

Quote: Irrigation is now . . . recognized . . . as a valuable tool in enhancing fruit quality.

Irrigation Advantages in the Great Lakes Region: An Ontario Perspective

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Ontario growers produce tree fruit crops on a wide variety of soils and rootstocks and in several distinct geographic regions in a humid continental climate that produces approximately 70 mm (<3 inches) of rainfall per month during the summer months. The move to higher density planting systems and more shallow rooted trees³ coupled with the increased need for investment risk management has led many growers to incorporate various water management schemes into their overall cultural practices. Irrigation is now becoming recognized in Ontario and other Great Lakes producing areas as a valuable tool in enhancing fruit quality through size and finish. Maintenance of tree performance from planting and from one year to the next is equally important. The fall of 1998 was very dry for many peach and apple growers, necessitating in some cases a predormancy irrigation regime.

During the last few years, we have recognized the potential for soil moisture deficits during the 3-month period of June, July and August when evapotranspiration (ET) rates are at their highest. It has become common to see deficits of 50 to 70 mm (2 to 3 inches) in any given month. For cultivars, including Empire and Gala, that have a tendency to be inherently small, adequate amounts of available soil moisture are necessary to add volume to a well-thinned crop. Traditionally, we have underestimated the water needs of Ontario's plantings of peach, apple and other tree fruit crops in both the establishment and full production years.

Typically, Ontario orchards start the year with field capacity soil moisture in the month of April and in early May. By the end of June, when final crop load has been established, available soil moisture in the top 30 cm (12 inches) of soil can drop to around 20% or less. This amount of available soil moisture can vary somewhat depending on rainfall. However, it is unusual for soils to rebound to field capacity ratings or to hold 50% available soil moisture in the top 30 to 40 cm (12 to 18 inches) for any length of time until the end of August and likely well into the month of September when ET rates diminish significantly. By then, the crop's fate largely has been determined.

Not every year produces the same soil moisture deficits. During the 1996 growing season when rainfall was unusually steady through the summer, it was more difficult to show any outstanding irrigation benefits. However, it is in the long term that consistent benefits appear to be shown

easily with apples on size-controlling root systems in Ontario. Peaches show a more consistent response to irrigation on an annual basis because of their relative time of maturity.

Limited use is being made of multifunctional irrigation systems in this region. The most common systems seen are either a traveling gun or precision irrigation system. The vast majority of producers are not set up for frost protection, overhead cooling or fertigation.

Many areas of the world are dependent on irrigation to sustain production. Unlike these areas where the irrigation system is the heart and soul of orchard culture, in Ontario we have not approached that degree of function. However, Ontario orchard irrigation systems have become an increasingly important tool to buffer the risk in planting and ultimately to protect the sizable investments growers have in higher density systems.

DRIP IRRIGATION

We (David and Gary Bianchi) grow 40 acres of apples, 5 acres of strawberries, and 10 acres of vegetables on a light sandy loam soil. Our proximity to Toronto has enabled us to develop the high end markets that demand quality. The markets want large, quality fruit for cell count sales.

Our traditional varieties have been McIntosh, Delicious, Golden Delicious, Cortland, and Idared, planted on standard seedling, M.7, MM.106, and M.26 rootstocks. Six years ago we began changing our orchard to staked Mutsu, McIntosh and Gala planted on M.9 and M.26. Our spacing is 2.1 x 4.9 m (7 x 16 feet) for M.9 and 2.7 x 5.2 m (9 x 17 feet) for M.26 rootstocks. We also have some trial plantings of Elstar and Gingergold on M.9 rootstock.

We started using overhead irrigation 30-35 years ago when we were planting on MM.106 rootstocks. This was not a solid set system. A lot of time and labor was required to move pipes from one block to another. Back then we realized the benefits of irrigation. We saw better tree establishment, improved growth and nutrient uptake, larger fruit size and consistent return bloom. In general, less drought stress seemed to improve the health of the orchard.

When we made the switch to M.9, we learned this rootstock was more drought sensitive and, with our soil type, we believed irrigation was an absolute necessity and not an option. It appeared the droughts were getting more extreme and prolonged each summer, and our 3-acre pond was running dry. This pond would normally hold 180 acre inches of water when full. We needed to conserve water and with drip irrigation we can do that. During dry periods we need the flexibility to give trees water as soon as possible. With a system that is not solid set and not a gun traveler type system, an orchardist is limited by how fast it can be moved around. In 1996, we made the decision to invest in drip irrigation and we installed 915 m (3,000 feet) of 2-inch underground pipe with 21,300 m (70,000 feet) of above-ground drip line to cover 10 ha (25 acres).

When it starts to get dry, we begin to irrigate on a schedule and will not alter this schedule until we receive a significant rain. The amount of water we irrigate each time varies with rootstock and weather conditions. We feel we are getting less russetting on the Golden Delicious with drip and at the same time lowering the probability of foliar disease infection on the apples.

