# Dealing with drought: part two

**By Kirk Thompson**

Editors Note: This is the second article, in a series from the Rio Grande Water Conservation District intended to help Valley producers make decisions about water.

As all water users are undoubtedly aware, 2002 is quickly developing into a drought of unparalleled magnitude. The drought monitor index now lists the San Luis Valley as having an extreme to exceptional drought severity based upon a lack of surface water supplies, a lack of precipitation, a lack of residual soil moisture, and poor vegetation health. Dropping ground water levels in the unconfined aquifer and a decrease in artesian pressure in the confined aquifer are also being experienced. Irrigators who rely solely on ditch water have already watched their prospects for full crops this year disappear. Many irrigators, who rely heavily on ground water, have never seen their well production drop off so heavy this early in the irrigation season before. Other areas seem to be somewhat immune from the well production problems thus far and are hoping for the best.

This article is intended to provide some water conservation suggestions and irrigation strategies to help center pivot irrigators who rely heavily upon ground water to cope with this year's drought. Given an available water supply, our obvious goal is to apply enough water to meet the crops current and full irrigation requirements. With dropping water levels, we don't want to over-irrigate now if we can conserve that limited amount of available water for more critical time periods later in the season. Consequently, it is more important now than ever that sprinklers have an accurate percent chart so that the depth of water that is being applied is known. Also pay close attention to crop evapotranspiration estimates so that you know how much water is needed to provide for current crop needs. It is fairly easy to get behind this time of year. Alfalfa water requirements shall increase to a fairly stable requirement after first cutting. The period of peak water use on barley is nearly over now and will begin to drop slightly after heading. Potato water requirements are increasing dramatically as the crop grows toward full cover.

Over the past two months, we have seen an unprecedented number of well production problems, especially on one-well systems that are in areas accustomed to having sufficient recharge from surface water. It is very important to monitor water levels and pay close attention to the irrigation system's operating pressure at the pivot. A pressure drop is an indication that the system's flow rate has also dropped. The ratio of the drop in flow is proportional to the square root of the ratio of the drop in pressure. As an example, if an irrigation system that was designed for 1000 gpm and 47 psi is now operating at 30 psi, the flow rate has dropped to around 800 gpm. At a given timer setting, 20% less water is being applied than expected.

For a pivot to easily keep up with crop water needs, systems are designed to have a flow rate of at least 6 gpm per acre of land irrigated. Consequently, when the system flow rate of a 125-acre pivot drops below 750 gpm, it becomes increasingly difficult to keep up with crop needs. If you are facing this situation, there are several alternatives that may help.

One of the simplest alternatives is to remove the end guns. A large Nelson 100 end gun with a booster pump may require up to 150 gpm. By removing the end gun, you free up that amount of flow for use under the rest of the pivot. The end gun area tends to be the least uniform and least productive area of the field, and abandoning this 20 to 30 acres makes more sense than abandoning acreage under the pivot.

There are several well remediation techniques that may stabilize or improve well production. If there is sufficient depth in the well, you might be able to lower the bowls to provide better submergence for the impellers and allow the pump to capture more water from a greater depth in the aquifer. If the well was not drilled to the confining layer (the Blue Clay Series for wells in the unconfined aquifer), the well can be deepened after obtaining a permit from the Division of Water Resources. If the well casing is encrusted, well surging or re-perforation techniques might help to redevelop its productive capability. The impellers or pump motor can be replaced if necessary. In the worst-case scenario, the well may need to be re-drilled. Several farmers are in the process of piping other old, decreed wells along the edge or corner of the field into the pivot. In drought conditions, it is certainly easier to provide a full system capacity with two or three wells pumping fairly easily (at say 300 to 600 gpm per well), rather than trying to provide the full system capacity with one well pumping hard (at say 1000 to 1200 gpm).

If the irrigation system begins pumping an excessive amount of air or begins surging (rapid pressure and flow fluctuations caused by pumping the aquifer level clear down to the impellers), the situation can be stabilized by modifications to the irrigation system itself. It is relatively cheap to re-nozzle the system down so that it is not pumping the well so hard. Usually, the majority of the existing nozzles can be re-used as smaller orifices are placed in the inner spans and the existing nozzles are shifted down the system. Re-nozzling alone only works effectively if there is still sufficient flow to keep up with the crop needs for the acreage irrigated.

All of these suggestions are intended merely for your consideration. The best solution will depend upon the specifics of your unique situation. While these alternatives may help to stabilize well production at a sustainable level for this year, none of these techniques will be effective if there simply is not enough water in the hole to meet crop demands. In this situation, more dire actions may be required. Such alternatives may require abandoning a part of a crop. I have already discussed that the most common sense area to abandon is the acreage under the end gun, as water application under the end gun is the least uniform. If the system flow rate drops considerably lower than 6 gpm per irrigated acre, you may have to consider abandoning additional acreage in the field. An individual decision must be made at that point as to whether it is better to deficit irrigate the entire field and expect some level of yield loss across the entire field, or if it is better to abandon a portion of the acreage and fully irrigate the remaining acreage. Some may choose to abandon irrigating the inner span(s) by plugging off those nozzles, as this area of the field is more likely to be over-irrigated. If you have an electronic panel timer, many can be programmed to shut off the water and travel dry across a pie slice of the field.

While it is too late to change cropping practices for this season, a future consideration for fields with insufficient flow is split cropping. As an example, growing half a circle of barley and a half circle of potatoes allows you to spread the peak water

needs of the field over a longer interval. The grain is planted earlier and reaches its most critical water use period and peak water needs earlier. By the time the barley has headed out, its water requirement begins to decrease as the potatoes begin to reach their most critical water use period. With split cropping, only half of the field is in a crucial period of peak water requirement at any one time.

In a water-short situation, deficit irrigation becomes a necessity. While this topic shall be the focus of a later article, it is worth pointing out that while yield loss will occur in water-short situations, the amount of yield loss and accompanying quality problems sustained can be minimized using proper deficit irrigation management techniques. In a water short situation, the goal is to get every drop of water possible into the root zone where it is accessible to the plant's roots. When the crop turns blue, the tendency is to speed the sprinkler up and get it across the crop with a small amount of water as fast and as frequent as possible. However, a small portion of each irrigation is lost to wind-drift or surface soil evaporation before entering the root zone. Cumulatively, more water will be lost over a season by applying 28 light irrigations than by applying 14 heavy irrigations. In a water-short situation, you should avoid the desire to get across the crop fast and should instead concentrate on re-filling the root zone as fully and as deeply as possible with each irrigation; even if this means you can't get back around quickly enough to begin the next irrigation when the crop needs it. Schedule your irrigations based upon depth not interval. This will encourage a deep rooting system, which is better able to tolerate dry periods.

All of this discussion has focused on alternatives that might help us get through this drought season. I am afraid that harder decisions may lie ahead for next year. While there will most probably be enough water in the aquifer to see most producers through this season, the aquifer will be seriously over-drafted by this fall in many areas of the Valley. Without sufficient recharge this winter, the aquifer system, which we rely on heavily as a reservoir, may be in a worse condition next year. Previous experience also indicates that it has historically taken several years of surface water recharge to rebuild the aquifer level after a drought. Serious decisions on each farm involving an understanding of the available water supply, individual economic realities and acceptable levels of risk tolerance will need to be weighed heavily before deciding on how many acres of which crops should be grown next year. Droughts are a natural event, however, and I am confident that the farmers and ranchers of the San Luis Valley will demonstrate the resilience and cooperation needed to see us through.

*Kirk Thompson is a partner at Agro Engineering, Inc.*