Field Notes

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Earlier this week I sent out an edition dedicated to determining when to drain rice fields. Following that request I was also asked to address a few issues regarding grain drying. I am not an engineer and do not pretend to be. The following information is taken from the Extension publication Rice Drying on the Farm first published by the University of Arkansas and later by the LSU Extension service. It is fairly old, but the physics of drying has not changed. The information in standard type is from the original publication. *The comments in italics are my crude explanations.*

Drying rice is accomplished by passing large volumes of heated or unheated air over the rice kernel so that the vapor pressure within the kernel is higher than the vapor pressure of the air surrounding the kernel. Thus, the moisture moves from the kernel to the surrounding air and is transported to the atmosphere. *This means you blow air over the grains to get moisture out of the grains. Sometimes adding heat to that air is necessary.*

This process of removing moisture from the rice should be slow to avoid stress cracking the kernel. Stress cracking reduces head rice yield.

The grains in the photo on the left are of Jupiter with very little fissuring or stress fracturing while those on the right have significant fissuring or stress fracturing. When milled these grains are likely to break.

Airflow rates for drying vary from a low of .5 cubic feet per minute (CFM) per bushel to a high of 50 or more CFM per bushel—dependent on the initial moisture content of the rice. *There are 3.6 bushels per barrel of rice. Remember the original publication was written in Arkansas where they express yield in bushels. The wetter rice is the higher the air flow must be.* The table below provides the recommended **minimum** airflow rates for different moisture contents.

13 to 15 percent moisture	.5 to 1 CFM per bushel
15 to 18 percent moisture	2 CFM per bushel
18 to 20 percent moisture	3 CFM per bushel
20 to 22 percent moisture	4 CFM per bushel
22 percent moisture and above	6CFM per bushel

The amount of heat added to the drying air is dictated by the desired final rice moisture content and the ambient air temperature and humidity. The objective is to add just enough heat so that the drying air is in equilibrium with the desired final moisture content. *This means add more heat as humidity increases and add more heat if temperature decreases.*

What is equilibrium moisture content? At a given temperature and relative humidity, there is a corresponding moisture content at which the rice will not lose or gain moisture from the air. *Got that? That means that if you did nothing to dry rice, but you did leave it exposed to the air it will eventually dry down to a level at which the moisture inside the grain and outside the grain are stable.*

What is relative humidity? *This is the amount of moisture in the air at a specific temperature **compared to** the amount the air is capable of holding at that temperature. It is determined by comparing **wet bulb** and **dry bulb** temperatures. These are obtained by using a **sling psychrometer**. A sling psychrometer is a board attached to a handle with something strong but flexible, such as a chain, so it can be swung around in a circle. On the board are two thermometers. One of the thermometers has a piece of cloth covering the bulb. This piece of cloth is moistened then the board is swung several times. The thermometer with the wet cloth covering the bulb is the **wet bulb** thermometer. When the thermometers are swung through the air rapidly moisture will evaporate from the wet bulb thermometer producing a cooling effect and a lower temperature reading than the uncovered thermometer. If the air is really moist the temperature will not drop as much as when the air is dry. Special charts are then used to compare the wet bulb and dry bulb temperatures and determine the relative humidity. That is why 95°F in south Louisiana feels a lot more uncomfortable than 95°F in Arizona and the basis of the phrase "It is not the heat it is the humidity". The dry Arizona air allows your body to cool as perspiration evaporates from your skin producing the same effect as the wet bulb reading. In Louisiana all you do is get wet.*

When drying rice one common question is, "How much heat do I need?" Under the right conditions, none. First, decide on the moisture level you want to dry down to. A 12% and a 13% chart are supplied. Then measure the temperature with the sling psychrometer. A chart should be supplied with the instrument that

the dry bulb temperature on one straight axis and the wet bulb temperature on a curved axis. Where these two numbers intersect in the chart gives you the relative humidity.

The temperature of the air being used to dry the rice is the next number needed. The space between the base of the grain bin and the rice is the plenum. The most accurate temperature reading should be taken in the plenum.

The rice drying charts have temperature on the left (vertical) side and relative humidity across the top (horizontal) side. Where these lines intersect are two numbers; the top number is the equilibrium moisture and the bottom number is the amount of heat in degrees F that must be added to the drying air.

For example:

The rice is to be dried to 12% moisture.

The plenum or ambient air temperature is 75°F. The relative humidity is 65%. In this situation the air should be heated 4°. This could happen at night around here.

