Handy Pocket Guide

NELSON

SAVE WATER, SAVE ENERGY
and do a better job of irrigating.

rotator® technology

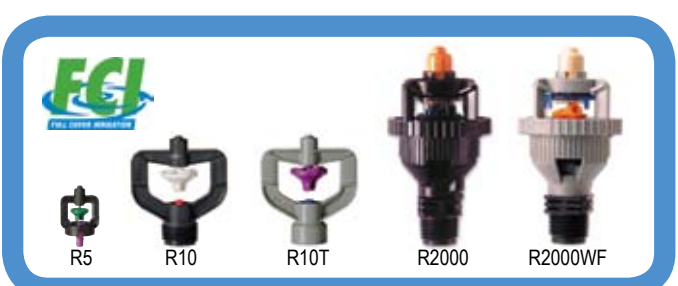
FULL COVERAGE IRRIGATION

FOR TREE & VINE CROPS — the facts.

WHAT IS FULL COVERAGE IRRIGATION?

Full Coverage Irrigation (FCI) is an irrigation design and management philosophy that enlists the irrigation system in a holistic approach to give the grower superior agronomic control over the farming system. FCI delivers benefits to the grower on many different levels to ultimately provide maximum return on investment. Key to a successful FCI system is a sprinkler designed and engineered to deliver water with maximum uniformity at a low application rate (to match the soil's infiltration rate) over a large radius of throw. In contrast to part coverage, drip or micro sprinkler systems, full coverage irrigation of the entire root zone (utilizing the full soil profile) gives tree & vine crops a healthy start and promotes high yield and grade throughout their entire life span.

Nelson Irrigation's Rotator® technology has proven itself in providing the performance necessary for an effective Full Coverage Irrigation system. The complete line of Nelson Rotator sprinklers has been specifically designed to deliver high uniformity in real world conditions. When combined with proper spacing and a good hydraulic design, full coverage irrigation systems can meet or exceed the distribution uniformity of part coverage, drip or micro sprinkler systems. They also provide the opportunity to grow a cover crop, which enhances the overall environment for the tree or vine crop. In your area, full coverage systems may have been replaced by part coverage systems years ago. Rotator technology lowers application rates and increases the uniformity of full coverage systems. These improvements to full coverage now make it the best choice!



THE MANY BENEFITS OF FCI

Rotator® Full Coverage Irrigation offers many benefits to growers not available through part coverage, drip, spray jet or spinner irrigation systems, such as:

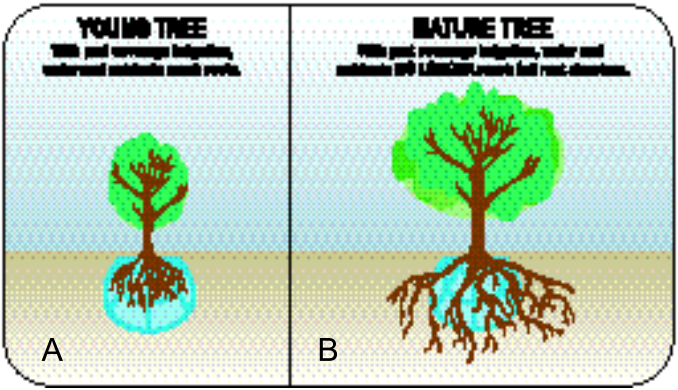
1. Reduced tree stress during periods of heat or harvest
2. Ability to establish and maintain a healthy cover crop
3. Improved water infiltration and reduced ponding
4. Prevention of soil cracking
5. Environmental control: cooling and dust suppression
6. Improved effectiveness of chemical and fertilizer applications
7. Salinity management
8. Increased overall nutrient availability

PART COVERAGE IRRIGATION FALLS SHORT

Young trees may thrive in part coverage systems, partly because they require more intensive management and more frequent smaller irrigations to meet the trees' needs as compared to flood or full coverage systems. Leaching is minimized because new systems have ample capacity to meet E.T. needs of small trees. The emission devices are located next to the trees and easily wet all of their small root systems. Soils are prepared before planting, and soil structure and aeration is typically good. Nutrients are spoon fed to the trees through fertigation. In the early years of tree growth, immobile nutrients are plentiful enough for a small tree.

The root systems often extend well beyond the coverage area of part coverage irrigation systems.

As time goes on, many problems can develop. Because seasonal rainfall fills a larger soil zone than is irrigated by the part coverage system, the roots grow outside the regularly wetted area.



Although the tree develops a greater density of roots in the wetted zone, the transpiration demand exceeds its ability to extract moisture from this limited area. During periods of heat stress, operators respond by increasing irrigation durations and nutrient leaching begins. To simply provide the daily ET requirement, the part coverage system is run 25 to 50% of the time. The soil in the limited root zone begins to develop problems such as reaching an anaerobic state due to frequent irrigation and/or application rates above the infiltration rate. These anaerobic conditions kill off active roots, even in the wetted area. This further restricts the size of the active root zone and contributes to stress. The effect can be dwarfing of the tree, and in many cases crop yields and quality suffer.

