Irrigation Practices in the Umatilla and Morrow County Area

In the production of irrigated crops a farmer must make three decisions; (1) when to irrigate, (2) how much water to apply, and (3) how to apply water. The third decision concerns the method of irrigation. At the most general level the method includes four steps; the diversion of water from a source, its conveyance to and distribution across a farm, and the application of the water over the surface of each field. The purpose is to provide the soil moisture required to support plant growth.

With each step there is the potential for water loss, loss not in the sense that the water is no longer available, it is just no longer available to meet the target soil moisture deficit. For each step the ratio of the water still available at the end of the step to the water available at the beginning is a measure of the efficiency. There is a diversion, conveyance, distribution, and application efficiency associated with every method of irrigation.

As the Umatilla and Morrow County area was first settled in the late 1800s small scale irrigation began to be practiced. Irrigation first began in the Umatilla County area in 1870, but only in the area's river bottoms. In that year Allen Ditch, a Umatilla County resident, secured the first water rights to the Umatilla River. The first agricultural practice in the area was stock raising, mostly horses, cattle, and sheep. Later, in 1876, farmers began growing grains. Small diversion dams were constructed, conveyance and distribution ditches were dug, and flood irrigation practiced. Irrigation occurred during periods of adequate stream flow. The acreage of irrigation was limited and the efficiencies were low.

In the early 1900s the practice of irrigation continued spreading in the area. Private concerns began initial projects which later became part of the Umatilla Project or connected to it. The Hinkle Ditch Company excavated the Hinkle Ditch in Umatilla County in 1903. Western Land and Irrigation Company took over the Hinkle operation, and extended and enlarged the system. The Furnish Ditch Company constructed the Furnish Ditch in 1905-06. The Irrigon Canal later became the site for construction of the Umatilla Project's West Extension. Maxwell Land and Irrigation Company built the Maxwell Canal which would be taken over later and renovated by the Bureau of Reclamation.

In December 1905 Congress authorized the Umatilla Project. This project included two storage reservoirs (McKay and Cold Springs), permanent diversion dams, larger canals (many concrete lined), and improved surface irrigation practices such as furrow. Early plans called for the irrigation of 60,000 acres of land. The amount of land irrigated by the project steadily increased in conjunction as structures were built and the number of landowners with whom Reclamation reached agreements. Reclamation reported 36,300 irrigable acres in 1918. In 1920 the Umatilla Project irrigated 12,028 acres. Irrigated acreage increased to 13,145 the next year. by 1950 the project held 32,561 irrigable acres with a total of 22,038 acres being irrigated. By the early 1990s the total area irrigated by the four main Irrigation Districts; Hermiston, Stanfield, Westland, and West Extension; has stabilized at around 43,000 acres.

A variety of crops have been grown in the Umatilla Project served lands. From year to year the mix changes but typical crops have been alfalfa, mint, grass seed, corn, and potatoes. Of no less importance, but constituting smaller acreages have been asparagus, melons, small orchards, and flowers. The largest acreage, however, has and continues to be pasture.

The biggest change within the districts over the last four decades has been the conversion from agricultural to residential irrigation for several thousand of their acres. Within the four main Irrigation Districts 50% to 80% of the land ownerships are under 10 acres in size.

The 1950s saw a significant change with the development of wells as the new source of water for irrigation along with the introduction of pressurized conveyance and distribution systems (pipelines) and sprinklers. These closed systems had much higher efficiencies and the utilization of groundwater greatly expanded the potential irrigated acres. Handlines gave way to wheel-lines allowing for the irrigation of even more acres. Efficiencies are no different between handlines and wheel-lines, but the reduction in set change times facilitated the irrigation of larger tracts of land with the same man-hours of work. Many smaller acreages were converted to solid set sprinkler systems all but eliminating set change time. Though the irrigated acres increased, the variety of crops grown changed little.

The most significant change in irrigated agriculture started in the late 1960s and early 1970's. This change was the introduction of center pivots and the direct pumping out of the Columbia River. By 1987 the irrigated lands in Umatilla and Morrow Counties totaled nearly 187,000 acres and 228,000 acres by 1997. By 2002 the total had pulled back to 217,000 acres. Much of this reduction resulted from the conversion of irrigated acres back to dryland acres within critical groundwater areas.

