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G02-1465 Crop Water Use in Western Nebraska

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NebGuide

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G1465

Crop Water Use in Western Nebraska

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This NebGuide provides information on average weekly crop water use values for the major crops grown in western Nebraska. The information is best used for planning decisions before the season begins or for long term irrigation system planning.

Whether your water originates from the ground or the river, water for irrigation is becoming limited due to diminishing supplies and increasing environmental needs. In many areas of the Nebraska Panhandle, groundwater levels are dropping due to over development of the aquifers. In river valleys, water shortages occur during periods of drought. Management is made even more difficult when a portion of the water supply is used for the needs of endangered species. In tight economic times, some deficit irrigation is probably the optimal management strategy.

Although water supplies are obtained from different places, surface water or groundwater, the connection between the two can be seen in a variety of ways. For example, outside of the river valleys where groundwater has been developed for irrigation, groundwater levels have declined and can be seen through the drying of ponds or lakes. In river valleys, water that seeps from canals and fields provides groundwater that can be pumped for various purposes or the water may return to rivers through streams or creeks.

We must recognize the connection between surface and groundwater and understand that our water supply is limited. Through irrigation management we can have a significant impact on sustaining or reducing the decline of water supplies. Improved irrigation methods offer some potential for sustaining water supplies by improving the efficiency of water application. However, the largest consumption of water within agriculture is the water that is consumed by the crop.

Slowing the rate of decline of water supplies will, in some cases, mean reducing the amount of water that is being used. This might mean limited irrigation where plants are allowed to go into crop water stress. In other cases it may mean changing to a crop that consumes less water or even reducing the amount of land irrigated. Either way, the results may mean smaller yields or growing a different crop.

We often consider making changes to our irrigation practices to improve efficiency and save water. Let's assume we convert from furrow irrigation to a center pivot. How much water can we save? If the same crop were grown, the same amount of water will be transpired or consumed by the crop. For the furrow system, water that ran off the field or percolated from the root zone is not lost as it will return to the river or groundwater where it can be used again. The result is that improving application efficiency by converting to a center pivot had minimal impact on water savings within the drainage basin.

However, improving application efficiency is still important. Converting from furrow to pivot reduces the amount of water that moves through the soil profile. This minimizes the degradation of the quality of groundwater. If surface water supplies are being used, improved application efficiency means that less water needs to be diverted to meet crop demands. Less water diverted means more water is retained in storage reservoirs for release at a later date. We also need to keep in mind that improved application efficiency upstream will result in less runoff and may negatively impact downstream water users that rely on runoff water for irrigation.

As irrigators make efforts to reduce consumption by converting to more efficient irrigation systems or changing crop rotations, deciding which system to use or which crop to grow will not be easy. This transition will take time and additional information. Producers must understand the crops they grow and the amount of water used.

As stated earlier, consumption of water by irrigated crops is the biggest user of water in Nebraska. This is not to say that all crops use the same amount of water or that crops use water at the same time of the year. *Table I* gives average weekly crop water use for the major crops grown in western Nebraska. These values should only be used as a guideline and not as actual values for scheduling irrigations. Water use fluctuates due to cloud cover, air temperature, humidity and wind.

