

Saving Energy and Fertilizer Costs

Best Management Practices for Southern Idaho Grain Producers

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High energy costs mean hard choices for grain growers in the upcoming crop season. With rising energy costs squeezing ever-decreasing profits, it's a critical time to streamline production practices to maximize fuel and fertilizer efficiency and to better control input costs. As you gear up for the next planting season, consider these ideas:

- You can manage only what you measure.
- Fertilize for realistic yield goals, not for overly optimistic targets.
- Soil testing may be your best investment in 2007. Why guess on N, P, and K needs when fertilizer prices are spiking higher?

Straw management

Current practices. Straw is currently managed through various levels of soil incorporation. Up to 50 pounds of nitrogen (N) may be added to enable microbial degradation (generally 15-20 lb N per ton of straw). Associated management costs include tillage operations, nitrogen fertilizer, spreading, and incorporation.

Alternative marketing of straw. Consider marketing straw for bedding, feed, or conversion to ethanol. In much of the irrigated production land in Idaho, the short-term costs associated with straw residue incorporation may be prohibitive in terms of time, equipment, and increased fertilizer for subsequent crops. UI fertilizer guides suggest adding 15 to 20 pounds N per acre for

each ton of residue incorporated, up to 50 pounds N per acre.

By marketing straw off the farm, it is possible to gain \$20 to \$40 per acre even when someone else handles the straw removal. Expenses are reduced with no residue handling, and straw removal saves the added nitrogen costs otherwise incurred. Keep in mind, constant removal of straw may result in "soil mining" and increase wind and water erosion in areas prone to such problems. A minimum amount of straw is required by NRCS on highly erodible land when participating in certain farm programs.

Incorporating straw immediately after harvest. If soil temperatures are relatively high, decomposition occurs quickly upon incorporation without additional N. This reduces N costs, but those savings are offset by the cost of running equipment across the field.

Cutting the grain as close to the ground as possible using a straw chopper on the combine and a chaff spreader will start the breakdown of straw at harvest time. For fall tillage, use minimum soil disturbance equipment such as a v-ripper. This not only breaks up the land but helps hold the snow and allows Mother Nature to begin breaking down the straw. In the spring, use minimum tillage equipment and leave the straw on top.

While close cutting increases harvest cost, it will reduce the cost of straw incorporation. In a no-till situation, however, taller standing stubble is easier to plant into the following season.

Burning stubble. In limited circumstances and where there is no viable market for straw, consider burning grain stubble. This will reduce tillage/residue management field operations and save fuel. Short-run cost savings exist, but may be offset by long-term losses. Also consider the nonmarket benefits and costs of burning such as reduced soil organic matter and increased erosion potential after burning straw. Awareness of the impacts on air quality should also be a significant factor in the decision to burn straw.

Fertility and nitrogen management

Fine tuning current fertilizer practices. In many cases, we guess on fertilizer needs based on previous experience and the assumption that grains are a minimally profitable rotation crop. Optimal management of nitrogen and other fertilizer inputs does not equate to managing for maximum yield, however, but for maximum profit.

Nitrogen (N) application should be based on a realistic yield goal adjusted for your soil type, residual soil test N, previous crop (legume), and irrigation water N credits. Accounting for all sources of available N (such as residual soil nitrogen, nitrate in irrigation water, N mineralized from organic matter, manure and crop residues) may allow you to reduce the amount of fertilizer N you apply.

Soil testing. Many producers do not test their soils for N before planting small grains, even though they may soil test before other crops in their rotation. Indeed, annual soil testing for P, K, S, and possibly other nutrients for small grains may be unnecessary, especially when small grains are part of a diverse crop rotation that includes higher-value crops that are routinely fertilized with these nutrients. But testing for N availability is essential even in diverse rotations because of the variability in residual N levels resulting from previous crop management. The cost of soil testing for N in the overwhelming majority of cases is minimal compared with the potential cost savings (or potential production increase).

