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Small Grain News

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Mid Season Nitrogen Fertility Management in Wheat and Barley

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The total nitrogen recovered by a wheat crop in season can range from 60 to 250 lbs N/A depending on the final grain yield. A high yielding and high protein wheat crop (3-3.5 tons/ac above 13% protein) will require about 180 to 220 lbs/A of applied nitrogen in a season. Residual nitrogen in the soil from previous crops will provide the difference between the nitrogen that is provided with fertilizers and the nitrogen which is recovered by the crop. Barley will require less applied nitrogen than wheat (about 125 lbs N/A) in a season because it is lower yielding and grain protein is not a concern.

A good guideline is to have at least one-half but no more than two-thirds of the seasonal nitrogen fertilizer requirement applied preplant to establish a vigorous crop with maximum yield potential. The remainder of the nitrogen fertilizer requirement should be supplied with one or two supplemental nitrogen applications during the crop season. The timing of the first post plant N applications should occur during tillering before the wheat starts elongating. The second postplant N application for increasing wheat quality should occur between boot and flowering. Barley or oats do not require an N fertilizer application after boot stage.

If needed, nitrogen fertilizers for yield are most effective during tillering, but are also effective in the jointing stage. Nitrogen applied after boot stage will have a minimal effect on grain yield (at most a 200 to 300 lbs/A yield increase due to plumper kernels and higher bushel weight) but will increase grain protein. Rates of 30 to 50 1bs N/A topdressed and followed by significant rainfall or irrigation should be sufficient to maintain vegetative growth of wheat and barley. Water run applications should be limited to 25 to 30 lbs N/ac to minimize volatilization of the fertilizer. Under extremely low rainfall conditions, two irrigations with each containing water run applications of nitrogen may be needed to maintain the crop.

The use of stem nitrate-nitrogen tissue tests is an effective way to monitor the nitrogen status of a wheat or barley crop. Table 1 provides critical stem NO_3-N levels for wheat and barley as the crop develops from the third and fourth leaf stage up to early boot stage (late March to early April). This test is not effective for managing late season N fertility in wheat after heading when the goal is to achieve high grain protein.

Proper tissue sampling procedure is important to attain a valid, informative analysis. Collect 20 to 40 stems at random from the field in question. Cut off the roots and plant tops and send the bottom 1 to 2 inches of each stem to an agricultural laboratory for analysis. Be certain the stem tissue sample is not contaminated with soil and old leaves. Submit the tissue sample the same day that it has been collected.

Choice of fertilizer material used to manage a crop will depend on the current weather conditions, weather forecasts, and costs. Urea (46-0-0) is the highest analysis and usually the cheapest form of dry fertilizer. It is particularly effective when broadcast and followed by at least 0.5 inches of rain within 5 days after application. It requires that the urea be converted to nitrate nitrogen by soil microbial processes so it is released over a longer period of time and less prone to leaching from the root zone. However, the urea form of nitrogen in the fertilizer is relatively unstable when it has been broadcast onto a dry soil surface and volatilization can occur.

Water run applications of nitrogen will be useful to supply the nitrogen fertility needs. Anhydrous ammonia (82-00), UAN-32 (32-0-0), and aqua ammonia (20-0-0) are the primary fertilizers used for this purpose. Anhydrous ammonia is most economical because of its higher analysis. However, UAN-32 is more easily handled and the nitrate component in UAN-32 is readily available to the crop.

A final alternative to supply N to the crop is aerial applications of UAN-32 or foliar urea. Tank mixes of UAN-32 with MCPA, dicamba, are effective means of applying both herbicide and nitrogen. Rates should be limited to less than 25 lbs N/A. If aerial applications of UAN-32 are applied when air temperatures exceed 80 ° F, considerable leaf burn and some degree of yield loss is likely.

TABLE 1. WHEAT AND BARLEY STEM NO_3-N ANALYSIS CRITICAL LEVELS DURING VEGETATIVE GROWTH

Growth Stage	Approx. Date	Deficient Level	Desired Range	Excessive Zone
3-4 leaf	Jan. 25	<7,000	7,000-12,000	>12,000
Tillering	Feb. 1 - March 5	<6,000	6,000-11,000	>11,000
Jointing	March 5 - March 25	<5,000	5,000-10,000	>10,000
Boot	March 25 - April 1	<4,000	4,000-9,000	>9,000

Nitrogen Management and Grain Protein

Wheat grown for semolina and bread-type end uses will likely require one more application of nitrogen fertilizer after heading to ensure high grain protein. Several years of trials throughout the Central Valley in the 1980's showed late applications of nitrogen after heading increased grain protein 1-2 percent and contributed to 150 to 300 lbs/ac more yield due to higher kernel weight.