THE BENEFITS OF COVER CROPS

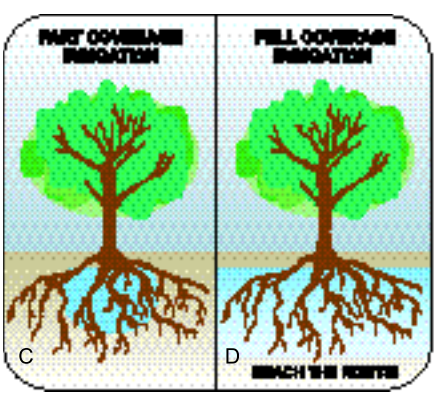
In many environments in which tree and vine crops are grown, the establishment and maintenance of cover crops is impossible without irrigation. Drip, jet or spinner irrigation systems almost never provide sufficient coverage for a cover crop. FCI systems are far superior in ensuring the healthy maintenance of a cover crop.

The many benefits of having cover crops in conjunction with tree and vine crops are well documented and include:

- Cover crops improve the infiltration capacity of the soil
- Cover crops reduce dust, which in turn reduces certain insect pressures
- Cover crops provide a habitat for beneficial insects
- Cover crops prevent erosion caused by wind or runoff
- Certain cover crops are legumes that fix atmospheric nitrogen in the soil
- Certain cover crops can be grown as green manure crops to make essential nutrients available to the crop
- Cover crops are an effective tool for controlling some noxious weeds
- Cover crops allow faster accessibility to the field after rain
- Cover crops can cool the orchard environment, which improves photosynthesis

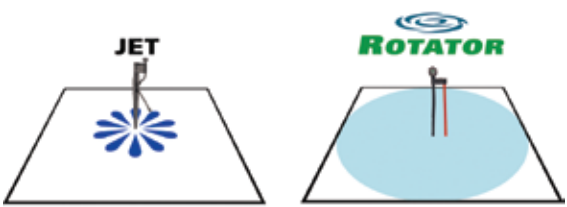
REDUCE STRESS DURING HARVEST

Full coverage systems build larger soil moisture reservoirs that reduce tree and vine stress when irrigation schedules must be interrupted for harvest operations. (See figure D, right.)



PREVENT INFILTRATION PROBLEMS

In part coverage systems, soil compaction, salinity and low organic matter content can quickly contribute to infiltration problems. The high kinetic energy and high instantaneous application rates of spray jet streams quickly break down soil aggregates and accelerate soil sealing. Ponding of water increases evaporative losses, further breaks down soil structure, creates anaerobic conditions that diminish nutrient availability and becomes a habitat to encourage disease development. Infiltration rates in soils can drop to near or below .10 in/hr (2.5 mm/hr). Spray jets typically deliver water to the soil at a rate of around .30 in/hr (8 mm/hr), spinners and drip between .15 to .25 in/hr (4 to 6.5 mm/hr). Full coverage



A Rotator sprinkler distributes water uniformly at a rate at which the soil can absorb the moisture.

Rotator systems can be designed to easily meet E.T. requirements and still deliver water to the soil gently in the range of .04 to .15 in/hr (1 to 3.8 mm/hr). A uniform light application rate Rotator full coverage system can be combined with applications of gypsum and other soil amendments to vastly improve soil infiltration problems.

ELIMINATE SOIL CRACKING

Heavy soils will crack when they dry. In some cases cracking can be so severe that it can damage root systems by shearing or by exposing them to heat or freezing. In tree nut crops, cracking can be a significant problem because nuts become lost in cracks during harvest. When full coverage irrigation is used on a timely schedule, soil cracking is eliminated.

PROVIDE DUST SUPPRESSION

The presence of dust has been known to encourage the development of some pests such as mites. Dust rising from the floors of orchards often exceeds Federal Clean Air Regulations. Excessive dust and powdery soil can make harvest difficult and costly — especially in nut crops when nuts must be separated from the soil. Some producers use full coverage irrigation to reduce dust problems.

APPLY CHEMICALS WITH A FCI SYSTEM

The benefit of fertigation through drip systems is well understood by many. The high uniformity of full coverage Rotator systems has made fertigation of larger trees very effective as well. Many pre-emergent herbicides require timely activation with around 1/2" (12 mm) of irrigation (see chemical manufacturers' details). Also, full coverage irrigation allows the option of applying dry fertilizers or special organic fertilizers and their quick incorporation into the soil.

COMBAT SALINITY ISSUES

Drip and part coverage irrigation systems push salts to the outside of the wetted pattern. This may restrict root system development and over time leave high concentrations of salts in the root zone. Ultimately these salts need to be pushed out of the soil profile. Used in combination with soil amendments, properly scheduled full coverage irrigation can be used to deep leach salts below the rooting levels of the soil profile.

