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Irrigation Management Practices in Nebraska

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Farmers have adopted a variety of new irrigation practices and technologies in recent years. These practices generally have led to better yields per unit of applied water, reduced labor, improved profits, and have often produced positive environmental impacts. Environmental improvements result from irrigation practices which reduce runoff or deep percolation below the root zone, hence reducing surface and groundwater pollution from pesticides and fertilizer.

Recently, a mail survey was sent to 5,000 irrigators in Nebraska, resulting in 898 useable returns. This survey provided information on how irrigators decided when to irrigate and how they determined the amount of water applied. Those irrigators using gravity irrigation methods were also surveyed about their use of surge values, alternate row irrigation, short set times, differential flow rates between hard and soft rows, and about management differences between the first and subsequent irrigations.

Adoption of irrigation management practices can affect application uniformity, runoff, the amount of water that will be leached below the root zone, and the amount of water that is effectively used by the crop as evapotranspiration. Survey results concerning the use of alternative practices are useful for educational program development and for environmental policy analyses.

Irrigators were asked how they decided when to irrigate and how they measured the amount of water applied. Good irrigation management requires consideration of soil moisture conditions, rainfall, and crop water requirements to decide when to irrigate. Careful measurement of the amount of water applied is also necessary for good management.

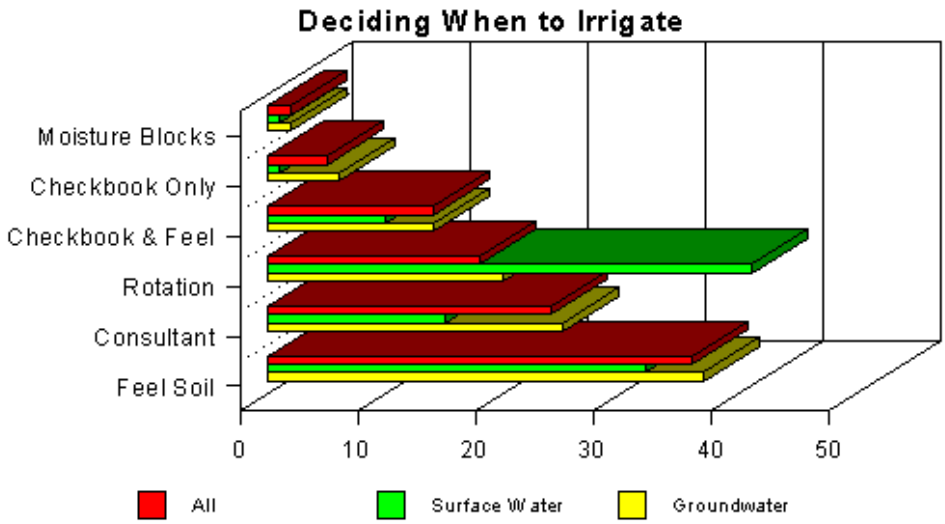


Figure 1. Irrigation scheduling.

Most irrigators reported that they used some method of monitoring soil moisture conditions to decide when to irrigate and how much water to apply, but only about one half reported using a checkbook method, crop consultants, or other relatively precise scheduling method (*Figure 1*). Feeling and squeezing the soil to determine moisture content was the most popular method of soil moisture monitoring used by both surface and groundwater irrigators. It was used by about 32 percent of surface water and 37 percent of groundwater irrigators, respectively. About half of the irrigators who used this method sampled the soil with a shovel and the other half used a deep soil probe. About 25 percent of groundwater and 15 percent of surface water irrigators used a scheduling consultant to decide when to irrigate. The checkbook method, which involves calculating water needs based on crop water use, rainfall and stored soil moisture, was used by slightly more than 20 percent of all irrigators. Most users of the checkbook method supplemented their calculations with occasional use of the feel method to check soil moisture. Soil moisture blocks were used to monitor soil moisture conditions by only 2 percent of all irrigators. A regular rotation was used by 40 percent of surface water users and by nearly 20 percent of the groundwater irrigators.

The relatively widespread use of rotation scheduling requires some interpretation. Although rotation scheduling can lead to excessive water use and unnecessary leaching, in some cases irrigators may have no other management option. Many surface water users, for example, receive water from an irrigation district on a rotation basis and do not have the option of managing based upon need. Moreover, in those cases where the irrigation system capacity is insufficient to meet peak crop water demand, rotation is unlikely to lead to over irrigation. In these cases it is a harmless and perhaps an appropriate management practice.

The use of rotation scheduling accounts for most of the difference in scheduling practices between surface and groundwater users. Because a higher percentage of surface water users receive water on a rotation basis, necessarily smaller percentages used consultants or the checkbook method, compared to groundwater irrigation.

Although most surface water irrigators are required to measure the amount of water diverted or applied, groundwater measurement is required only in the Upper Republican NRD groundwater control area. Statewide over one third of the groundwater irrigators indicated that they did not measure the amount of water applied. About 28 percent of all groundwater irrigators (43 percent of sprinkler irrigators) measured the water applied by sprinklers with a rain gauge or similar container. About 22 percent of all groundwater irrigators determined the amount of water used by multiplying the pumping rate by the hours of operation.

