

In general, estimates of crop water use can be made from reference evapotranspiration (direct evaporation from soil surface and transpiration through crop leaves) and crop coefficients. Reference evapotranspiration (real time ET_o or normal ET_o) and crop coefficients (K_c) are commonly used to predict the consumptive water (ET_c) use for a particular crop from the following equation:

$$ET_c=K_c*ET_o$$

Real time or normal ET_o and K_c values are available from California Department of Water Resources and University of California (see California irrigation Management Information System (CIMIS)). Crop coefficient values during early growth stages vary widely and depend mostly on wetting frequency (irrigation management or rainfall frequency) of bare or nearly bare soil, amount of energy available for evaporation (weather conditions) and soil type (soil hydraulic properties). Estimating evaporation from bare soil is also important for many agricultural applications. Such applications include agricultural operations after leaching irrigation to minimize soil compaction and estimating upward movement of salts from water table (groundwater) after irrigation termination (soil evaporation between the end of one growing season and the beginning a new growing season).

We conducted several experiments at the University of California Desert Research and Extension (UCDREC) near Holtville and at the Mesa Farm of the University of Arizona near Yuma, Arizona to estimate evaporation from bare soils. Soil evaporation was determined as the residual of the energy balance equation, where net radiation, soil heat flux, and sensible head flux density were measured. Soil hydraulic properties (hydraulic conductivity and infiltration rates) were also measured. Evaporation occurs in two stages, the first stage is when soil is saturated or nearly saturated after an irrigation event (Stage 1) and then Stage 2, where evaporation depends on soil hydraulic properties as well as weather conditions. Evaporation during Stage 1 is mostly controlled by the amount of energy available for soil evaporation. Accurate estimates of Stage 2 evaporation can be achieved by using site-specific soil hydraulic parameters and weather conditions.

Early stage crop coefficient or evaporation coefficients could be obtained from Figure 1. More information about evaporation from bare or nearly bare soil can be found in the publications listed below. Please feel free to contact us (352-9474 or kmbali@ucdavis.edu) for a copy of the publication.

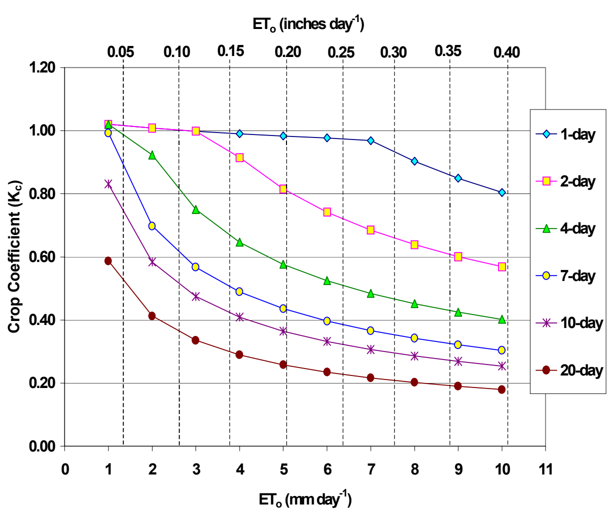

Figure 1. Crop coefficient, Kc as a function of daily ETo and wetting frequency (irrigation or rainfall events) for bare or nearly bare soils.

References:

1- Snyder R. L., K. M. Bali, F. Ventura, and H. Gomez-MacPherson. 2000. Estimating Evaporation from Bare or Nearly Bare Soil. American Society of Civil Engineers, Journal of Irrig. & Drain. Engr. Vol. 126, No. 6, 399-403.

2- Ventura F., B. A. Faber, K. M. Bali, R. L. Snyder, D. S. Duce, and K. F. Schulbach. 2001. Model for Estimating Evaporation and Transpiration from Row Crops. American Society of Civil Engineers, Journal of Irrig. & Drain. Engr. Vol. 127, No. 6, 339-345.

THE BIOTERRORISM ACT OF 2003

Herman Meister and Michael Rethwisch*

The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 directs the FDA to take steps to protect the public from threatened or actual terrorist attacks on the U. S. food supply and other food related emergencies.

To carry out certain provisions of the Bioterrorism Act, the FDA has established new regulations requiring that food facilities register with the FDA and that the FDA be given advanced notice of shipments of imported food.

This act went virtually unnoticed by most of us in the agriculture community. It came to our attention belatedly, so we will provide you with information to assist you in determining whether you need to register or not. One source of information that would be helpful is on line at **http://www.fda.gov/oc/bioterrorism/bioact.html** This site provides assistance in signing up online if desired. There is no cost for signing up. If you do not have internet access, you can request the booklet "What you need to Know about Registration of Food Facilities" or a copy of form 3537 (registration form) from the FDA by phone (1-800-216-7331) from 7 a.m.-11 p.m. EST.