If the plenum temperature is 60°F and the relative humidity is 65% it would take an additional 6° of heat to accomplish the same drying result.

At temperatures above 85°F no additional heat is needed until the relative humidity reaches or exceeds 60%.

If the relative humidity is 50% or less no heat is needed until the temperature drops to 45°F.

Some modern equipment monitors these factors, makes the necessary calculations and decides whether to add heat or not and how much to add. Some systems do not use any additional heat substituting very high air flow rates to accomplish the same thing.

Plenum temperature should not be allowed to exceed 105°F.

Without the additional engineering training I can't offer much more than this. Hope it helps.

RICE DRYING CHART
12 %

EQUILIBRIUM MOISTURE CONTENT (WET BASIS) OF GRAIN AT VARIOUS TEMPERATURES AND HUMIDITIES
AND
DEGREE OF HEAT NEEDED TO DRY YOUR GRAIN TO 12 PERCENT MOISTURE CONTENT
DO NOT EXCEED 105 DEGREE F PLENUM TEMPERATURE

TEMP (F)	PERCENT RELATIVE HUMIDITY																
	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
40	7.2 0	8.1 0	8.9 0	9.7 0	10.4 0	11.0 0	11.7 0	12.3 2	13.0 4	13.6 5	14.3 7	15.0 9	15.8 11	16.6 13	17.5 14	18.7 16	20.4 17
45	7.1 0	8.0 0	8.8 0	9.5 0	10.2 0	10.8 0	11.5 0	12.1 1	12.8 3	13.4 5	14.1 7	14.7 9	15.5 11	16.3 12	17.2 14	18.4 16	20.1 18
50	6.9 0	7.8 0	8.6 0	9.3 0	10.0 0	10.7 0	11.3 0	11.9 0	12.5 3	13.2 4	13.8 7	14.5 9	15.2 11	16.0 13	17.0 14	18.1 16	19.8 17
55	6.8 0	7.7 0	8.5 0	9.2 0	9.9 0	10.5 0	11.1 0	11.7 0	12.3 2	13.0 5	13.6 6	14.3 9	15.0 11	15.8 12	16.7 13	17.9 15	19.5 16
60	6.7 0	7.6 0	8.3 0	9.0 0	9.7 0	10.3 0	10.9 0	11.5 0	12.2 1	12.8 4	13.4 6	14.1 8	14.8 9	15.6 11	16.5 13	17.6 14	19.2 16
65	6.6 0	7.5 0	8.2 0	8.9 0	9.6 0	10.2 0	10.8 0	11.4 0	12.0 0	12.6 3	13.2 5	13.9 7	14.6 9	15.4 11	16.3 13	17.4 14	19.0 16
70	6.5 0	7.3 0	8.1 0	8.8 0	9.4 0	10.0 0	10.6 0	11.2 0	11.8 0	12.4 2	13.0 4	13.7 7	14.4 9	15.1 10	16.0 12	17.1 14	18.7 15
75	6.4 0	7.2 0	8.0 0	8.7 0	9.3 0	9.9 0	10.5 0	11.1 0	11.6 0	12.2 1	12.9 4	13.5 6	14.2 8	15.0 10	15.8 12	16.9 14	18.5 15
80	6.3 0	7.1 0	7.9 0	8.5 0	9.2 0	9.8 0	10.3 0	10.9 0	11.5 0	12.1 1	12.7 3	13.3 5	14.0 8	14.8 9	15.6 11	16.7 13	18.3 15
85	6.2 0	7.0 0	7.8 0	8.4 0	9.0 0	9.6 0	10.2 0	10.8 0	11.4 0	11.9 0	12.5 3	13.2 5	13.8 7	14.6 9	15.4 11	16.5 13	18.0 14
90	6.2 0	7.0 0	7.7 0	8.3 0	8.9 0	9.5 0	10.1 0	10.6 0	11.2 0	11.8 0	12.4 2	13.0 4	13.7 7	14.4 9	15.3 10	16.3 12	17.8 14
95	6.1 0	6.9 0	7.6 0	8.2 0	8.8 0	9.4 0	10.0 0	10.5 0	11.1 0	11.6 0	12.2 1	12.9 4	13.5 6	14.2 8	15.1 10	16.1 12	17.6 14

RICE DRYING CHART
13 %

EQUILIBRIUM MOISTURE CONTENT (WET BASIS) OF GRAIN AT VARIOUS TEMPERATURES AND HUMIDITIES
AND
DEGREE OF HEAT NEEDED TO DRY YOUR GRAIN TO 13 PERCENT MOISTURE CONTENT
DO NOT EXCEED 105 DEGREE F PLENUM TEMPERATURE