Drip irrigation gives us more flexibility with our crop load management and thinning strategy. If we have a heavy set, we may decide to thin less aggressively and rely more on irrigation to help size development of the crop.

TRAVELING GUN SYSTEM

My (Pete Geerts) orchards are in Lambton County, Ontario, just west of Arkona and about 10 miles from Lake Huron. I will describe our irrigation system and why we went with a traveling gun system for our apple and peach orchard.

Our orchards are planted on a very gravelly textured soil which does not retain moisture well. A big part of the orchard is on a reclaimed gravel pit.

We draw water from a 5 ha (13 acre) abandoned gravel pit, .8 km (1/2 mile) from the orchard. This pit is 5 m (16 feet) deep and has some very strong springs that feed it. We estimate that this reservoir holds approximately 2000 acre inches of water. In late October 1998, the water level was down about 1.5 m (5 to 6 feet) as a result of water drawn during the growing season with poorer than usual recharge rates due to an unusually long, dry growing season.

The volume of water available to us was the reason for going with a traveling gun system. This high pressure system uses a lot of water compared to trickle systems. We can easily use 360,000 imperial gallons of water in 12 hours of irrigation.

We recently dug a pond closer to the main planting. The water table is quite high in this location and, even if we pump the pond down, it will refill with water from the surrounding gravel beds.

We use a Bauer reel with 260 m (850 feet) of 3.75-inch inside diameter hard hose line. It is an older system that still works very well. We attended a lot of auction sales before we finally found a reel that would fit our budget.

The reel has a piston retrieve which pulls the line back in while irrigating. It works on water pressure so there is no motor on the reel. The whole system works on one tractor and one pump located at the water source. We try to maintain a pressure of 125-135 psi at the inlet of the reel. The water leaves the gun at a pressure of 80-90 psi and throws a distance of 52 m (170 feet). This translates to a width of 104 m (340 feet) per pull. We use a 1.26-inch nozzle which puts out between 475 to 500 gallons per minute. It takes about 11 to 12 hours to complete a full pull applying 50 mm (2 inches) of water at a time and covers about 2.8 ha (7 acres). The reel is on a turntable. We can turn the reel and pull the gun out again to cover 5.6 ha (14 acres) from one spot. This makes the system more versatile than trickle in this regard. With the summer of 1998 being so dry, we irrigated one orchard 3 times for a total of 150 mm (6 inches) of water applied. The speed of retrieve for the line is adjusted with a simple water valve which slows down or speeds up water flowing to the piston which, in turn, retrieves the line.

The pump is a Bauer F-9-80 and is sized to match the output of the reel. When the pump is matched to the system, less horsepower is required to run the system. At first I did not think the pump would run the system because it is so small. We use a 67 hp tractor to run the pump and it is all it can do to run it when we are pumping water over 900 m (3000 feet) on relatively flat ground. I would feel much more comfortable with a 70-80 hp tractor on it. The pump has a capacity of about 550-600 gallons per minute and will run to 180 psi maximum.

The main line pipe is 6-inch Wade Rain aluminum pipe that will take a maximum safe pressure of 180 psi. The reason we use 6-inch over 5- or 4-inch is less pressure loss over a long distance. For instance, 6-inch pipe loses 0.4 lbs. pressure for every 100 feet of distance where 5-inch pipe loses 1.4 lbs. for every hundred feet. The smaller the diameter of pipe, the more the turbulence as water moves. At present, we have 3300 feet of pipe and we need another 1000 feet so that we can irrigate all of our orchards. If we were to use smaller diameter pipe, we would need another tractor and pump in line to boost the pressure. This would be necessary to maintain line pressure to the reel. By using 6-inch pipe we can run the whole system from one tractor and one pump. This size pipe costs a little more and is a little heavier and harder to handle, but I feel the expense is justified.

Our orchards are planted at a spacing of 4.5 x 2 m (15 x 7 feet). Apple cultivars grown at Birnham Orchards include Gala, Golden Delicious, McIntosh, Empire, Mutsu (Crispin), Spartan, Delicious and Jonagold. Our oldest trees are 9 years old. M.26 and M.9 are the rootstocks of choice. The gun cart goes between the rows nicely and, with some modifications, could be used on even narrower rows with ease.

During the very dry 1998 growing season, we irrigated our young peaches only once in their second leaf with 1 inch of water through the whole season and this seemed to be enough to keep the trees growing. These trees were not cropped in 1998 but appear to have set up a good percentage of fruit buds for the 1999 season.

In conclusion, irrigating has helped give us control of crop volume and fruit size as well as achieving better fruit color. By eliminating moisture stress in the orchard, we can maintain the carbohydrate production needed for crop production, tree growth and survival, especially with peach. We are able to grow higher fruit quality and still come back next year with a good crop because of return bloom coupled with good tree health.

Irrigation is not the whole answer to growing better fruit but plays a big part and is another tool we can use to maximize returns from our orchards. In our situation, money spent on this irrigation system has been well spent.