



WHEELMOVE SPRINKLER IRRIGATION OPERATION AND MANAGEMENT

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Wheelmove sprinklers water about 336,000 acres in Utah. This is more than one fourth of Utah's 1.3 million acres of irrigated land. There are nearly four and one half times as much wheelmove irrigated area than that watered by center pivots in Utah. Utah is the number one state in proportion of wheelmove to total irrigated acres. The reason for this is that many of Utah's field or farm units are usually smaller than 40-80 acre blocks or are odd-shaped. Economics also may be a factor, particularly with regard to initial capital outlay costs.

Often times, one wheel move is placed on a 40 acre 1/4 mile by 1/4 mile field. An 11 or 22 day irrigation interval is possible depending on whether 12 hour or 24 hour set-times are used. The soil type, crop, rooting depth, and design evapotranspiration rate are all factors to be considered so that the system application does not exceed either the root zone soil water storage capacity or the soil surface infiltration rate. These factors also determine whether a 12 hour or 24 hour move cycle should be used.

WHAT IS A WHEELMOVE?

The term "wheelmove" seems to be the industry preferred label for what are also known as wheel-line, sideroll, or lateral-roll irrigation machines. A wheelmove consists of the mover, lateral pipe, wheels, sprinklers, couplers, and connectors to the mainline supply.

The lateral pipe conveys water along the line to sprinklers typically spaced 30 to 40 feet apart. While system lengths vary, most are 1280 feet long to match a quarter mile wide field. The lateral pipe also acts as an axle for wheels midway between the sprinklers. The lateral pipe is typically either 4 inch or 5 inch diameter, with some systems using 5 inch close to the mover and 4 inch further away. The 5 inch pipe is desirable as a stronger axle where the system operates on a side hill or on undulating ground.

The wheels vary in diameter from five feet (actual diameter is 64 inches) to ten feet. The most common wheel diameter in Utah is 7 foot (76 inches) which moves the line 60 feet laterally with 3 revolutions. Five foot (64 inches) wheels are often used to give a 50 foot move with three

revolutions. Probably a significant majority of wheelmoves have 7 feet diameter wheels with 5 inch pipe.

The height of lateral line/axle limits the crops which are adapted to wheelmove systems to approximately half the wheel diameter. It is not likely to see a wheelmove in a corn field except, perhaps, for one or two early irrigations. Nor would it be used in orchards or any other similar tall crops. This is not a serious limitation in Utah as only six percent of the irrigated land is in corn and orchard crops. Nearly 80% is in perennial forages including alfalfa, hay, and pasture.

The couplers connect the lateral pipe sections together and transmit the axle torque. They also include a drain and an outlet for the sprinkler. In fields of varying width, such as those at an angle to a roadway, the ease of dropping or adding lateral sections is important. Thus, a clamp type coupler may be desirable. Also, the use of a leveler on the sprinkler is not only recommended but is an essential requirement for any wheelmove system.

The joint of pipe making up the lateral pipeline serve as the axle for the wheelmove system and are supported above the ground by wheels mounted midway along their length. Sprinklers are located at the connections and ends of the lateral pipe, positioning a sprinkler head midway between each well and at the ends of the lateral pipeline. Normally, a wheelmove system has impact sprinkler heads with levelers to keep the sprinklers in an upright position. Located adjacent to each sprinkler is a drain that automatically empties the lateral pipeline when water pressure drops off. The couplers between the pipe joints provide a watertight connection and also transmit torque, produced by the power mover, to the entire length of the system. The power mover is mounted in the center of the wheelmove system and provides the power to move or drive the irrigation system. One end of the lateral line is connected via a flexible hose to a pressurized mainline pipe with risers at suitable intervals.

MECHANICAL OPERATION

At periodic intervals (typically, 11 ½ or 23 ½ hours) the system is rolled 50 or 60 feet laterally by a small single cylinder gasoline or diesel engine power unit. The power unit, (or power mover) operates through a combination of hydraulics, gears, and chains located at the middle or end of the lateral. All the water must be drained through the automatic drains from the line prior to moving. The move usually takes 20 to 30 minutes, including draining, which is considerably less time than required for a hand move line.