TEMP (F)	PERCENT RELATIVE HUMIDITY																
	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
40	7.2 0	8.1 0	8.9 0	9.7 0	10.4 0	11.0 0	11.7 0	12.3 0	13.0 0	13.6 2	14.3 4	15.0 5	15.8 7	16.6 9	17.5 10	18.7 12	20.4 13
45	7.1 0	8.0 0	8.8 0	9.5 0	10.2 0	10.8 0	11.5 0	12.1 0	12.8 0	13.4 2	14.1 3	14.7 5	15.5 7	16.3 8	17.2 10	18.4 12	20.1 14
50	6.9 0	7.8 0	8.6 0	9.3 0	10.0 0	10.7 0	11.3 0	11.9 0	12.5 0	13.2 1	13.8 3	14.5 5	15.2 7	16.0 9	17.0 10	18.1 12	19.8 14
55	6.8 0	7.7 0	8.5 0	9.2 0	9.9 0	10.5 0	11.1 0	11.7 0	12.3 0	13.0 0	13.6 2	14.3 5	15.0 6	15.8 9	16.7 10	17.9 11	19.5 12
60	6.7 0	7.6 0	8.3 0	9.0 0	9.7 0	10.3 0	10.9 0	11.5 0	12.2 0	12.8 0	13.4 2	14.1 4	14.8 5	15.6 7	16.5 9	17.6 10	19.2 12
65	6.6 0	7.5 0	8.2 0	8.9 0	9.6 0	10.2 0	10.8 0	11.4 0	12.0 0	12.6 0	13.2 1	13.9 3	14.6 5	15.4 7	16.3 9	17.4 11	19.0 12
70	6.5 0	7.3 0	8.1 0	8.8 0	9.4 0	10.0 0	10.6 0	11.2 0	11.8 0	12.4 0	13.0 0	13.7 3	14.4 5	15.1 6	16.0 8	17.1 10	18.7 11
75	6.4 0	7.2 0	8.0 0	8.7 0	9.3 0	9.9 0	10.5 0	11.1 0	11.6 0	12.2 0	12.9 0	13.5 2	14.2 4	15.0 6	15.8 8	16.9 10	18.5 11
80	6.3 0	7.1 0	7.9 0	8.5 0	9.2 0	9.8 0	10.3 0	10.9 0	11.5 0	12.1 0	12.7 0	13.3 1	14.0 4	14.8 5	15.6 7	16.7 9	18.3 11
85	6.2 0	7.0 0	7.8 0	8.4 0	9.0 0	9.6 0	10.2 0	10.8 0	11.4 0	11.9 0	12.5 0	13.2 1	13.8 3	14.6 5	15.4 7	16.5 9	18.0 11
90	6.2 0	7.0 0	7.7 0	8.3 0	8.9 0	9.5 0	10.1 0	10.6 0	11.2 0	11.8 0	12.4 0	13.0 0	13.7 3	14.4 5	15.3 6	16.3 8	17.8 10
95	6.1 0	6.9 0	7.6 0	8.2 0	8.8 0	9.4 0	10.0 0	10.5 0	11.1 0	11.6 0	12.2 0	12.9 0	13.5 2	14.2 4	15.1 6	16.1 8	17.6 10

The two photographs above illustrate a situation we recommend rice farmers avoid if possible. The rice crop in the top photo is purely volunteer in a crawfish pond that was not very productive. The famer is plowing it now but as you can see it is already heading and some seed are bound to be viable. At least it is scheduled to go into soybeans next year.

Shown above are two leaves from Jupiter. The three lesions in the center of the top leaf are definitely blast. The smaller spots on the lower leaf may also be blast, but of an incompatible race according to Dr. Groth. An incompatible race can infect and cause small lesions, but the disease is unable to develop fully. These were taken on the edge of the field where water was an issue.

Dr. Linscombe said he has found blast in his CL261 plots near Mamou and panicle blight in CL261 in his plots near Mowata. Any later rice is more likely to have more disease given the current weather. The season isn't over yet.

As county agent Andrew Granger said, "You never know what you are going to catch in your sweep net." I've been told you can distinguish the pit vipers from harmless snakes by looking at the pupil. The pit vipers have a vertical slit versus the round pupil of the harmless snakes. I always felt if you got that close it was probably a post mortem examination. A good camera and a little luck worked this time.