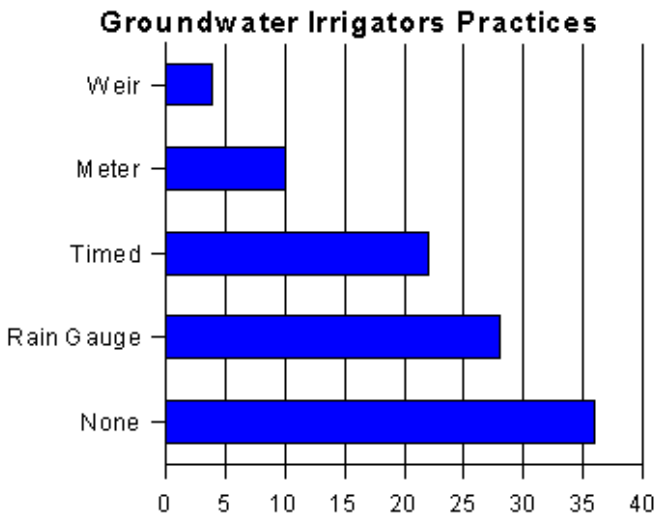
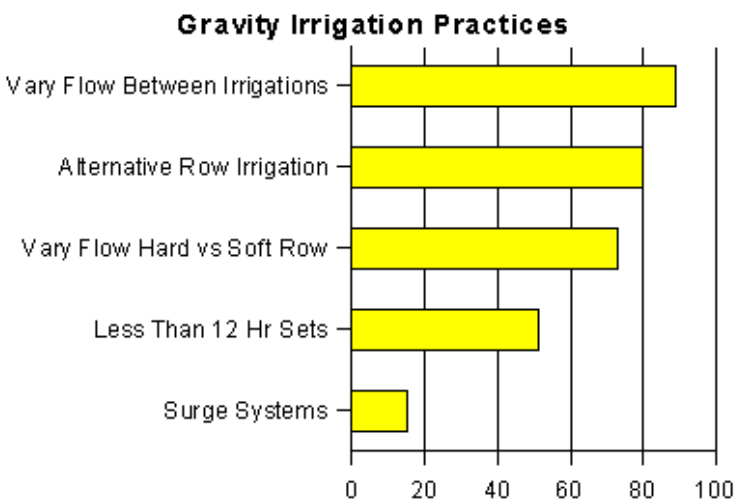


Figure 2. Water measurement.

A meter on the well was used by only 10 percent of all irrigators and about 4 percent measured the amount of groundwater applied with a weir (*Figure 2*).

Gravity irrigators not only must irrigate at the right time and apply the correct amount, but they must also choose from several management options which affect application uniformity and efficiency. The survey listed several practices which usually lead to improved uniformity or efficiency. Irrigators were asked to indicate which ones were being used in a specific field. A relatively large number of irrigators reported using the efficiency enhancing practices listed, with the exception of surge irrigation. About 89 percent of the gravity irrigators reported that they varied the flow rates between irrigations by changing the number of tubes or gates. Perhaps more surprising, 75 percent of the irrigators reported that they varied the flow rates between hard and soft rows, 80 percent of the irrigators reported using every other row irrigation, and 51 percent reported using less than 12 hour sets. Although only 15 percent reported using surge valves, this was also larger than expected (*Figure 3*).

Those using surge valves were asked to indicate how the surge valves were being used. Irrigators reported that 73 percent of the surge valves were used for actual surge irrigation, while the remaining 27 percent were used only to automatically change sets. This is contrary to the concerns expressed by some industry observers that the full potential of surge irrigation was not being exploited. Surge valves which are used only to facilitate the use of improved set times probably lead to some improvement in uniformity and efficiency, but in most cases further improvements are possible through the use of actual surge irrigation.



Little difference was noted in the years these management practices were adopted by gravity

irrigators, except for surge irrigation. Most of the farmers reported that the practices they now used had been used for more than five years. The proportion of farmers who had adopted a particular practice during the past five years ranged from only 7 to 11 percent among the different practices. In contrast, 80 percent of those using surge irrigation had adopted it in the past five years.

Figure 3. Management.

In interpreting these data it is important to keep in mind that all percentages are expressed as "percent of irrigators" but they are based on data from only one field per irrigator. This means that "percent of irrigators" is not the same as "percent of acres." If irrigators with large operations are more likely to adopt better management practices, then "percent of irrigators" underestimates "percent of acres." Conversely, "percent of acres" would be higher than "percent of irrigation" for practices which were more likely to be used in smaller operations.

For more detailed information on irrigation management practices, see NF 93-140, *Water Management for Irrigation in Nebraska*; NF 94-176, *Surge Irrigation*; and NF 93-118, *Fine Tuning Furrow Irrigation Systems*.

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