Prior to moving the line it should be straight. Then the mover will be slightly ahead of the line, which will be tight without slack when moving. If the line migrates to one end in moving, the opposite end should be “trailed” back manually. This unbalance will tend to shift the line in the desired direction. The end should be realigned after the line position is corrected. It is important to keep the wheels from getting ahead of the mover so as to prevent serious misalignment.

When the wheel line operates crosswise on a slope, the line may migrate down slope. If the mover is situated off center towards the downhill side, the extra “pull” from the longer uphill line will tend to offset this downward migration.

IRRIGATION APPLICATION

A typical wheelmove in Utah uses impact sprinklers with levelers and has 3/16" diameter nozzles operating at 45 to 50 psi pressure. Unfortunately, some systems are operating at pressures somewhat below this which lead to problems with distribution uniformity.

Several years back, in a program funded in part by the Utah Department of Agriculture and the Utah Agricultural Experiment Station, we evaluated numerous sprinkler irrigation systems around the state. Irrigation application efficiencies (water stored in the root zone divided by a water delivered to the field) for wheel moves varied from 39% to 75%. With reasonable

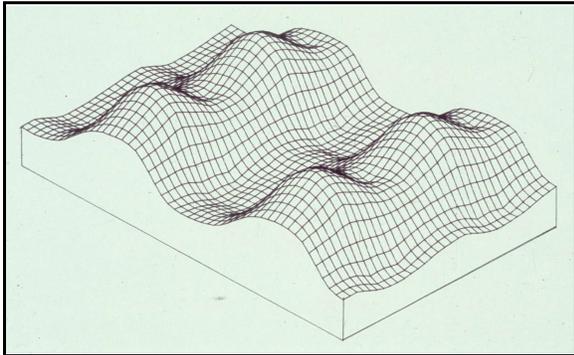


Figure 1. Wheelmove water distribution, no offset, CU of 62%.

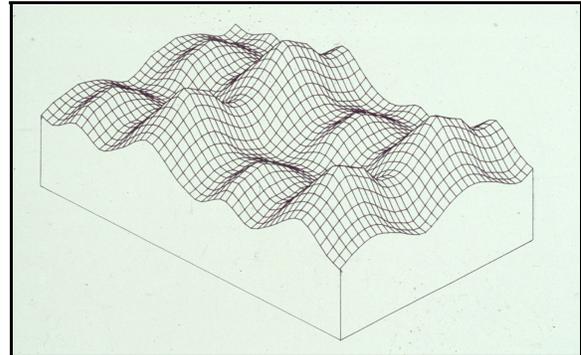


Figure 2. Wheelmove water distribution with 20 foot offset in 2nd irrigation (CU of 87%).

good management, the wheelmove application efficiencies averaged nearly 70% (Hill, 1994). The lower application efficiencies were from lower pressures than designed or, perhaps, a greater distance in the move than is desirable. One such system we evaluated had a coefficient of uniformity (CU) of 62% on the 40 foot by 60 foot sprinkler spacing (Fig. 1). The uniformity improved to 87% when a 20 foot offset (Fig. 2) was used on alternate irrigations. The 20 foot offset, in this case, was equivalent to one revolution of the wheel move to either the right or the left of the previous irrigation lateral position.

WHEELMOVE SEQUENCING

The objective of the moving sequence is to maintain adequate soil water for best crop growth, while not causing excess deep percolation. Deep percolation is detrimental to water conservation and salinity reduction goals. Various wheel move sequencing scenarios have been tried and/or suggested:

- A. Irrigate every move across the block and then roll it back empty. This move sequence is similar to the way hand move lines were used. But a major disadvantage is the long distance the empty line is rolled back.
- B. Skip irrigate every other move across the block and then on return irrigate the skipped sets on the way back instead of rolling back empty.
- C. Irrigate every set across and then start, say twelve hours later, and irrigate every set coming back.

This avoids rolling the line empty all the way back, it also avoids some of the concern about the skip irrigation having alternating unirrigated spots on either side that may bother people. However, irrigating so soon after the previous irrigation causes extra deep percolation losses on the wet side of the field. There is also a longer than needed interval between irrigations on the opposite (or “dry”) side. This mode is not recommended due to the alternate over irrigation followed by soil water shortage.