The N application should be applied after heading. A fairly wide window (about 3 weeks) of opportunity exists for the N application ranging from just after the grain heads have elongated from the flag leaf sheath to about 2 weeks after flowering. This should coincide with early to mid April for December plantings.

Appropriate late season N rates may range from 20 to 50 lbs N/ac. Lower N rates are appropriate for lower yielding crops (2.25-3.0 tons/ac) and higher N rates are best suited for yields above 3.0 tons/ac. Sufficient grain protein may be attained without a late season N application if wheat yields are less than 2.25 tons/ac, if preplant fertilizers and topdress applications were applied during the vegetative growth stages. Generally, cool, dry weather during grain filling will result in higher grain yields and management for protein will be more critical.

Nitrogen fertilizer trials have shown an application of N near boot stage (before heading), which should occur between mid to late March for December plantings, will also elevate grain protein. Typically, the increase in grain protein is about 0.5-1.0 percentage point. The grain protein increase with N applied at boot stage is not as large as the response when applied at flowering (about 1.0-1.5% increase). The smaller effect on grain protein with an N application at boot stage is attributed to two factors: 1) the boot stage N application may also result in a yield response of 500 to 1000 lbs/ac which means more grain is produced and requires more N in the grain to attain suitable protein levels; and 2) the wheat plant is more efficient at partitioning the nitrogen to the grain after heading than at boot stage (before heading).

Water run applications of ammonia or UAN-32 or urea topdressed just before irrigation are the preferred materials and methods for late season fertilization. Topdressing ammonium nitrate just before an irrigation is another option, but it is less desirable since it is less effective in raising grain protein.

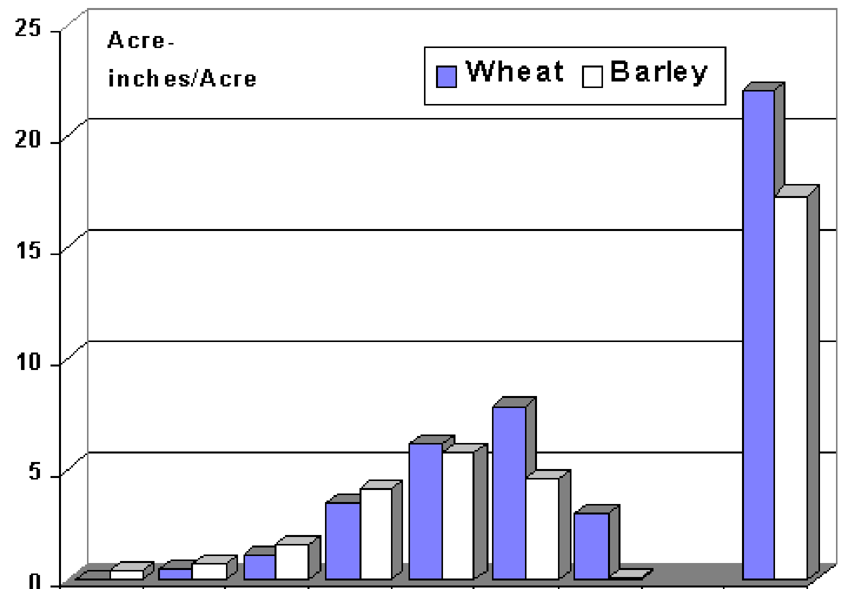
Irrigation Management

Determining Irrigation Cutoff

Studies conducted in 1985 and 1986 at the UC Westside Research and Extension Station near Five Points and related studies conducted in Kings County in 1987 through 1989 revealed that the primary dry matter and nitrogen accumulation in wheat was completed between 28-32 days after flowering for Yecora Rojo wheat. This corresponded to about the last 10 days of April and the first three weeks in May.

The amount of crop water consumption corresponding to this critical 30-36 day period of grain filling (depending on wheat variety) averages about 7 inches/ac. It may range from 6-8 inches/ac depending on weather conditions as well. Figure 2 provides a monthly breakdown of the average seasonal water consumption for irrigated wheat and barley. Wheat consumes about 5 inches/ac more water than barley because the consumption is higher in May and extends into June, whereas barley matures earlier and may be dry enough for harvest by early June.

