

Irrigation Past to Present

June 23, 2010



Gary Zoubek, Extension Educator, York County
Brandy VanDeWalle, Extension Educator, Fillmore County

Nebraskans have long realized that using soil and water resources wisely is important, particularly since the state's economy relies on agriculture. **Irrigation ditches were constructed in Nebraska as early as 1856. However, Nebraska's current extensive irrigation system stems from the droughts of the 1890s and 1930s.**

Initially, Nebraska received all its irrigation water from streams and rivers. These waterways continue to supply water for much of Nebraska's cropland today. What rivers are most important from an irrigation perspective? **The Platte, Loup and Republican rivers were especially important.**

Estimated Irrigated Acres In Nebraska			
Year	Surface Water	Groundwater	Total
1860	9,000	-	9,000
1890	12,000	-	12,000
1900	150,000	1,000	150,000
1920	450,000	1,000	450,000
1940	500,000	40,000	540,000
1950	600,000	470,000	1,070,000
1960	850,000	1,650,000	2,500,000
1970	1,000,000	3,000,000	4,000,000
1980	1,000,000	6,200,000	7,200,000
1990	1,000,000	7,000,000	8,000,000
2000	82, 478 Registered Wells		8,150,000
2005	91,328 Registered Wells		
12/06/2009	106,370 Registered Wells		
* Nebraska Agricultural Statistics Service			

Since 1940, however, irrigation from wells has increased dramatically. Of Nebraska's 8 million irrigated acres in 1990, about 7,000,000 million acres are irrigated from wells, with the rest coming from streams and rivers.

Nebraska State Irrigation Association formed in 1893.

Irrigation Wells 1910-1936 - 1200

Peaks in mid-50's & 70's

1992 - 75,570.

Currently - Approximately 113,000 Registered Irrigation Wells in Nebraska.

Only two other states, California and Texas, have more irrigated acres, and Texas has been experiencing a steady decline in irrigated acres over the past quarter century.

Much of the Nebraska is lying over the Ogallala Aquifer. It is one of the premier sources of U.S. groundwater and is a valuable irrigation endowment for the state of Nebraska.

In 1889, the Nebraska legislature passed the Rayner bill, the state's first irrigation law. Under this law people could take water from streams after they had posted notice at the diversion point. Beneficial use was the basis of a person's right to water.

An 1889 survey reported that Nebraska had 214 irrigators. An irrigated farm average 55 acres. The total land irrigated in Cheyenne, Scotts Bluff, Lincoln and Sioux counties was 11,744.

A well that flows is called an artesian well.

Irrigation Types

- 1) gravity(flood, siphon tubes, gated pipe, surge gated pipe)
- 2) sprinkler systems(center pivot, tow-line, big gun)
- 3) trickle or drip irrigation

On-Farm Delivery Methods for irrigation

Gravity Irrigation

Initially canals and ditches were run from rivers or wells and areas cut so that water would go down the rows. A major problems was cutting and uneven distribution.

Irrigation Spile (Lath boxes)

Somewhere, at some time, an ingenious farmer, tired of the problem of cutting the ditch bank and its uneven water distribution, came up with "lath boxes". Cut in to 2-foot pieces and made in to long narrow boxes. The lath boxes were "mudded" into the ditch banks so each row of corn received the only the water each box could provide. Lath boxes meant that the volume of water flowing down each row was far more uniform than by the bank-cut method. The only disadvantage was that sometimes they'd wash out.

Siphon tubes

Small curved pipes, typically 0.5 to 4.0 inches in diameter, that deliver water over the side of a head ditch or lateral to furrows or rows. The widespread use of siphon tubes for irrigation was due to their development in 1934 and subsequent marketing by Cozad irrigator, farmer and entrepreneur. He worked hours and hours to achieve a uniform water distribution system. His first siphon tubes were made from discarded boiler flue pipes. They were steel and heavy. In 1942 with the advent of plastic tubing he began building siphon tubes out of plastic. Nebraska Plastics Inc., "COZAD" trade name siphon tubes was started in 1945.

Most siphon tubes used in this area were made of aluminum. Even used to have siphon tube setting contests.

Gated pipe

The first gated pipe was produced in California. Hastings Irrigation Pipe was the second firm and is one of the largest in the US.

Hand-moved sprinklers

With the development of pressurized city and town water systems, sprinklers were developed to water lawns and gardens. Sprinkler irrigation on a larger scale began with city parks and golf courses, then high value crops and finally to other agricultural crops. The first spring-activated rotating sprinkler head was developed in 1933.

Tow-line or (Skid-tow) sprinkler lines

The first two-line sprinkler system was invented in 1950 in Portland Oregon by W.H. Stout. They were modified hand-moved sprinklers that could be moved with a tractor. T-L Irrigation of Hastings was the first manufacturer of towline systems in Nebraska. They're much more labor-intensive than center-pivot or lateral-(linear) move sprinkler systems.