Accompanying the rapid increase in irrigated acres since 1970 has been the construction of food processing facilities in the area. This has led to an increase in the types and varieties of crops grown. Also, with center pivot irrigation large farms can more easily adjust their crop mix from year to year depending on market prices. A wide range of potatoes, onions, sweet corn, and carrots from processed to fresh pack are grown. Alfalfa is now baled, cubed and chopped. Varieties of grass seed, mint, and vegetable crops are grown. And now more than one crop can be grown on the same field in the same year, peas and corn are but one example.

The latest change has been the introduction of drip irrigation. Though not a new technology, the use of drip irrigation in this area has primarily been associated with the growing of hybrid-poplar trees. Starting in the early 1990s several companies purchased existing center pivot irrigated farms and began converting them to drip irrigated tree farms. Today there are approximately 23,500 acres of trees being grown in the area. The other use of drip irrigation has been crops such as melons grown under mulch. A limited number of acres of onions are also drip irrigated.

Within an area reaching from 20 miles east of Hermiston to 40 miles west and from the Columbia River to 25 miles south there are today approximately 198,000 irrigated acres. These acres include the approximately 43,000 acres within the four main districts and 155,000 acres of private development served primarily by totally pressurized systems. The one significant exception is the Columbia Improvement District which serves approximately 13,000 acres and has as part of its conveyance system a large open canal. This canal, however, is concrete lined and very well maintained having no seepage or spillage losses.

Of the 198,000 irrigated acres, approximately 130,000 acres are pivot irrigated, 33,000 acres are sprinkler irrigated (handlines, wheel lines, or solid set), 25,500 acres are drip irrigated, and 9,500 acres are still surface irrigated. The surface irrigated acres are all within the districts and are predominantly pastures.

There are no records of measured efficiencies from the early years, however, most canals were unlined and surface irrigation practices crude. An indication of the low efficiencies was the duties associated with early water rights; as high as 10 acre-foot per acre and commonly 4.5 acre-feet per acre (3 acre-feet per acre for fine textured soils and 6 acre-feet per acre for coarse textured soils.) Over the years most of the acres within the districts have been converted from surface irrigation to sprinkler (handlines, wheel lines, or solid sets), center pivots, or drip irrigation.

The conveyance efficiency of a canal can vary from nearly 100% for a short lined canal in good condition to 15% for a long poorly maintained earthen canal. For the main conveyance canal of the four districts in the area conveyance efficiencies range from 60% to 90% depending on the month, seepage losses along earthen canals are higher in the spring during start-up. There is also spillage losses associated with conveyance canals. Since the water users don't take a constant rate throughout the season and there is a lag-time from diversion to delivery, some spill is almost always occurring at the tail of a main conveyance canal. It should be noted that these seepage and spillages losses are relative to the intended purpose of supplying soil moisture on specific fields. Seepage from canals may sub to "irrigate" other low lying areas, recharge shallow aquifers from which water is pumped, or eventually return to nearby streams through sub-surface flow. And spillage flows are always directed back to surface waters which can be reused or return to streams and rivers.

As with main conveyance canals, there are losses associated with smaller distribution ditches. The distribution efficiency of a smaller ditch can vary from nearly 100% for a short lined ditch in good condition to 70% for a longer poorly maintained earthen ditch. There is typically no spillage losses associated with distribution ditches since they just move water from the main canal to the point of application and may not run continuously.

The water losses associated with the diversion, conveyance, and distribution of water are virtually eliminated with pressurized systems compared to open canal systems. The trade-off is cost; pressurized systems have higher construction as well as annual operating costs. With the increases in electrical energy rates the cost of water represented by power bills has become one of the largest single per acre cost for irrigated crops.

The application efficiencies associated with surface irrigation methods can vary greatly. Some methods can achieve efficiencies as high as 95%. Those historically practiced in this area come nowhere close to that level, however. With wild flooding it is hard to achieve an application efficiency higher than 50%. With graded borders or furrows it is possible to reach 75% depending on soil type, length of run, and the level of control. For most surface irrigation in this area the application efficiency will be between these limits.

