HEALTHY FOOD SYSTEMS • HEALTHY ENVIRONMENTS • HEALTHY COMMUNITIES • HEALTHY CALIFORNIANS

University of California
Agriculture and Natural Resources
Making a Difference for California
Cooperative Extension Sutter-Yuba Counties

Rice Notes

October 2010

IN THIS ISSUE

- Insects of Farm Stored Rice
- How Long Does it Take for Rice to Ripen?
- Measuring Grain Moisture Content before Harvest
- Using a Desiccant to Accelerate Dry Down
- What a Year for Rice Blast

Produced by:

Christopher Greer
UC Farm Advisor
UCCE Sutter, Yuba, Placer and Sacramento Counties
cagreer@ucdavis.edu

Insects of Farm Stored Rice

Luis Espino, UC Farm Advisor Colusa County

When inspecting stored rice, one may find that insect numbers increase dramatically in short periods of time. This sudden explosion of insects may lead you to believe that they all came crawling or flying into the bin from a nearby location, such as a field, weed patch or the neighbor's bins. Most likely these insects originated in your own bin. The insects that infest stored rice can survive in grain residue inside the bin or around the storage area. Later, when bins are filled, these insects, extremely well adapted to the temperature and moisture conditions of stored grain, will reproduce exponentially and may cause problems.

Initial infestation of farm stored rice can originate outside grain bins. A few insects might take refuge and survive in weeds, other nearby bins, even rice fields. Several stored rice insects are strong flyers and can find their way to a filled bin. More often, however, stored grain insects survive inside farm bins when there is no grain in the bin, that is, when we think there is no grain inside the bin. Very small amount of grain residue, such as spilled grain, broken kernels, or grain dust can be used by these insects to survive between harvests. An almost undetectable number of insects can live in these residues, but because of their high reproductive capacity, a few insects when bins are filled with grain may result in large infestations later on. For example, female rice weevils can lay between 300 and 400 eggs. Under favorable conditions, larvae will emerge from these eggs and go through four larval instars and a pupal stage, after which they will become adults, all in just 35 days. These new adults will mate and females lay eggs, repeating the cycle. Soon, you will have a large weevil infestation. Another insect, the confused flour beetle, starting from a single pair, can reach a population of over 1 million in just five months! These figures demonstrate how easily grain can be infested when a few insects survive inside an empty bin.

Insects infesting stored rice can be classified as internal or external feeders. Internal feeders develop inside the kernel and feed on the embryo and endosperm; these are also referred to as “hidden infesters” because they can’t be easily seen when inspecting the rice. They are considered important because they directly affect the grain; milling quality is reduced, milled rice can be contaminated, and, in the case of seed, germination can be affected. External feeders develop outside the kernels and use brokens, dust, fines, bran and other small particles as food. The activity of large numbers of both internal and external feeders produces heat, which in turn can promote spoilage. A special group within the external feeders is one consisting of fungus (mold) feeding beetles. These do not damage the grain directly, but their presence indicates that mold is developing on the grain. Additionally, these beetles can reach high numbers and cause a load of rice to be classified as “infested” when delivered to the mill, or they might be confused with more damaging pests and trigger an unnecessary fumigation. Either way, it is important to monitor the grain constantly to detect any signs of infestation early on so that management measures can be taken.

A recent survey of farm-stored rice has shown that mold feeding insects predominate during the first few months of storage (see figure 1). The survey found that the most common insects were silken fungus beetles, the hairy fungus beetle, minute brown scavenger beetles and the foreign grain beetle. When “panning” your rice, you will probably find high numbers of these beetles, especially right after harvest. It is possible that these beetles were picked from the field during harvest. For example, if rice lodged and panicles came in contact with water, there might be mold growing on the grains at the time of harvest. Fungus beetles can be found feeding on this mold in the field and can be picked up with the combine. Or, as mentioned earlier, they might have been feeding on mold growing on grain residue inside the empty bin.