Volume-gun sprinklers

During the 1970's traveling volume-gun sprinklers gained great popularity with farmers especially for irregularly shaped or long rectangular fields.

Center Pivots self-propelled sprinkler systems

Center pivots were invented in Nebraska and this technology that has developed over the past half century, has transformed irrigated agriculture worldwide. Not only has it opened up lands which would otherwise not be irrigable, but it has also greatly enhanced water use and other input efficiencies on land that was previously gravity irrigated. Thousands of Nebraska's irrigated acres are being converted each year to center pivot systems.

In 1947, Frank Zybach, a wheat farmer in Colorado went to a demonstration of had move sprinkler irrigation and thought, there has to be a better way. By the next summer he build a small two-tower experimental center-pivot system. He joined efforts with E. Trowbridge in Columbus and in 1953-1954 they produced 19 systems. They had a difficult time selling the new concept. Farmers wouldn't try and bankers wouldn't fund. Valley Manufacturing (Valmont Industries) purchased the company in 1954. The pivots save much labor and worked on rolling land.

Nebraska' Irrigated Cropland Acreage by Statistical District, 2000						
District	Total Cropland	Total Irrigated Cropland	% Irrigated Cropland	Center Pivot Irrigated	Other Irrigation	Center Pivots as a percent of Total
	-1,000 acres--		Percent	-1,000 acres--		
Northwest	3,013	709	23.5	422	287	59.5
North	2,033	537	26.4	520	17	96.8
Northeast	3,390	877	25.9	776	101	88.5
Central	2,144	1,210	56.4	535	675	44.2
East	4,034	1,463	36.3	784	679	53.6
Southwest	2,568	924	36.0	738	186	79.9
South	1,857	897	48.3	399	498	44.5
Southeast	3,054	766	25.1	433	333	56.5
State	22,093	7,382	33.4	4,608	2,774	62.4

Corner systems and lateral-move sprinkler systems.

Corner systems and lateral-move sprinkler systems were developed in 1975-1976. Make it possible to irrigate square or rectangular fields.

Surge irrigation

Surge irrigation gained popularity in the 80's. Is a method to improve the efficiency of gravity irrigation by alternating the irrigation cycle.

Drip irrigation systems

Other Types of Irrigation Systems

Solid-set sprinklers with risers

Rotating Boom-type sprinklers

LEPA sprinkler systems

KROY - York Spelled backwards began making center pivots in 1968 Paul Geis Automobile dealer. Still makes aluminum pipe as well as plastic pipe.

In the late 1960's Gus Thieszen a Henderson well driller began building a center pivot under the name of Oasis. Only for a few years. Many other small firms over the years, but now five major companies.

In the Book "Flat Water: A History of Nebraska and Its Water" It reports that the top five center pivot manufactures in the country are all in Nebraska. They are: Valley at Valley, Zimmatic at

Lindsey, Electrogator at Deshler, T-L Irrigation at Hasting, and Lockwood at Gering.

In all more than 80 companies tried making center pivots.

Nebraska Center Pivots

1972 - 2,725

1980 - 18,785

1988 - 27,617

1997 - 42,444

Units of Water Measurement

Water measurement is an important tool for checking irrigation management skills. Irrigators can use one of several methods to measure water.

There are two conditions under which water is measured--at rest and in motion.

Volume units are used for water at rest.

Water in motion is described in units of flow.

Volume units describe how much space a given amount of water will occupy. Water in tanks and ponds is an example of water at rest. Common units of volume are gallons, acre-inches, acre-feet, and cubic feet. These units are defined as:

Acre-inch--the volume of water that would cover an acre one inch deep.

Acre-foot--the volume of water that would cover an acre one foot deep.

Cubic foot--the amount of water that would fill a container one foot wide by one foot long by one foot deep.

Flow units tell how fast a given volume of water is moving past a fixed point. They can be used to describe the discharge of a pump, flow in a canal or river, and discharge of a sprinkler, gate, or siphon tube. Flow units frequently used in irrigation are gallons per minute (gpm) and cubic feet per second (cfs).

Gallons per minute--the rate of flow necessary to fill a gallon container in one minute.

Cubic foot per second--the amount of water that would flow in a stream one foot wide by one foot deep and moving at a rate of one foot every second.

List of Equivalents

Volume Units

1 gallon = 8.33 pounds

1 cubic foot = 7.48 gallons

1 acre-inch = 3,630 cubic feet

1 acre-inch = 27,154 gallons

1 acre-foot = 43,560 cubic feet

1 acre-foot = 325,851 gallons

Units of Flow

1 cubic foot per second = 449 gallons per minutes
(450 for practical purposes)

1 cubic foot per second for 1 hour = 1 acre-inch

452 gallons per minute for 1 hour = 1 acre-inch

1 gallon per minute = 0.00223 cubic feet per second

1 gallon per minute = 0.00221 acre-inches per hour

Length Units 1 mile = 5280 feet

Area Units 1 acre = 43,560 square feet