The application efficiencies associated with sprinkler irrigation systems including handlines, wheel-lines, and solid sets that are properly laid out and operated will range from 70% to 80%. Actual application efficiencies can be considerably lower if the wrong sprinkler spacing, nozzle size, or operating pressure is used.

The application efficiency associated with the first generation of center pivots used in the area ranged from 75% to 85%. Sprinklers were impacts mounted along the top of the spans and the minimum operating pressure at the end was typically 50 psi.

Since the first pivots went in there have been many changes. Impact sprinklers have been replaced with spray heads that provide uniform patterns at a 10 to 20 psi operating pressure. Pressure regulators have been added to increase the application uniformity. Drop tubes have placed the spray heads closers to the ground reducing wind drift and evaporative losses. For mint, drop tubes extend all the way to the ground emitting water through socks. And for crops such as onions, dual packages that can be switched to provide two different application rates are commonly used. The application efficiency associated with the newest generation of center pivots range from 85% to 95%. The type of drip irrigation systems utilized in this area, when maintained, also have application efficiencies in the 85% to 95% range.

For this area around 65% of the irrigated lands have center pivots with application efficiencies ranging from 80% to 95%, another 13% of the irrigated lands utilize drip irrigation with application efficiencies ranging from 85% to 95%, and around 17% of the irrigated lands are under one form or other of sprinkler irrigation. The actual application efficiencies associated with the sprinkler irrigation systems in the area varies greatly, but most are reasonably maintained and achieve the 70% to 80% level. Less than 5% of the irrigated ground is surface (flood) irrigated and all of that is within the districts and are predominately in pasture.

Application efficiency is only one part of the equation, however. Associated with the different methods of irrigation, how water is applied, there are achievable levels of efficiency. The other two decisions originally mentioned, when to irrigate and how much water to applied, are the most important in determining true efficiency. If a perfect system is operated incorrectly either the crop will not produce and/or water will be wasted. The key is good irrigation management.

Irrigation management, sometimes referred to as scientific irrigation scheduling, addresses the decisions of when and how much. Involved are the precise monitoring of soil moisture levels, the accurate measurement of water applied, and the estimate of water needs for the next week. In this area IRZ Consulting contracts with a number of farms to weekly measure soil moisture levels using neutron probes and water application amounts using rain gauges. Then weather data from a series of stations is used to calculate crop water requirements for the next seven days. This information is used to provide an irrigation management plan to the farm for each field. Studies have found that such scientific irrigation scheduling can reduce water usage by 7% to 30% with the accepted average savings being at least 10%.

One mistaken notion about scientific irrigation scheduling is that the total water required for the production of a crop is limited to the calculated crop water requirement during the growing season often call Evapotranspiration or ET for short. The fact is this is only a portion, all be it the largest portion, of the total water required to produce a crop. Prior to planting a crop in the spring an irrigation may be required to prepare the soil for cultivation and prior to emergence one or more irrigations may be required to prevent wind erosion. If seed cannot be protected and enabled to germinate in the soil, a crop will never be produced. And after harvest irrigation may be used to facilitate chemigation and/or provide soil moisture for a winter cover crop.

The other mistaken notion about irrigated agriculture is that farmers waste water. Thirty years ago in this area that was partially true. Water was considered cheap because the only cost was the relatively inexpensive electrical power required to pump it. The cost of power and the perception of more is better have changed. The cost of power has increased significantly and other costs associated with over-irrigation have been realized. As stated previously, the cost of water represented by power bills has become one of the largest single per acre cost for irrigated crops.

And the indirect costs of over-irrigation are the adverse effects on nutrient management and crop health. Agri-chemicals including fertilizer are another significant per acre cost which the farmer doesn't want to wash away. And too much water in the root zone can reduce yields and/or crop quality through limiting adequate aeration and promoting disease. Simply put, the costs of over-irrigation cannot be afforded with the low margins available to farmers and the vast majority of them in this area cognizant of that fact.

The climate and soils of this area made it ideally suited to agriculture, what was lacking was water. Irrigation has allowed the area to bloom, literally and figuratively. Not just the cost, but the value of water is well understood in this area. Not that every area farmer utilizes all the services available to them for scientific irrigation scheduling, but no place in the State of Oregon is the general level of irrigation management any better than here. There is always room for improvement and every year improvements are being made.