If during storage, grain is aerated and dried properly, mold will be eliminated and the insect infestation will be drastically reduced. Fungus feeding beetles will have to move somewhere else where they can find food. During the survey, proper aeration caused the insect population to drop from 3 to less than 0.5 insects/trap/day in 3 months. Other damaging insects of stored rice, such as the Angoumois grain moth, lesser grain borer or rice weevil, were not found during the farm survey. These insects become active in stored rice when temperatures start increasing early in the spring and thrive during the hot summer months. If you store rice during the summer, increase your monitoring efforts and keep an eye out for these insects.

The best way to prevent insect infestations during farm storage is the use of good sanitation practices. Following are some important tips worth remembering that can help you reduce the risk of infestation and avoid the need for expensive fumigations:

- Carefully clean your bins before putting in the new crop. Vacuum residues if possible. Include the bin base, walls, conveyors, cracks and crevices. Remember that insects can survive in very small grain residues.

- Clean the area around bins, remove grain spills, hulls, weeds and trash.

- Clean combines, bankouts, trailers and all other transport equipment before and during harvest.

- Don't store new crop on top of old grain. Grain that has been stored for a year most likely contains insects that will move to the new crop.

- Treat the inside and outside surfaces of bins, and the floors of the storage area with approved residual insecticides 4 to 6 weeks prior to harvest.

- Clean rice before storage. Rough rice containing large amounts of brokens and fines is attractive to insects. Presence of chaff, weed residues and seeds can also interfere with aeration and promote mold development.

Before harvest, take the time to inspect your bins and surrounding areas to make sure you reduce the sources of initial infestations. After harvest, monitor your rice regularly, at least every two weeks during winter and weekly during spring and summer. Don't let insects steal part of your hard earned profits.

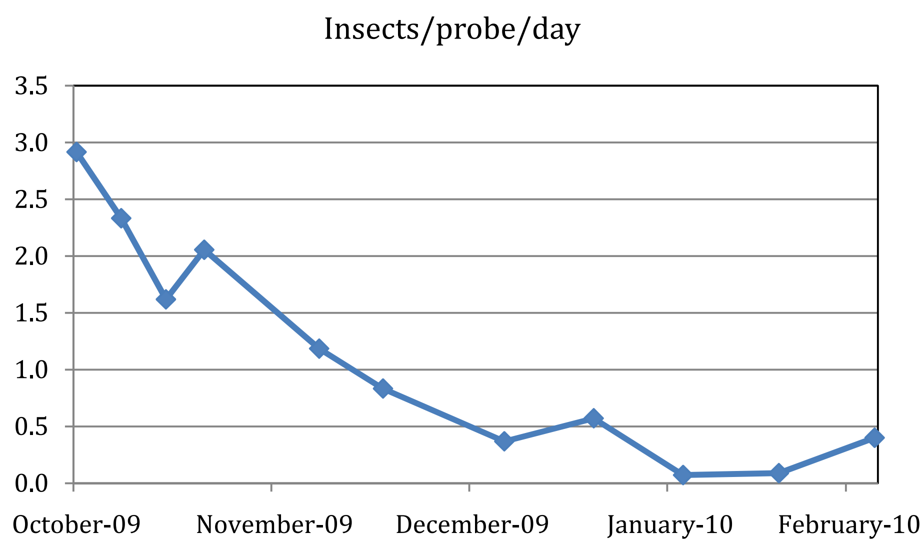

Figure 1. Number of mold feeding beetles caught with probe traps in farm stored rice, Glenn County, 2009-2010.

How Long Does it Take for Rice to Ripen?

Cass Mutters. UC Farm Advisor Butte County

The moisture content (MC) in many fields planted in mid to late May is likely to be around 27 to 28% this week for the early maturing varieties (e.g. M205 & M206). Projected temperatures for the next 10 days are expected to be in the mid to upper 80's. Cooler temperatures during grain maturation contribute to good head rice yields. It is thought that under such conditions the starch in the endosperm is more structurally sound and therefore less prone to breaking during the milling process.