D. Irrigate every set across, roll the line empty for about three sets back and then irrigate the rest of the way back. Roll the line empty for three sets or so and then irrigate across again.

This reduces the effect mentioned in Part C above, but does not eliminate it.

E. Other possible variations exist and depend upon soil, crop and field characteristics.

MAINTENANCE CONCERNS

Much of the maintenance is related to the single cylinder air-cooled engine and associated hydraulics, gears, and chain drive for moving the system. It is important to follow the engine manufacturers’ recommendations for oil viscosity and change intervals and for air filter, spark plug, and other service requirements. The wheelmove manufacturers provide adequate operation and maintenance instructions to fit their particular drive system. It is important that the owner/operator read and be familiar with and follow the instructions that match the equipment he/she is using (for more information details see USU Extension Fact Sheet WM 05).

Check all nozzles and impact sprinklers for plugging, mismatched sizes, breakage, corrosion or other damage caused by wear or winter weather. Couplers and connections should be checked for leaks and repairs/replacements should be done early. It is a good practice to identify problem components at the end of the previous irrigation season and to have the replacement parts on hand for spring installation. If water leaks occur at joints or drain plugs during irrigation, check the gaskets and pipeline connections for wear or cracks and replace them as needed. Check and tighten the couplers and connectors as required.

In those places where an open ditch water supply is used, adequate screening and sediment removal are essential for minimum trouble operation . This is particularly a problem in the spring and early fall with more trash in the ditches and canals at those times.

There are quite a few anecdotal stories about runaway wheelmoves in high winds. Anytime the wheelmove is empty, and particularly during the off season, it is essential that it be anchored to prevent wind damage. Often this is as simple as moving the system over to a fence and tying it down in three or four places to sturdy posts. However, special wind anchors are available which attach to the lateral pipe and act like a brace to prevent movement.

GRAVITY PRESSURE SPRINKLERS

Wheelmoves are used on almost all of the more than 300 gravity pressurized sprinkler systems in Utah. Utah’s mountain valley topography is favorable to developing gravity pressurized pipelines. Much of our irrigated area is in mountain valleys in close proximity to canyon streams. Thus, it is often economic to install a pipeline up the canyon to gain about 110 feet or so of elevation induced head. This also has the advantage of reducing open channel water

seepage losses in the canyon mouth alluvium and extends the available water supply.

Many previously surface irrigated systems (private irrigation companies as well as individuals) have converted over to gravity pressure wheelmove irrigation. This switch from the traditional (often pioneer built) surface irrigation to gravity pressurized sprinkler has created some interesting situations. The value of “head end” water access opportunities in preference to a “tail end” location in multiple user surface irrigation systems is well known. However, when a conversion to gravity pressure sprinklers occurs, the historically “tail end” irrigators become switched to the “head end” position in that they now have the highest pressure. For some, this is the first time ever that they have had access to abundant water instead of the tail end dribble they are used to. These advantages are often short-lived as the irrigation company board of directors have responded by requiring pressure or flow regulated nozzles and strict adherence to water deliveries proportionate to water stock shares owned.

WHEELMOVE SUPPLIERS

While there are similarities in available wheelmove systems, prices and features vary considerably. Some of these companies manufacture the wheels, fittings, couplers, etc., and ship to dealers who then press couplers on aluminum pipe for the purchaser. One or two make their own pipe and ship complete systems from the factory.

Presently there are six U.S. wheelmove manufacturers:

Boss Irrigation Systems
PO Box 5695
Lubbock, TX 79408
(806) 763-9591
www.bossirrigation.com

Lake Company
PO Box 2248
Bakersfield, CA 93303
(805) 399-9131
www.lakecompany.com

Pierce Corporation
PO Box 528
Eugene, OR 97440
(541) 485-3111
www.pierce-irrigation.com

Rain Dance Irrigation
(Thunderbird Side Roll)
14402 Chambers Road
Tustin, CA 92780
(714) 832-3400

Travis Pattern & Foundry
E. 1413 Hawthorne Road
Spokane, WA 99207
(509) 466-3545

Wade Manufacturing Co.
PO Box 23666
Portland, OR 97281
(503) 692-5353
www.waderain.com

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WHERE CAN YOU GET HELP?

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