Avoiding early fall nitrogen application. In early fall, apply only the minimum amount of N needed to establish the crop to avoid N leaching, immobilization, and volatilization losses. Recent research in southern Idaho suggests that any N applied for purposes of straw decomposition is more effectively used by the next crop if applied in late fall or spring.

Research by the USDA-Agricultural Research Service at Kimberly under field conditions did not support applying N in early fall for straw decomposition but did support incorporating residues as early as possible to take advantage of warmer temperatures and longer periods of time for decomposition to occur.

Optimizing fertilizer application. Optimize your fertilizer application for maximum dollar return based on fertilizer price, your expected yield response, and the price of grain.

Considering cheaper nitrogen sources. The best source of N is usually the source that is least costly. Urea is generally the least costly form of dry N. The only concern for urea is that the N can be lost to volatilization if it remains on the surface under warm, windy, and/or humid conditions. Incorporating urea into the soil via mechanical means (2-4 inches) or irrigation (0.5 inch of irrigation water or precipitation) will prevent this N loss, and application under cool conditions will lessen it.

Application of ammonium sulfate is more costly but may be warranted if soil and water tests indicate a need for sulfur in addition to N. Be aware that the N in ammonium sulfate can also be volatilized if not incorporated quickly.

Urea is more toxic than other N sources, so if it is applied with the seed in the seed row it should be limited to 20 to 25 pounds N per acre (figures 1 and 2). Use of fertilizer products such as polymer-coated urea or a urease inhibitor with regular urea will help slow conversion of urea into ammonium and reduce the toxicity risk.

The cheapest source of N may be anhydrous ammonia (gas) or aqua ammonia (liquid), but these forms require incorporation and soil sealing during the application (6- to 8-inch depth of placement and deeper if soil is dry). For many producers who have access to these sources, the cost can be significantly less per unit of N than for dry urea; however, increased fuel consumption due to the higher horsepower needs for application may offset the cost savings.

If applying phosphorus (P) to your grain crop, most sources, such as MAP (11-52-0) also contain N and can be a good choice for supplying both. Banding P has been shown to improve uptake efficiency and, as such, allows 30 to 50% less total P to be applied if soil test levels aren't too low. If soil test levels are low, a broadcast application of P will be needed as well.

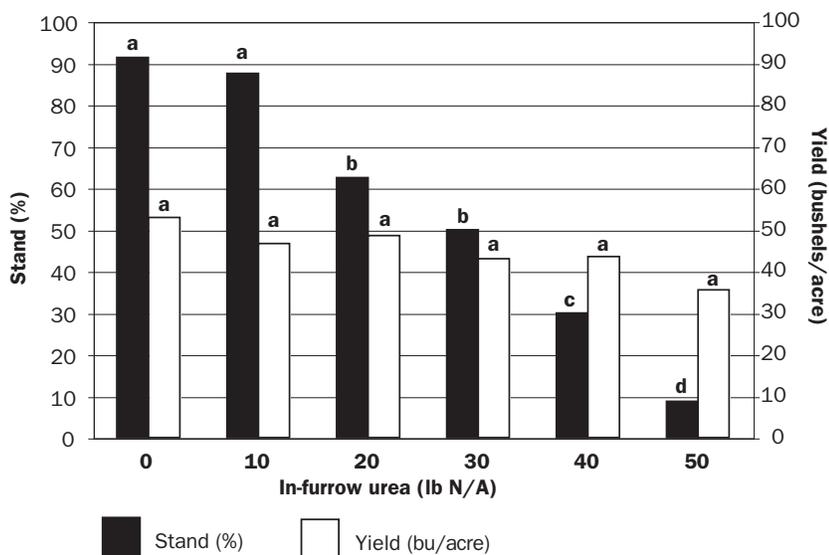


Figure 1. In-furrow application of urea (0, 10, 20, 30, 40, and 50 lb N/A) with spring barley (Baronesse) under dryland conditions. Note: Stand is a visual estimate of percent stand compared to an optimum of 100%. Treatments with the same letter are not significantly different. Source: Windes, J.M. 2006. Cereal Variety Trials, Soda Springs.