Grain dry down should progress fairly steadily for the remainder of the month. Keep in mind that the MC of M206 will sometimes 'hang' around 25% and remain unchanged for several days. Based on research conducted last year and irrespective of drain time, the grain dry down rate for M205 and M206 was 0.6% and 0.9% per day, respectively (figure 2). M202 dried at a rate similar to M206. The early drained fields (e.g. 16 days after heading, DAH) did begin drying down sooner, but the rate of moisture loss from the kernel was comparable across drain dates. If we use these values as a general guideline then 28% M205 today would be approaching a harvest MC of 20% in about 13 days. M206 would be ready in about 9 days assuming that it doesn't stall at 25% MC.

As a point of reference and based on the CIMIS station in Durham, the average temperatures from October 1 to October 25 last year were 71° and 47°, maximum and minimum. Compared to the long term average, 2009 was a cool year in October. The long term maximum and minimum average temperatures are 81° and 49° F. Of course, higher temperatures will accelerate the grain dry down rate as would a north wind.

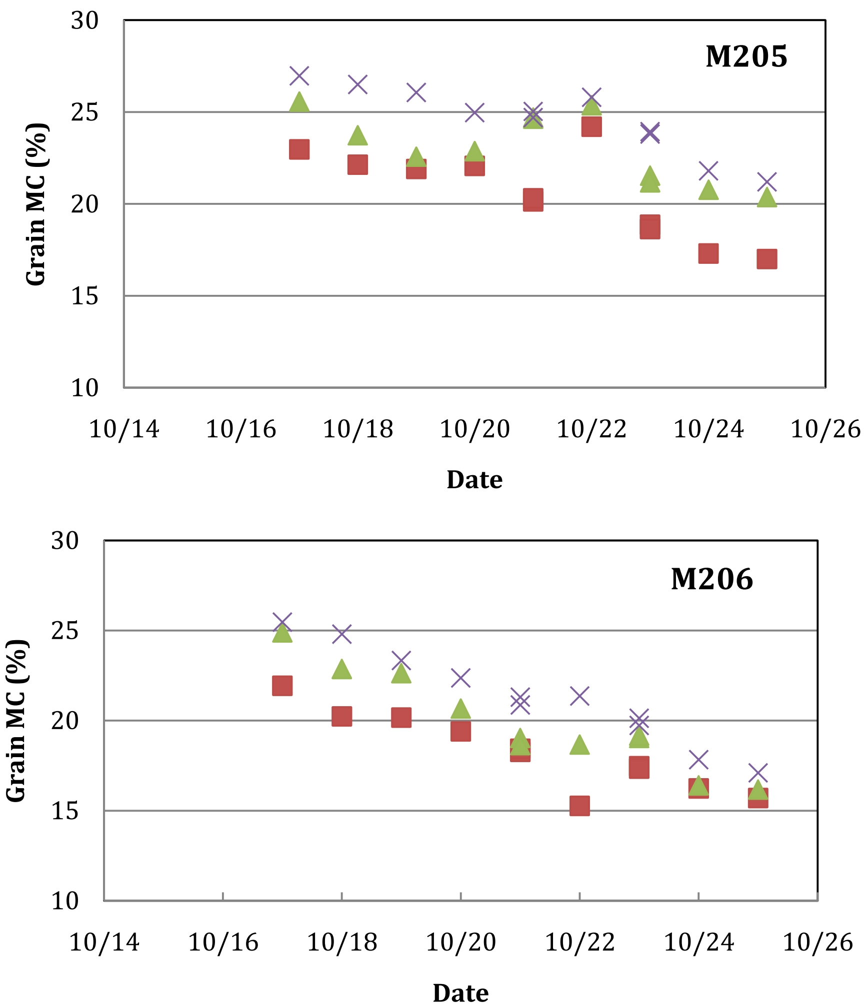

Figure 2. The loss in grain moisture over time for M205 and M206 in 2009 at the RES when drained at 16 (■), 20 (▲), and 24 (X) days after heading (DAH).