FIGURE 2. AVERAGE MONTHLY BREAKDOWN OF WATER CONSUMPTION BY IRRIGATED WHEAT AND BARLEY



	Dec.	Jan.	Feb.	Mar.	Apr.	May	June		Total
Wheat	0	0.5	1.1	3.5	6.2	7.8	3.0		22.0
Barley	0.4	0.7	1.6	4.1	5.8	4.6	0.1		17.3

Month

Timing the final irrigation is critical. Sufficient moisture must be available from the last irrigation to carry the crop through hard dough (the end of dry matter accumulation). However, too much irrigation/rain resulting in additional soil moisture beyond hard dough stage is wasted and may be detrimental to the crop. Lodging and black point are more likely to occur in wheat that is irrigated too late into the season. Late irrigations can also result in having ground too wet for effective deep ripping.

There are a wide range of appropriate irrigation cutoff dates, depending on the soil water holding capacity and crop root zone depth. Fine textured clay soils with high water holding capacities and deeper root systems may receive their final irrigation in late April to early May. In contrast, course sandy soils tend to have more shallow root systems and have lower water holding capacities. As a result the final irrigation may occur as late as the second or third week in May.

Stripe Rust Control in Wheat

The following guidelines were developed by Lee Jackson and Farm Advisors and are posted on the California Weed Commission website. The table below shows the benefit of a fungicide applied at flag leaf when stripe rust is present and we have conditions favorable for the disease.

COMPARING THE UNTREATED CHECKS OVER YEARS BY VARIETY STRIPE RUST CONTROL IN THE SACRAMENTO VALLEY

Doug Munier, Jerry Schmeire, Ken Britton, Lee Jackson

Year	SR Rating (1-8 scale)	Percent FL Infected	Yield Lbs/A	Bu Wt
Summit:				
2004	3.3	27 %	6271	62.0
2005	4.1	42%	4658	59.2
2006	7.9	97%	2311	47.9
Express:				
2003	3.6	31%	4118	59.8
2004	3.1	24%	6041	63.8
2005	5.6	69%	3792	53.1
2006	6.0	77%	4281	57.4

Pay attention to reports of stripe rust in other areas of California and surrounding areas.

- Infection in other areas is an early-warning for your area since spores of the stripe rust pathogen are wind-borne and can be disseminated over long distances (hundreds of miles) to cause infection.
- The California Wheat Commission's Weekly Bulletin is a good source of this type of information.

Monitor weather conditions.

- Cool, wet conditions (50-60 degrees F with intermittent rain, fog, or dew) are <u>most favorable</u> for infection, spore production, and spore dispersal. Keep in mind, however, that races of the stripe rust pathogen now present in California can cause disease at higher temperatures and drier conditions than in the past.

Monitor your crop carefully during the growing season in order to detect the first infections early enough to plan for effective fungicide application(s).

- Initial infections in the Central Valley can occur as early as January or as late as April.
- A trigger-point for fungicide application for effective disease control of susceptible varieties under conducive weather conditions is when 10 percent of plants show symptoms of infection or when "hot spots" of disease are detected in the field.
- Protection of the flag-leaf from infection and protection of the plant during the grain-fill period is the goal.
- Under continuing severe disease pressure, more than one application may be necessary to adequately protect susceptible varieties.
- Application timing is critical since available effective fungicides have residual activity of no longer than about 3 weeks.
- If the initial application is made too early, (before infection is detected) the protective activity of the fungicide will be gone before disease appears. Losses then will occur if disease subsequently develops.
- If the initial application is made too late (after disease is well established and severe), the fungicide will not prevent loss (the damage has already been done).

The following are fungicides for stripe rust control:

- **Tilt** (Syngenta). No later than Feekes 8 (flag-leaf completely emerged) 4 oz. <u>*not silage or hay.*</u>
- **Stratego** (Bayer). No later than Feekes 8 before head emergence. 10 oz. <u>*not for silage or hay.*</u>
- **Quadris**(Syngentz). No later than Feekes 10.5 <u>*not for silage.*</u>
- **Quilt** (Syngenta). No later than 10.5 <u>*not for silage.*</u> 10.5-14 oz.
- **Headline** (BASF). No later than Feekes 10.5 (full heading, beginning of flowering) 6-9 oz.

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In this issue:
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