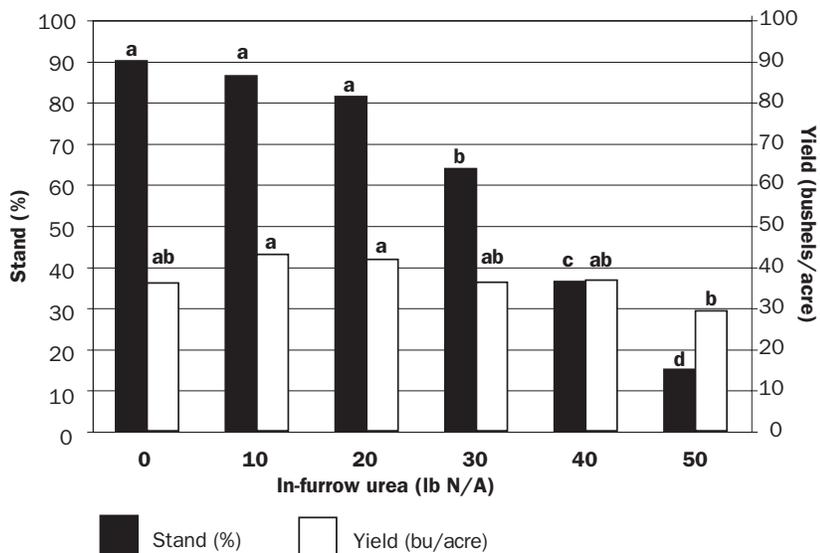


Figure 2. In-furrow application of urea (0, 10, 20, 30, 40, and 50 lb N/A) with spring wheat (WB936) under dryland conditions. Note: Stand is a visual estimate of percent stand compared to an optimum of 100%. Source: Windes, J.M. 2006. Cereal Variety Trials, Soda Springs.

Optimizing nitrogen timing.

In much of southern Idaho, the most effective dry granular N application for early planted fall wheat is a top-dress application in late winter or early spring, not a preplant application. Any N applied to soils once temperatures drop below 50°F will probably be used more effectively than earlier applications because less is immobilized by microorganisms or lost to volatilization.

Nitrogen that can be tank-mixed according to the label with other foliar applications such as herbicides will be used effectively by small grains, but there is a limit to the amount that can be applied without causing foliar burn. As a foliar application, urea causes less burn than urea ammonium nitrate (UAN or Solution 32). Base your application rate on a spring soil sample, as there is too much opportunity for N loss if samples are taken earlier.

Optimizing irrigation. Be cautious with the first irrigation. More nitrogen can be lost from the rooting zone by leaching than with any subsequent irrigation, especially if the field was plowed. If you have to irrigate to insure early vegetative growth during tillering, avoid wetting soils to depths below the existing root system. Limiting the first irrigation to about 0.5 inch on coarse-textured sandy soils is a good practice.

Don't irrigate any longer during the season than necessary. In soils with good water-holding capacity, shutting off the water at soft dough will not affect yield and may improve quality. Shutting off all irrigation at mid-dough stage in more coarse soils is recommended as long as the upper 2 feet of the soil profile is at or near field capacity.

Considering fertigation. Apply N through irrigation (fertigate) to reduce trips across the field and avoid physical crop damage. Little N is needed by young plants, and less by dormant winter crops. Nitrogen can be metered through irrigation lines and applied to closely match crop demands. For hard (red) wheat protein enhancement, if N is limiting, an extra shot (30-40 lb N/A) can be applied when most needed for optimal grain protein—late vegetative to early grain fill. When irrigation is less than optimal, N rates can be reduced in anticipation of yield that is likely to be moisture limited. The downside of fertigation is the cost per unit of N is likely greater than with traditional N sources, but savings in fuel and other efficiencies may offset this added cost.

Plant or production monitoring. Some after-the-season assessments might be in order for fine-tuning nitrogen fertilization practices. For wheat, grain protein is a reasonable means for estimating the adequacy of nitrogen provided in the system. For soft whites, protein levels below 10% probably mean nitrogen was inadequate for maximizing returns. If soft wheat protein exceeds 11% the reverse is probably true. Hard red winter wheat protein lower than 11% and DNS (dark northern spring wheat) protein below 12% mean nitrogen is probably inadequate for maximum returns.

