Farm Views

Reducing Energy Bills for Irrigation

Some producers in Nebraska reported pumping double the normal amount of water to grow crops in 2002. The prospects for continued drought in 2003 are high. It is important that irrigation pumping plants operate efficiently to keep costs to a minimum, but it is especially important when energy prices are high and the supplemental water needed for crop production is expected to be higher than normal, as well.

Most irrigation in Nebraska depends on groundwater as the water source. Nearly all groundwater for irrigation is pumped using a vertical turbine pump. The University of Nebraska has field tested hundreds of pumping plants over the years. Based on these field tests and on laboratory tests of engine efficiency, the university developed the Nebraska Pumping Plant Performance Criteria, NPPPC (usually shortened to NPC). This criteria states the amount of useful work (water horsepower-hours, whp-h) one should reasonably expect to achieve in the field for each unit of energy consumed by a pumping plant.

In a pumping plant test, the technician measures total head (lift plus system pressure), flow rate (gallons per minute) and rate of energy consumption. The performance of the pumping plant is stated in terms of whp-h per unit of fuel. The performance *rating* is the performance of the particular pumping plant compared to the NPC and is expressed as a percentage of the NPC. A rating of 100% indicates that the pumping plant is operating as expected. A rating below 100% indicates the pumping plant is using more energy for the work that it is doing than the criteria calls for. For example, a pumping plant operating at 70% of the NPC is only producing 70% of the useful work it should for the energy it is consuming.

The most recent statewide pumping plant efficiency study conducted by the University of Nebraska tested 180 pumping plants. As one might expect, the efficiency of the pumping plants tested by the university varied considerably. Some pumping plants achieved very good efficiency. In fact, 15% actually exceeded the NPC. (Performance ratings over 100% of the NPC are possible when a highly efficient motor is attached to a well-designed pump that is not worn or misadjusted). The fact that some pumping plants exceed the criteria is witness to the fact that the criteria is a reasonable target for all pumping plants. The other 85% of the pumping plants were found to use more energy per unit of work than would be expected by the NPC. The average pumping plant in Nebraska was found to be operating at only 77% of the NPC. To put it another way, the average pumping plant in the study was using 130% as much energy as it would if it were operating at the NPC (1.0/0.77 = 130%).

When the efficiency of a pumping plant is not what it should be, the problem is either in the power unit, in the pump or both. Internal combustion power units on irrigation pumps can have the same problems as those in cars and trucks. About the only thing that will cause poor electric motor efficiency is if the bearings are bad or if the motor is far larger than what is needed for the job.

Causes for poor pump performance include: pump designs that are poorly matched to the job they are currently doing (perhaps the operator has switched from gated pipe to a center pivot sprinkler or a high pressure to a lower-pressure sprinkler package), pumps that had worn impeller vanes and/or internal seals as a result of pumping sand or impellers that were not properly adjusted within the pump bowls.

There are many pump manufacturers and each manufacturer can have dozens of pump designs in their catalog. At a given rotational speed, a given impeller design operates on a head versus capacity curve. The greater the head (pressure) the pump is working against, the lower the capacity the impeller can produce. **See Fig. 1**. The efficiency (work produced versus energy consumed) changes along the operational curve. Each design will have a best efficiency point at a certain head/capacity condition, with lower efficiencies on either side of the best efficiency point. The job of the field engineer is to select an impeller design that will operate efficiently when pumping the volume of water required for the application and which will produce the total head required with a multiple number of stages.