Domestic and foreign facilities that manufacture, process, pack, or hold **food** for human or animal consumption in the U.S. must register with the FDA by December 12, 2003. Included in the definition of food was "raw agricultural

commodities for food use" which pertains to both animal and human food, and affects many people in the low desert.
Registration is required to assist the FDA in determining the location and source of a potential bioterrorism incident or an outbreak of food-borne illness. Just who needs to register is *question*. In general, if you grow and harvest a crop (washing, trimming outer leaves, and cooling are part of harvesting) and do not process it for retailing or commercial use, then you do not have to register. For example, if you harvest watermelons and apply a sticker (labeling) to the melon, then you should register. Cotton delivered to the gin by the farmer would not require the grower to register, but if the gin sells the cottonseed, the ginning company would have to register. Alfalfa hay growers will not have to register unless they operate a press and ship domestically. Sugar beet growers will not have to register, but Holly Sugar should register. Many of you grow various crops, so each of you will have to determine for yourself whether not you should register.

For specific information, you may contact Barbara Rincon, US FDA Compliance Officer. She is located in Irvine, CA at 940-608-4439.

*Michael Rethwisch, UCCE Farm Advisor, Riverside County

FUGINCIDE RESISTENCE MANAGEMENT

Thomas A. Turini

When a fungicide is used, any fungi resistant to the applied material survive at a higher rate than sensitive individuals. This results in the increase of resistance in the fungal population to subsequent applications of materials with the same mode of action.

The likelihood that fungicide resistance will become a problem partially depends upon the mode of action of the fungicide. Fungicides with a single-site mode of action kill by interfering with a single biological process. Some fungi within a population may have a slightly different biology that allows them to survive exposure. Multiple-site fungicides disrupt many processes that are essential to the survival of a fungus. Therefore, it is unlikely that an individual will be resistant to a multiple-site fungicide. The mode of action and risk of resistance of selected fungicides are presented in Table 1.

Other factors that influence chances fungicide resistance development includes the period of time the fungal population is exposed to the material and the number of fungi exposed. A fungicide that is applied several times during a season is much more likely to have resistance problems than a fungicide applied once. The larger the population exposed to a fungicide the greater the chance of resistance development. Therefore, fungal pathogens with high rates of reproduction are most likely to develop fungicide resistance. In addition, applying fungicides after the target is widespread in the field exposes a larger population to the material.

Fungicide use patterns influence resistance development. Use fungicides protectively. When the fungicide is on the crop before the disease is widespread, fewer individuals are exposed to the material than if the material is applied to field in which the disease is already severe. Use a tank mix with materials that have a low resistance potential. When multiple applications are necessary, alternate fungicides with different modes of action.

Cultural practices that may help reduce fungicide resistance include using disease resistant varieties, maintaining proper soil fertility, avoiding sites with high disease pressure and rotating crops.

Failure of a fungicide application to control the disease does not necessarily indicate resistance is a problem. Other factors such as improper timing, poor coverage, insufficient rate and low effectiveness of the material can also cause poor disease control. However, many of our fungicides are at risk and careful attention to failures of applications is justified.

Table 1. Properties of selected fungicides

Class	**Mode of Action (MOA)**	**Single-Site MOA**	**Trade Names of Compound(s)**	**Systemic Activity**	**Resistance Potential**
Benzimidazole	Interferes with the synthesis of DNA	Yes	*Benlate, Topsin*	Yes	High
Dicarboximide	Inhibits spore germination and fungal growth	No?	*Ronilan, Rovral*	Yes	Moderate
Carbamates	Inactivates enzymes probably inhibiting respiration	No	*Dithane, Maneb, Thiram*	No	Low
Inorganic - Sulfur	Inhibits respiration and forms H_2S, which is toxic to most cellular proteins	No	*Various*	No	Low
Isophthalonitrile	Affects various enzymes and metabolic processes	No	*Bravo*	No	Low
Phenylamide	Interferes with RNA polymerase template complex	Yes	*Ridomil Gold*	Yes	High
Strobilurin	Disrupts electron transport in the mitochondria	Yes	*Cabrio, Flint, Quadris*	Yes	High
Triazole	Inhibits sterol production	Yes	*Bayleton, Folicur, Rally*	Yes	High
Imidazole	Inhibits sterol production	Yes	*Procure*	Yes	High

MEETING NOTICE: A Conservation Tillage Demonstration Field Day and Seminar is planed in cooperation with the NRCS for **May 19th**. Mark your calendar now for this special event.

CIMIS REPORT

Khaled Bali and Steve Burch*

California Irrigation Management Information System (CIMIS) is a statewide network operated by California Department of Water Resources. Estimates of the daily reference evapotranspiration (ET_o) for the period of April 1to June 30 for three locations in the Imperial County are presented in Table 1. ET of a particular crop can be estimated by multiplying ET_o by crop coefficients. For more information about ET and crop coefficients, contact the UC Imperial County Cooperative Extension Office (352-9474) or the IID, Irrigation Management Unit (339-9082).

Please feel free to call us if you need additional weather information. Or check the latest weather data on the worldwide web. Imperial County Weather Stations:
http://www.ipm.ucdavis.edu/calludt.cgi/WXSTATIONLIST?COUNTY=IM
California weather databases: http://www.ipm.ucdavis.edu/WEATHER/weather1.html
CIMIS web page: http://www.cimis.water.ca.gov/

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

Station	April		May		June	
	1-15	16-30	1-15	15-31	1-15	16-30
Calipatria	0.26	0.29	0.32	0.36	0.39	0.40
El Centro (Seeley)	0.24	0.28	0.31	0.34	0.36	0.38
Holtville (Meloland)	0.25	0.28	0.32	0.35	0.38	0.39

Eric T. Natwick
County Director