Zone mapping. Use zone maps produced for other crops such as potatoes to maximize fertility for high-production zones and minimize waste in low-production areas.

Mapping fields for soil type and productivity is essential to targeting high and low production areas. Divide your fields into management units based on soil color and topography. Collect a single soil sample from each management unit and determine N rate based on residual soil N and the yield potential of the soil in the zone. This ensures you are optimizing N application for each area in the field.

Utilizing PCU. Polymer-coated urea or other N stabilized with nitrification or urease inhibitors may improve the effectiveness of some applied N. The cost may not be that much more than urea, and the savings from reduced N losses may offset the initially higher costs.

Other fertilizer management

Considering cheaper K sources. If fertilizing to provide potassium, KCL (potassium chloride - muriate) is about a third less expensive than K_2SO_4 (potassium sulfate) and probably more effective in addressing physiologic leaf spot in small grains. Some soils are low in Cl, and KCL is a more appropriate K source if you don't need the sulfur.

Fertilizing for maintenance versus crop requirements. Many growers maintain higher soil test levels for P, K, S, and other nutrients than are required for maximum economic returns. To some extent this has caused a considerable reservoir of nutrients to be held in the inorganic and organic fraction, some of which becomes available during the growing season. This might be a good year to draw on this reservoir.

Banding vs. broadcasting. Broadcasting is the most convenient and quickest application method, but banding P and K can be more efficient if you avoid salt effects.

Other production practices

Idling fields. Idle poor-quality, least-productive fields or portions of fields. Focus field operations and inputs on your most productive fields or portions of fields. Example: shut off pivot corners and end guns.

Choosing appropriate varieties. Grow plant varieties that use less water and/or fertilizer and yet produce good quality and acceptable yields. Choose disease- and insect-resistant varieties with a history of good productivity within your area. Also consider market acceptability.

Reducing tillage. Fuel usage for tillage systems varies tremendously. At \$2.00 per gallon diesel, conventionally tilled corn uses fuel to the tune of \$14.17 per acre, while no-till corn consumes \$9.14 per acre. Without tillage, you can run smaller, more fuel-efficient tractors. No-till can conserve moisture and potentially reduce irrigation costs associated with diesel-run pumps.

We urge you to visit the USDA Natural Resources Conservation Service's (NRCS) online energy estimator. This energy estimator will help you calcu-

late diesel fuel costs associated with various tillage practices. Plug in a zip code and crop acres, and the estimator will tell you much diesel it will take to raise crops typically grown in your particular area under various tillage scenarios. We also recommend you consult your local soil and water conservation district to see if there are rental programs for direct seed drills available in your area.

Furrow-irrigated producers have some special challenges. Onion producers by statute must bury onions left in the field. Plowing may be necessary following potatoes if volunteer potatoes are an issue. For other low-residue crops, plowing may not be necessary.

Corn grain residues generally require some tillage, but grazing corn stalks where possible can greatly reduce the tillage required, not to mention provide additional income. Following many other crops, producers often perform more tillage than is justified for small grain establishment, especially under sprinklers where furrows don't need to be reestablished. Following small grains, straw removal could improve the prospects for reduced tillage, especially for subsequent bean corner plantings.

Maintaining vehicles. Maintain and tune up your tractors and other vehicles to ensure that fuel consumption is optimal. Proper maintenance and upkeep will also reduce replacement costs and increase equipment longevity.

Optimizing tractor horsepower. Optimize tractor horsepower requirements by operation and implement used.

Parking gas guzzlers. Park gas guzzling pickups and drive a fuel-efficient vehicle (car) whenever possible.

Renegotiating contracts. Renegotiate land rental agreements to better reflect the return to land based on higher input costs. This applies to both crop-share and cash leases.