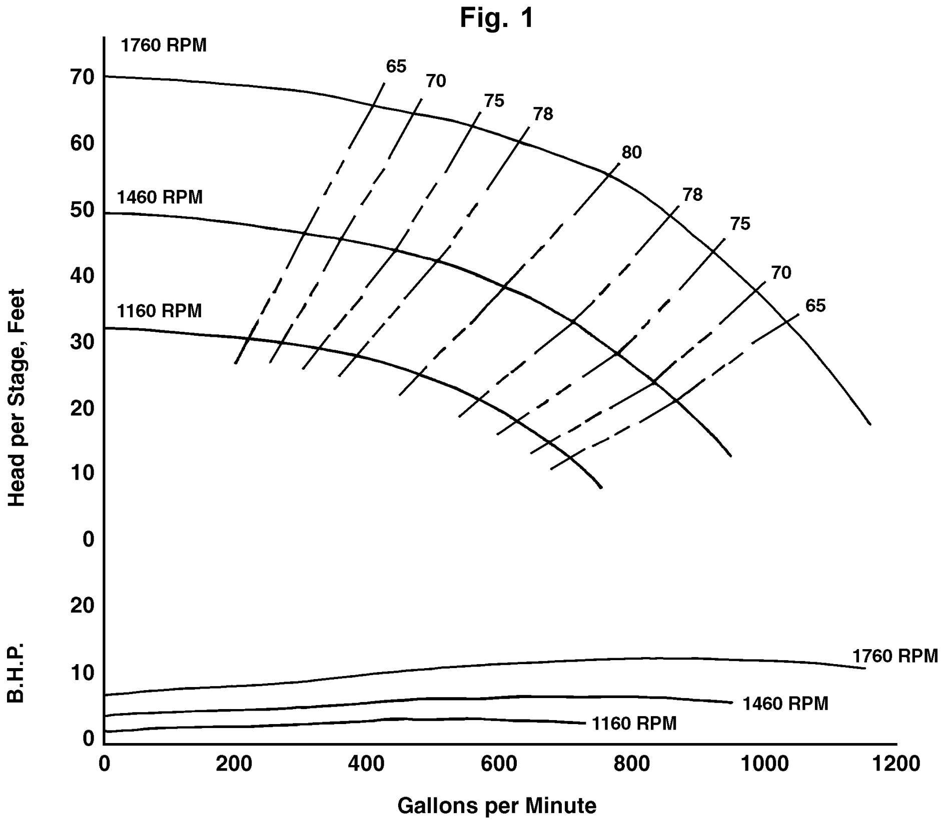


Fig. 1

In the recent pumping plant tests, 57% were determined to potentially benefit from adjustments. Adjustments either to the engine or pump or both resulted in 14% average savings in energy costs over the initial test results. An equally important result of the pumping plants tests was inefficient pumping plants were identified and the feasibility of making repairs beyond the field adjustments were calculated. On some pumping plants, the potential savings in energy costs from major repair or even replacement of the pump would pay for itself in only a few years.

If there isn't a water meter installed on the system, a short-term pumping plant test can be run using one of a variety of devices to measure the flow rate. Contact a reputable well driller and ask if they are equipped to run a short term pumping plant efficiency test. At today's energy prices, identifying a pumping plant that needs adjustment or repair could result in saving hundreds or even thousands of dollars in energy costs per year.

If the producer knows the total fuel used over a period of time, the total volume of water pumped (from water meter readings, usually stated in acre-inches), the system pressure measured at the discharge head and the water level (measured while the pump is running), the performance rating can be calculated.

For more information on how to estimate long-term performance, contact Tom Dorn, extension educator in Lancaster County via e-mail at tdorn1@unl.edu. (TD)

2003 Pesticide Container Recycling Dates

Last year, more than 6,250 pesticide containers were collected in Lancaster County.

The Nebraska Pesticide Container Recycling program provides a recycling opportunity for plastic from 1- and 2.5-gallon containers. More than 40 inspection/collection sites are available to take your rinsed plastic containers to in Nebraska. Three pesticide container recycling dates have been established in Lancaster County.

The UNL Cooperative Extension in Lancaster County, in conjunction with local businesses, will be holding public collection days from 9 a.m. to 3 p.m. at the following locations:

- June 27 — Firth Co-op, Princeton
- July 11 — Farmers Cooperative, Waverly
- July 25 — Farmers Cooperative, Bennet

In addition, the Lancaster County Extension office, located at 444 Cherrycreek Road in Lincoln, is accepting containers now through Oct. 31 between 8 a.m. and 4:30 p.m. Call 441-7180 for directions.

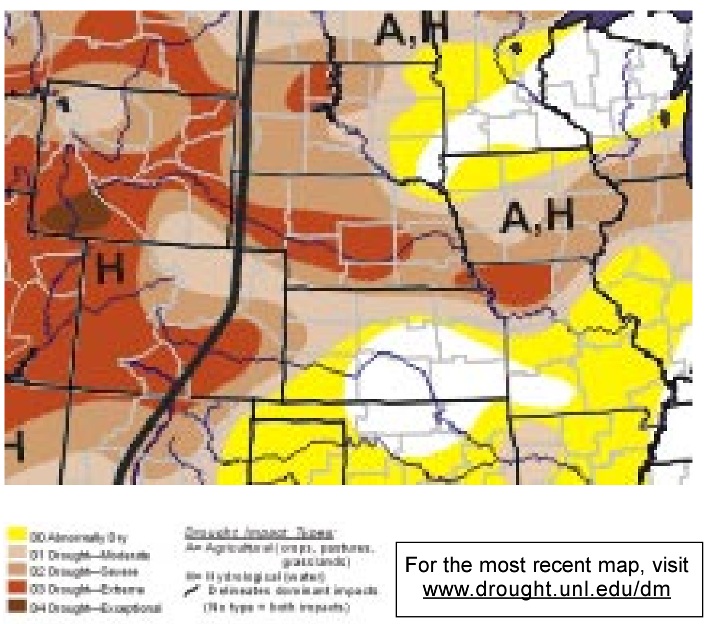
All liquid pesticide containers require proper rinsing (triple rinsing or pressure rinsing). Rinse the containers immediately after emptying and place the rinse water in the spray tank for application on the labeled site. It is illegal to burn the containers. Crop oil and adjuvant containers may also be recycled. Please remove caps and plastic labels or multi-layered paper labels.

Commercial applicators are encouraged to recycle their customer's plastic containers at these sites.

Last year, more than 171,530 pounds (86 tons) of plastic from pesticide containers were recycled in Nebraska. This plastic is kept separate from regular recycling channels and only goes into environmentally safe uses such as pesticide shipping pallets, agricultural drain tile, parking lot tire bumpers, rail road ties, plastic lumber, etc. (TD)

Latest U.S. Drought Monitor Map

As of April 29, Lancaster County is in **severe drought** conditions with the following dominate impact types: Agricultural and Hydrological



For the most recent map, visit www.drought.unl.edu/dm