Measuring Grain Moisture Content before Harvest

Cass Mutters, UC Farm Advisor Butte County

Measure the grain moisture content (MC) at the same time every day. Mid day is a good choice after the dew has evaporated. Here's why. Grain moisture content (MC) may vary by as much as 5% during the day with the highest MC in the early morning before the dew evaporates (figure 3). When using MC to determine when to harvest, it is important to sample at a consistent time of day. Additionally, the rice can reach a particular MC several times before harvest. This partially explains why rice harvested at an "optimal" MC may produce low quality rice. The greater number of wet-dry cycles the rice experience, the increased likelihood of fissures. The portion of the figure where MC does not change is during a north wind period. There is minimal loss of head rice during the north period, which can be offset by the reduced drying costs. The fissuring of the kernel occurs when the wind stops and the diurnal hydration-dehydration cycles return.

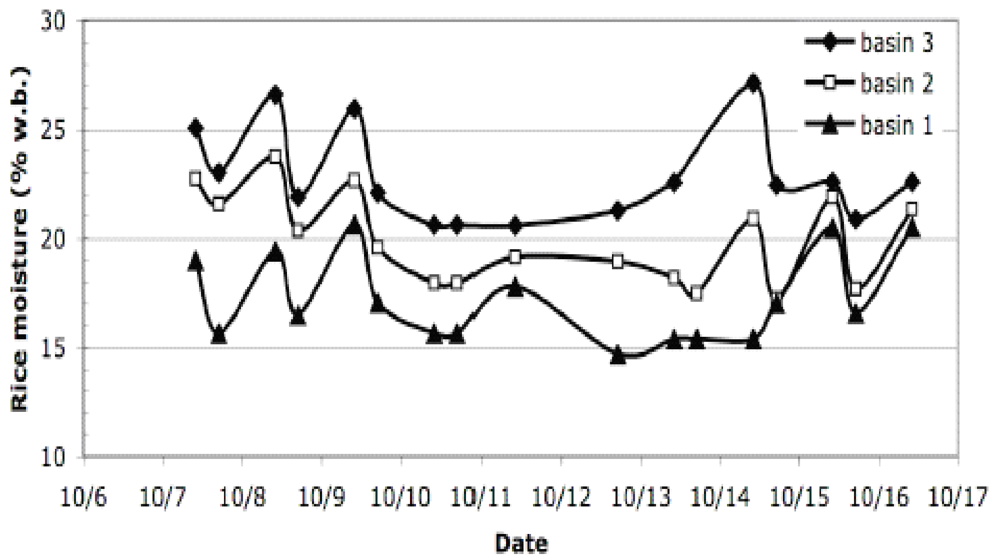

Figure 3. The diurnal variation in kernel moisture content when drained at 12 (basin 1), 16 (basin 2) and 20 (basin 3) days after heading in 2007.

Using a Desiccant to Accelerate Dry Down

Cass Mutters, UC Farm Advisor Butte County

In the event that the rice fails to dry to harvestable moisture content (MC) due to low temperatures and/or rain, it may be necessary to apply a desiccant. Sodium chlorate is a crop desiccant that is registered for use in California rice. This compound has been used only occasionally in California. Consequently, information on its use on California varieties is sparse. Systematic trials conducted in southern rice producing states provide some basic guidelines and reassurance that yield and quality are not affected when sodium chlorate is used at label rates. However it is reported that application when the average kernel moisture was above 25% risked reducing milling quality. This potential injury is associated with the variation in individual grain MC on a plant. For example, at an average MC of 25%, there will be kernels with MC above 27%, the point at which the kernel is physiological mature. Once sodium chlorate is applied these high moisture kernels will stop growing and will not mature. Do not apply sodium chlorate earlier than about 35 to 40 days after heading. The studies also found seed germination unaffected by sodium chlorate, should the need arise to treat a seed field.