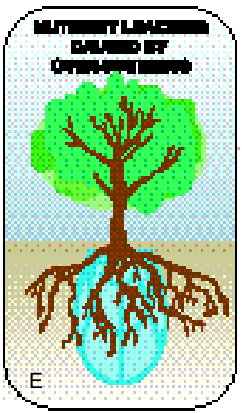
PROMOTE GOOD SOIL HEALTH AND NUTRITION

Organic growers rely heavily on organic fertilizers and the generation of nutrients through decomposition of organic matter by micro organisms and the activity of other beneficial bacteria. Microbe activity in the soil is all but stopped in hard dry soils. A full coverage system not only increases a tree's ability to mine nutrients present in the soil in the mineral form, it creates a better environment for the natural generation

and utilization of nutrients. It can also increase the effectiveness of organic based soil amendments or fertilizers. Over time, cover crops contribute organic matter to the soil, which improves soil structure and increases aeration.

PREVENT NUTRIENT LEACHING

Keeping nutrients in the active root zone is a function of good irrigation scheduling. When trees become large, the quantity of water required between irrigation events to meet transpiration needs can easily exceed the water holding capacity of the soil in the limited root zone. This problem frequently occurs in shallow or sandy soils. For operators of part coverage irrigation systems, frequent irrigation events become more and more challenging to manage. This results in almost unavoidable deep percolation of highly mobile nutrients such as Nitrogen and Potassium. (See Figure E.)



THE BENEFITS OF CROP COOLING

Effective crop cooling requires a uniform full coverage water application system. Crop cooling is used to increase red color in apples and in several crops to reduce or prevent sun scald.

Research has demonstrated that cooling increases photosynthesis. Growers have also come to realize that cooled fruit is better suited for storage and is of higher quality. Other crops, such as cherries, are cooled to increase flowering. High uniformity, reliability, ideal droplet size and simple overhead mounting are important features that make Rotators the product of choice for crop cooling.

ORCHARD FLOOR PREPARATION FOR HARVEST

The ability to wet the entire orchard floor during summer enables better orchard floor preparation for harvest. Nut growers report that a retrofit to a full coverage irrigation system can pay for itself in one year because it allows them to more effectively level and firm up the orchard floor prior to harvest. The use of brush chippers is now common place. Over a 3 to 5 year period of time, the chips release nutrients back into the soil as they decompose. A fully wetted orchard floor accelerates the decomposition process and enables tillage equipment to work the chips back into the soil during the summer prior to harvest.

PROVEN RELIABLE, LOW COST, LESS MAINTENANCE

Full coverage systems with Rotators are generally less expensive to maintain and operate than the majority of part coverage systems with sprays or spinners. The larger radius of throw means that a Rotator® Full Coverage System has fewer sprinklers per acre. Consequently, nozzle sizes are generally larger, require less filtration and plug less often. Rotator Full Coverage Systems often have a longer expected useful life than many part coverage systems. The patented Rotator motor is well proven in the field to deliver superior start-up and longer life than the typical products used in part coverage irrigation systems.

CROP SPECIFIC BENEFITS FROM FULL COVERAGE IRRIGATION

Apples & Pears

- Larger root systems are established, stress is reduced and fruiting wood is increased
- Cover crops provide many benefits (see page 5)
- Cooling
- Improved nutrient availability

Tree Nuts

- Improved infiltration
- Dust reduction
- Salinity management
- Reduced stress during production and harvest

Cherries, Peaches & Other Stone Fruits

- Reduced stress during fruit bud formation
- Cover crops improve infiltration and cooling
- Improved nutrient availability

Citrus and Avocados

- Reduced stress improves fruit size
- Activation of fertilizers and herbicides
- Improved nutrient availability
- Improved infiltration reduces disease potential

Vine Crops

- Cover crops prevent erosion and provide a habitat for beneficial insects
- Cooling
- Dust suppression
- Effective soil moisture management possible with high uniformity of Rotator® sprinklers

WARRANTY AND DISCLAIMER

Nelson Rotator® Sprinklers, Feedtube Assemblies and accessories are warranted for one year from the date of original sale to be free of defective material and workmanship when used within the working specifications for which the products were designed and under normal use and service. The manufacturer assumes no responsibility for installation, removal or unauthorized repair of defective parts and the manufacturer will not be liable for any crop or other consequential damages resulting from any defects or breach of warranty. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSES AND OF ALL OTHER OBLIGATIONS OR LIABILITIES OF MANUFACTURER. No agent, employee or representative of the manufacturer has authority to waive, alter or add to the provisions of this warranty nor to make any representations or warranty not contained herein.

NELSON IRRIGATION CORPORATION
848 Airport Rd.
Walla Walla, WA 99362 U.S.A.
Tel: 509.525.7660
info@nelsonirrigation.com

NELSON IRRIGATION CORPORATION
OF AUSTRALIA PTY LTD
35 Sudbury Street, Darra QLD 4076
Tel: +61 7 3715 8555
info@nelsonirrigation.com.au

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WWW.NELSONIRRIGATION.COM