Skipping seed treatments. The potential exists to skip seed treatments where you have practiced excellent rotation and there is no documented history of high soil disease pressure. Take care to avoid planting malt barley infected with high levels of smut diseases. Many growers will also spare the expense of buying certified seed and utilize bin-run seed, but they risk weed seed contamination.

Scouting. For problem insects such as cereal leaf beetle and fungal diseases such as stripe rust, applying control measures according to published thresholds may save costs of preventative treatments.

Broadcast seeding. There are some situations where combining a broadcast fertilizer and seeding operation makes sense. It normally requires a higher seeding rate. For late fall seedings, where small grains aren't emerging until spring anyway, broadcast seeding with the fertilizer application can facilitate a more timely planting, especially if it enables a fall planting on soils difficult to get onto in the spring. Fertilizer is normally incorporated with a shallow tillage operation, which would serve to cover the seed (though seed depth and soil dryness are issues). Timely germination does depend on winter conditions. Fortunately, emergence of plantings from late November through January doesn't vary much, and consequently yields don't differ much either. This could be an option in early fall as well but timely germination and emergence is more dependent on subsequent irrigation because fall showers are not dependable in many areas such as western Idaho.

Broadcast seeding is less of an option in spring, where spring showers are infrequent and delays in germination and emergence can have appreciable effects on yield and quality. If irrigated right after shallow tillage, a spring broadcast seeding is more feasible, but most of western Idaho doesn't have access to irrigation water until April, and small grains should be well established by then.

Reducing seeding rates. Recommended seeding rates for irrigated spring barley can be as high as 120 pounds per acre. Most barley varieties compensate well at lower seeding rates by increasing the number of tillers produced per plant. In research done at Aberdeen, there were little to no differences in yields of barley planted at 60 pounds per acre and at 120 pounds per acre when seeded at optimal planting dates.

Malting/brewing companies recommend establishing a plant stand of 750,000 plants per acre to optimize both yield and grain quality. Depending on the 1,000-kernel weight and germination percentage of the variety, this may equate to 70 to 80 pounds of seed per acre. Dryland barley could also be planted at reduced seeding rates.

Managing weeds. Determine the weed species and density in each field before deciding which herbicide(s) to use for weed control. Using the same herbicide combination for weed control in all your grain may not be necessary. It may also be possible to use less expensive herbicides or generic forms.

On the other hand, use the recommended rates for weed control. Using reduced rates (below labeled rates) may save some money in the short term, but may also lead to bigger weed problems in the long term.

Make sure your sprayer is calibrated accurately. Overapplication of herbicides increases costs and crop injury potential, which leads to lower yields.

Further information

To order publications from Educational Communications, phone (208) 885-7982, email calspubs@uidaho.edu, or go online at info.ag.uidaho.edu.

Web sites

UI Cereals Agronomy for Idaho, www.ag.uidaho.edu/cereals/.

UI Cereals Agronomy for South Central and Southeastern Idaho, www.ag.uidaho.edu/sceidaho/. Many of the publications in the following list are also available through this web site.

Publications

Straw management

Economic Considerations of Burning Straw and Alternative Uses of Straw. 1996. Winter Commodity Schools Proceedings, vol. 28: 83-89. UI Extension, Moscow, Idaho.

Fertility management

Nitrogen Management for Hard Wheat Protein Enhancement, PNW 578, available online at <http://info.ag.uidaho.edu/PDF/PNW/PNW0578.pdf> or in print from UI Educational Communications.

Wheat Straw Management and Nitrogen Fertilizer Requirements, University of Idaho CIS 825. Order from UI Educational Communications.

Reducing tillage

New Math: Will Fuel and Fertilizer Bills Drive Adoption of Conservation Tillage? Available online at <http://www.ctic.purdue.edu/partners/112005/feature.asp>.

USDA Natural Resources Conservation Service Energy Estimator, available online at <http://ecat.sc.egov.usda.gov>

Reducing seeding rates

Spring Barley Production Guide, University of Idaho Extension BUL 742, table 6, available online at <http://info.ag.uidaho.edu/pdf/BUL/BUL0742.pdf> and in print from Educational Communications.

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