Plants treated with sodium chlorate rapidly dry over the course of just a few days, typically within 24 to 48 hours of application. During that period the grain MC can drop as much as 5%. It is advisable to apply it only on the acres that can be harvested within 3 to 5 days after application. This is especially important under California conditions. Referring back to Figure 3, if the kernels are rehydrated by dew or rain after being dried down they will crack. When using sodium chlorate, harvest as soon as the kernels reach the desired MC to protect milling quality.

What a Year for Rice Blast

Chris Greer, UC Farm Advisor

The geographic distribution, incidence and severity of rice blast have been much greater in 2010 than in recent years. There are several factors that may be contributing to this situation. For any plant disease you must have a susceptible host, favorable environment, and the presence of the pathogen for disease to occur. All of these factors seem to have come together in 2010. At season's end, I will evaluate the climatic data to tease out any conditions or trends that may have favored rice blast this year. Questions always arise as to why rice blast may be found in one field and not another. There are several factors that influence the susceptibility or tolerance of rice plants to rice blast disease.

Plant Resistance and Rice Blast

First and foremost is the inherent resistance of a specific rice variety. Currently, M208 is the only variety commercially available in California with a specific resistance gene to the race of the pathogen identified here. Unless a new race of the pathogen is introduced into California or the current race mutates and evolves to overcome the resistance gene, M208 will maintain its resistance to rice blast in California. None of the other rice varieties grown in California have specific resistance to rice blast. These varieties do however differ in their tolerance to infection by the pathogen. M104 and M205 appear to be the least tolerant of the most widely grown commercial varieties, while M202 and M206 are somewhat more tolerant. It is not unusual to see areas where M104 and M205 plants have been killed entirely by leaf blast.

There are also differences in tolerance due to plant tissue age. Younger, more succulent rice tissue is much more susceptible to rice blast than is older tissue. For example, panicle neck nodes are much more susceptible to infection at emergence when tissue is green than they are once the panicle has tipped and started to ripen. One of my concerns in 2010 is that delayed planting coupled with a mild growing season may have combined with favorable environmental conditions to present a wider window for leaf blast infections to occur and produce copious amounts of infectious spores.

Water Management and Rice Blast
Any practice which leads to aerobic conditions in the soil predisposes rice plants to rice blast disease. Drill seeding and draining for stand establishment or herbicide applications in water seeded systems increase the risk of infection and susceptibility to rice blast. Rice plants grown in deeper water exhibit increased resistance to the disease over those grown in shallower water depths. This is apparent when we often see localized increased disease severities associated with high spots within a field. From an irrigation standpoint, maintaining a deep continuous flood is the best option for minimizing the risk associated with rice blast disease.

Nitrogen Fertility Management and Rice Blast
The impact of fertility management on rice blast disease susceptibility may be easily seen in affected fields where excessive levels of nitrogen have been applied. Excessive nitrogen fertilizer rates lead to increased host susceptibility, disease incidence, and disease severity. Areas where leaf blast is so severe that plants are actually killed often occur in aqua overlaps in fields planted to less tolerant varieties such as M104 and M205.

Plant Stress and Rice Blast
Any form of stress may predispose rice plants to rice blast disease. Even slight stress may significantly alter the plant's ability to tolerate infection by the pathogen. Nutrient deficiencies such as potassium and silica have been shown to significantly increase rice blast disease incidence and severity around the world. Other common stresses that may impact disease tolerance in California may include salinity, extreme temperatures, and herbicide injury. Managing the rice crop to avoid plant stress is a significant and often overlooked tool in minimizing risk associated with rice blast disease.

Converging Factors and Rice Blast
As you can see there are many factors that influence the incidence and severity of rice blast in a specific field. I have only scratched the surface and there are many other factors that play a role. Rice blast is a very complicated disease that has the ability to increase in incidence and severity very rapidly under the right conditions. Growers need to manage for this disease in a holistic approach rather than just relying on fungicide applications for effective management. Little changes here and there in cultural practices can add significantly to the management of this disease.