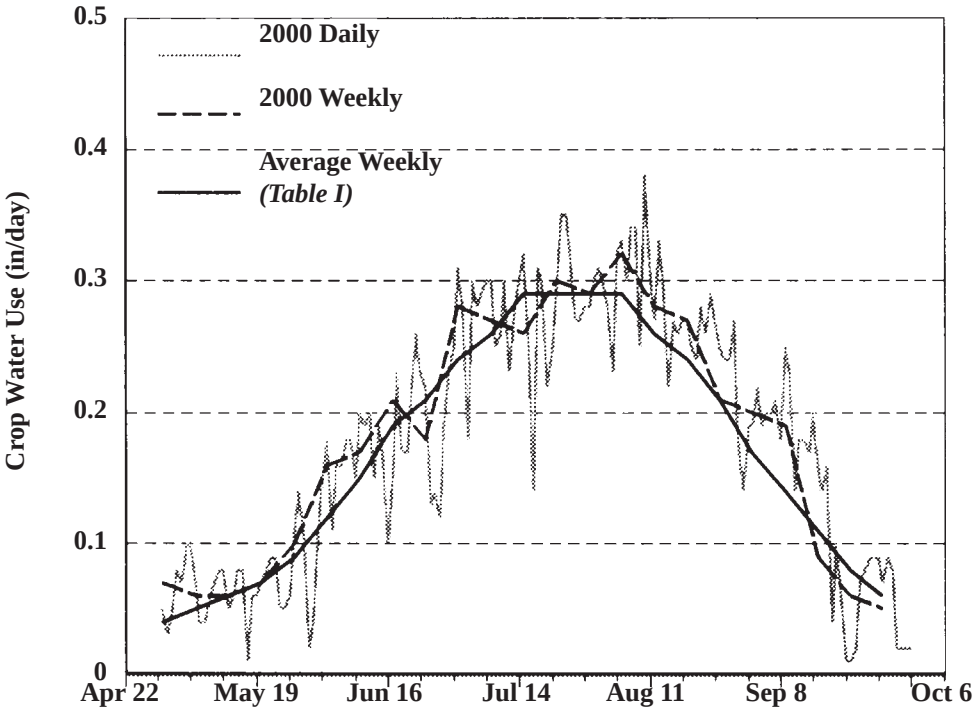

Figure 1. Example of daily variation in crop water use for corn.

See NebGuide G85-753, *Irrigation Scheduling Using Crop Water Use Data*, for irrigation scheduling concepts and methods. Such variation is also expected from year to year.

Crop water use varies daily depending on climatic conditions. As an example, the variation in daily water use for corn in 2000 is shown in *Figure 1*. Note, in mid-July water use varied from over 0.3 inches per day to 0.13 inches per day in less than a week. When these daily values are expressed in terms of inches per week, also shown in *Figure 1*, we see that weekly water use values vary much less than daily values and a seasonal water use curve begins to develop.

The final curve shown in *Figure 1* is the average weekly water use values for corn from *Table I*. The difference between the 2000 weekly water use and the average weekly water use is small. This would indicate that the average water use values given in *Table I* can be used effectively for planning purposes but do not predict daily water use accurately enough for scheduling irrigations.

When using *Table I*, remember a killing frost in the fall effectively stops crop water use for the season. The exception is for winter wheat, and perhaps cool season pasture and alfalfa. Although water use values through the winter are not given, evaporation of water from the soil surface continues. During this dormant period evaporation may total as much as 4 inches. The water that evaporates must be replaced through precipitation or irrigation in the spring or early summer to avoid plant water stress.

Weekly values for alfalfa in *Table I* assume the crop is always growing at full cover. Because alfalfa is cut 3 - 4 times during the season, total water use given in *Table I* reflects the reduction in water use that occurs when the crop is removed. After cutting, alfalfa water use is reduced to nearly half of current water use rates. Water use then gradually increases over about a two-week period until the crop attains full cover and returns to the rates given in the table. For pasture, the crop is not expected to reach full cover due to grazing. As a result, water use values given in the table have been reduced by 15% of the full cover crop amount.

Also given in *Table I* are normal precipitation amounts for three areas in the Panhandle. Comparing precipitation with a specific crops water use can provide an indication of when and how much irrigation will be needed through a normal growing season. This information can assist in the planning process before the season begins as well in designing system capacity, selecting a crop rotation or determining the number of acres a given water supply will support. To find more information on irrigation systems, system efficiency and irrigation water management, visit this Web site: *www.ianr.unl.edu/pubs/irrigation/*.

Table I. Average weekly crop water use in western Nebraska and 30-year normal precipitation for select locations.

