Cooperative Extension, University of California

Rice Leaf

Butte County Prepared by: Cass Mutters, Farm Advisor June 2010

Throw Away the Calendar

Now that planting is finally finished, what can we expect for the rest of the season? The rate of plant growth and development will vary noticeably between fields planted at different times. Fields planted early experienced several weeks of cool weather resulting in slow growth. In contrast fields planted on May 35 are off to a quicker start. It is likely that later planted fields will reach specific growth stages in fewer days after planting (DAP) than fields that were planted early. For example and based on past year's observations, M205 planted around May 1 will reach panicle initiation (PI) in about 62 DAP. Whereas if it was planted in early June when the weather was hot, it can reach PI in as little as 54 DAP. The shortened vegetative stage can result in few tillers and a less dense canopy. Conversely, plant development in some early planted fields is slow this year where 45 day old rice is not yet tillering. In this case PI may also be delayed as compared to more typical years. Expect a similar growth response in the other Calrose varieties. Try to avoid any practices that may cause undue plant stress which can further reduce plant leaf area and biomass. Vigorous leaf growth contributes to rapid and complete canopy closure which inhibits weed growth.

The time required to reach specific growth stages has implications for both weed control and N management. All herbicide applications need to be finished before PI, else productivity may be compromised. Scheduling production operations that are growth stage sensitive by the calendar is unreliable in a year like this. Be sure to scout your fields to determine the actual stage of growth so that weed clean-up operations are conducted at the proper time. The early planted rice with delayed development may be slow to rebound from herbicide applications.

As discussed below, N top dressing is most efficient if applied just before PI. Post PI applications of N contribute little to yield and can accelerate internode elongation which creates tall, lanky plants and ultimately leads to lodging. This problem is particularly pronounced in the Japanese varieties.

Well, Just How Cold Was May?

One measure of temperature in relation to plant growth is degree days (DD). DD is a measure of heat accumulation used to predict the date that a flower will bloom or a crop will reach maturity. Unless stressed by other environmental factors like moisture, the development rate from emergence to maturity for many plants depends upon the daily air temperature. DD are calculated by taking the average of the daily maximum and minimum temperatures compared to a base temperature (55 F for CA rice).

Using accumulated DD for comparison, 2010 was the coolest start to a growing season since 1998 when we last experienced a strong El Nino effect in the spring (Table 1). On average over this time period the DD accumulation during this part of the growing season is 753. The minimum temperature (55 F) and maximum temperature (95 F) using data from CIMIS station #12 were used in Tables 1 and 2.

M206 takes fewer DD to reach heading than M202 and M205 based on data from variety trials at the Rice Experiment Station (Table 2). M205 required the greatest number of DD among the main medium grain varieties. On average, M206 required 1420 DD while M202 and M205 took 1544 and 1583 DD, respectively

Table 1. Accumulated DD from May 1 to June 13 across years.

Year	DD	Year	DD
1997	705	2004	792
1998	**509**	2005	733
1999	655	2006	849
2000	773	2007	781
2001	1023	2008	770
2002	812	2009	766
2003	779	**2010**	**598**

Table 2. Accumulated DD from planting to 50% heading at RES for three varieties across years.

Year	Planting date	M206	M202	M205
		DD to 50% heading		
2003	29-May	1534	1620	1677
2004	18-May	1386	1567	1615
2005	26-May	1412	1547	1565
2006	24-May	1444	1610	1657
2007	20-May	1398	1587	1539
2008	7-May	1469	1525	1614
2009	6-May	1294	1355	1416
Ave.	19-May	1420	1544	1583

If you would like to calculate DD for your location it can be done on-line at www.ipm.ucdavis.edu. Click on Degree Days in the mid page and follow the instructions. If you need some assistance, give us a call (Cass @ 538.7200, Chris @ 822.7515, Luis @ 458.0578).

Midseason Nitrogen Fertilizer

After our initial cool wet spring, weather conditions have improved and temperatures are increasing. In a few weeks, rice will be changing from the vegetative to the reproductive stage. Nitrogen deficiencies should be corrected at this time.

The milestone signaling the beginning of the reproductive stage is panicle initiation (PI). At this moment, the cells at the shoot apex, which is at the base of the plant, start transforming into the panicle; however, this "primordial" panicle is not visible yet. All that can be noticed is a light green band at the lowest internode. When this happens, rice is said to be at "green ring" or PI. About a week later, when the panicle grows to 1/16th of an inch long and is visible with the naked eye, rice is said to be at the panicle differentiation (PD) stage. It is very important to correctly identify when plants reach PI and PD since midseason N applications, also known as topdressing, should be made between these two events.

When midseason N is applied at the proper time, the fraction that is available to the plant is absorbed by the root in 3 to 7 days. The fast response to the N application at this time is mainly because plants have a well developed root system. On average, 25 lbs N/a are applied at midseason. When topdressing with N rates higher than 60 lbs/a, the efficiency of N uptake will be drastically reduced. Ideally, no more than 30 lbs N/a should be used midseason. If N rates higher than 60 lbs/a are required, most likely grain yield has already been compromised, and, although some yield may be gained, lodging and disease may become bigger problems.

Midseason N application may not always be necessary. If the soil has a good supply of N throughout the season, maximum yields can be obtained using pre-plant N fertilizers only. However, there are several factors that prevent this from happening, such as extended drain periods, high soil permeability and low native N soil content. When soils have a low native N content, midseason N applications will likely be necessary to provide a constant supply of N.