	Weekly crop water use (inches/week)								*Precipitation (inches/week)*		
Date	*Alfalfa*	*Corn*	*Dry Edible Bean*	*Small Spring Grain*	*Sugar beet*	*Small Winter Grain*	*Actively Grazed Pasture*	*Potato*	*Scottsbluff*	*Alliance*	*Sidney*
4/15-22	0.50	——	——	0.25	0.20	0.60	0.40	——	0.37	0.38	0.39
4/22-28	0.80	——	——	0.30	0.30	0.85	0.65	——	0.41	0.42	0.43
4/29-5	1.10	0.25	——	0.35	0.35	1.05	0.90	——	0.56	0.57	0.60
5/6-12	**1.45**	**0.35**	**——**	**0.55**	**0.40**	**1.25**	**1.10**	**——**	**0.65**	**0.65**	**0.67**
5/13-19	**1.80**	**0.40**	**——**	**0.80**	**0.50**	**1.50**	**1.30**	**0.30**	**0.66**	**0.66**	**0.69**
5/20-26	**1.85**	**0.50**	**——**	**1.10**	**0.60**	**1.95**	**1.35**	**0.40**	**0.67**	**0.67**	**0.70**
5/27-2	**1.90**	**0.65**	**0.20**	**1.30**	**0.75**	**2.00**	**1.45**	**0.45**	**0.67**	**0.67**	**0.71**
6/3-9	2.00	0.85	0.20	1.45	0.90	1.95	1.45	0.55	0.64	0.65	0.69
6/10-16	2.00	1.05	0.30	1.70	1.05	1.75	1.50	0.70	0.64	0.64	0.67
6/17-23	2.05	1.30	0.50	2.15	1.20	1.50	1.50	0.85	0.64	0.64	0.67
6/24-30	2.10	1.50	0.80	2.10	1.35	1.15	1.50	1.05	0.61	0.61	0.65
7/1-7	**2.10**	**1.70**	**1.25**	**1.95**	**1.50**	**0.75**	**1.60**	**1.30**	**0.51**	**0.52**	**0.57**
7/8-14	**2.10**	**1.85**	**1.70**	**1.70**	**1.65**	**0.50**	**1.60**	**1.50**	**0.49**	**0.51**	**0.56**
7/15-21	**2.10**	**2.00**	**1.90**	**1.40**	**1.75**	**0.10**	**1.60**	**1.65**	**0.49**	**0.50**	**0.54**
7/22-28	**2.10**	**2.00**	**2.05**	**0.95**	**1.85**	**——**	**1.60**	**1.80**	**0.47**	**0.48**	**0.53**
7/29-4	**2.05**	**2.05**	**1.90**	**0.55**	**1.90**	**——**	**1.50**	**1.85**	**0.39**	**0.39**	**0.44**
8/5-11	2.00	2.00	1.65	0.10	1.85	——	1.50	1.80	0.33	0.32	0.37
8/12-18	1.90	1.85	1.35	——	1.75	——	1.40	1.75	0.31	0.31	0.36
8/19-25	1.80	1.65	0.95	——	1.70	——	1.35	1.65	0.29	0.28	0.34
8/26-1	1.70	1.45	0.55	——	1.60	——	1.30	1.55	0.28	0.27	0.32
9/2-8	**1.60**	**1.20**	**0.20**	**——**	**1.50**	**——**	**1.20**	**1.45**	**0.31**	**0.30**	**0.33**
9/9-15	**1.45**	**0.95**	**0.10**	**——**	**1.35**	**——**	**1.10**	**1.35**	**0.31**	**0.30**	**0.32**
9/16-22	**1.35**	**0.75**	**——**	**——**	**1.20**	**——**	**1.00**	**1.25**	**0.28**	**0.29**	**0.31**
9/23-29	**1.20**	**0.55**	**——**	**——**	**1.00**	**0.30**	**0.90**	**——**	**0.25**	**0.26**	**0.28**
9/30-6	**1.05**	**0.40**	**——**	**——**	**0.85**	**0.40**	**0.80**	**——**	**0.22**	**0.22**	**0.23**
10/7-13	1.00	——	——	——	0.65	0.50	0.70	——	0.20	0.20	0.21
Total	32.00*	27.25	15.60	18.70	29.70	17.90	32.25	23.20	11.63	11.69	12.56

* Total crop water use for Alfalfa has been reduced to account for the approximate reduction in water used due to harvesting.

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