Several methods can be employed to estimate the N nutritional status of rice plants at midseason: leaf chemical analysis, chlorophyll meter and the leaf color chart. In all cases, leaf samples should be taken at PI and the Y-leaf should be used to determine plant N content. The Y-leaf is the most recently fully expanded leaf. It is important to sample at PI; during the vegetative phase, such as tillering, plants are actively growing and the N content can vary drastically. The critical N tissue concentration at PI is 3.3% (Fig. 1); concentrations lower than this critical value indicate an N deficiency and warrant topdressing.

The chlorophyll meter can be used to estimate N content by measuring the amount of light absorbed by chlorophyll in leaves. For cultivar M-202, a meter reading of 35 corresponds to the critical value of 3.3% N. The leaf color chart is a very practical, accurate and reliable method to estimate plant N content. It consists on a series of panels with colors that match the color of plants with different N contents. By comparing the chart with Y-leaves, an estimation of the N status of the rice plant is possible. The chlorophyll meter and the color chart have the advantage of allowing instant determination of plant N concentration, where as the leaf chemical analysis method requires a few days for processing. Keep in mind that the chlorophyll meter 'samples' a very small area of the leaf (2 x 3 mm). Therefore a large number of readings are necessary to get a reasonable estimation of leaf N levels.

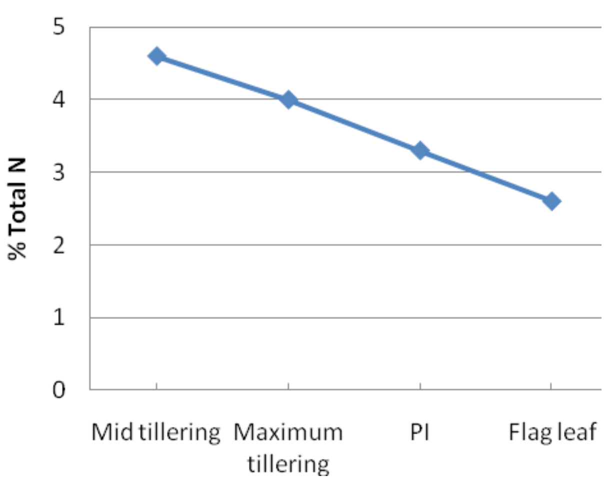

Fig. 1. Critical N tissue concentrations in Calrose rice varieties at four stages of growth.

Managing Weed Populations to Protect Against Herbicide Resistance

Due to the wet spring and rush to get rice planted in a timely manner weed management in rice will likely be more challenging this year. In many fields, groundwork was limited or rushed so that germinating weed seeds were allowed to get a head start in moist soil. Cool weather after planting didn't seem to slow the development of weed species as much as it hindered the progress of rice seedling development. These differences in growth stage between rice and weed populations made for interesting decisions in choosing effective herbicide programs. All of these factors put farmers at a disadvantage in managing weed populations through the season in California rice fields.

Conditions this year made it very difficult to apply herbicides at the optimal time. Weeds that escape early season control practices increase the risk of developing herbicide resistant weed populations. Herbicide resistance management is a critical consideration in years such as this. Below are a few reminders and tips that will assist you in making weed management decisions the rest of the season.

Herbicide Resistance

Herbicide resistance is the ability of certain biotypes within a weed species to survive an herbicide treatment that kills all other biotypes of that species. Repeated use of the same herbicide or herbicides with the same mode of action or mechanism for crop selectivity will select for herbicide-resistant biotypes. Some weed biotypes may become resistant to more than one herbicide mode of action.

Facts About Weed Resistance

- Herbicide-resistant biotypes are present within a weed species' population as a part of normal genetic variation.
- Certain weed biotypes can be simultaneously resistant to herbicides that differ chemically and in their mode of action (MOA).

Symptoms of Weed Resistance in the Field

Resistance needs to be ultimately confirmed by a specific test. Failure to control weeds can occur due to factors such as faulty spraying, incorrect dose or timing, weeds too large, subsequent weed germination after treatment, very large infestations, poor coverage, and other factors.

The presence of resistance in the field is characterized by the following:

- There are healthy looking plants alongside dead plants of the same species after treatment.
- The species was previously well controlled by the same herbicide and rate but a gradual decline in control has been noticed over time.
- The same herbicide (or herbicides with the same MOA) has been used repeatedly on the same site.
- Discrete patches of the target weed persistently survive treatment with a given herbicide(s).
- Resistance in the same weed species and herbicide occurs in neighboring fields.

What Factors Favor the Evolution of Resistance?

- Excessive reliance on chemical control and repeated sequential use of the same MOA. In other words, if you have used Cerano (for example) for several years in a row on the same field(s) then you are inviting herbicide resistance.
- A monoculture of continuous rice production.
- Weeds that produce lots of seeds with little dormancy.
- A herbicide that has high efficacy on a specific weed species.
- A herbicide with prolonged residual activity.

How to Delay the Evolution of Resistance

1. Within season cultural practices
   - Control all weeds that escape to prevent seed return to the field by cutting, roguing, or spraying weed patches with a non-selective herbicide.
   - Avoid spreading resistant weeds: clean equipment, harvest resistant fields last, etc.
   - Maintain adequate water depth for weed suppression.

2. Herbicide use
   - Avoid using the same MOAs sequentially within the same or consecutive seasons. Control escaped weeds with sequential applications of alternate MOA herbicides.
   - Use tank mixtures of two herbicides that are equally effective on the same weed and, if possible, with similar residual activity.

   - With different residual activity, apply the tank mixtures when most weeds have emerged, and maintain adequate water depth.
   - Don’t use the same tank mixture repeatedly.
   - Do not use ALS inhibitors or ACCase inhibitors as the sole means of control.
   - Keep yearly records of herbicide use within each field.

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